# MSG No. 148.20 $R_I\bar{3}$ [ Type IV, trigonal ]

* symmetry operation

Table 1: Symmetry operations for 3d polar vector.

| No. | tag | matrix (polar) | det | TR |
|---|---|---|---|---|
| 1 | $\{1\|0\}$ | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | 1 | 1 |
| 2 | $\{3^+_{001}\|0\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | 1 | 1 |
| 3 | $\{3^-_{001}\|0\}$ | $\begin{bmatrix} -1 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | 1 | 1 |
| 4 | $\{-1\|0\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$ | −1 | 1 |
| 5 | $\{-3^+_{001}\|0\}$ | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$ | −1 | 1 |
| 6 | $\{-3^-_{001}\|0\}$ | $\begin{bmatrix} 1 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$ | −1 | 1 |
| 7 | $\{1\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} 1 & 0 & 0 & \frac{2}{3} \\ 0 & 1 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{1}{3} \end{bmatrix}$ | 1 | 1 |
| 8 | $\{3^+_{001}\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} 0 & -1 & 0 & \frac{2}{3} \\ 1 & -1 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{1}{3} \end{bmatrix}$ | 1 | 1 |
| 9 | $\{3^-_{001}\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} -1 & 1 & 0 & \frac{2}{3} \\ -1 & 0 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{1}{3} \end{bmatrix}$ | 1 | 1 |
| 10 | $\{-1\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} -1 & 0 & 0 & \frac{2}{3} \\ 0 & -1 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{1}{3} \end{bmatrix}$ | −1 | 1 |
| 11 | $\{-3^+_{001}\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} 0 & 1 & 0 & \frac{2}{3} \\ -1 & 1 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{1}{3} \end{bmatrix}$ | −1 | 1 |
| 12 | $\{-3^-_{001}\|\frac{2}{3}\frac{1}{3}\frac{1}{3}\}$ | $\begin{bmatrix} 1 & -1 & 0 & \frac{2}{3} \\ 1 & 0 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{1}{3} \end{bmatrix}$ | −1 | 1 |
| 13 | $\{1\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} 1 & 0 & 0 & \frac{1}{3} \\ 0 & 1 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{2}{3} \end{bmatrix}$ | 1 | 1 |

*continued ...*

Table 1

| No. | tag | matrix (polar) | det | TR |
|---|---|---|---|---|
| 14 | $\{3^{+}_{001}\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} 0 & -1 & 0 & \frac{1}{3} \\ 1 & -1 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{2}{3} \end{bmatrix}$ | 1 | 1 |
| 15 | $\{3^{-}_{001}\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} -1 & 1 & 0 & \frac{1}{3} \\ -1 & 0 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{2}{3} \end{bmatrix}$ | 1 | 1 |
| 16 | $\{-1\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} -1 & 0 & 0 & \frac{1}{3} \\ 0 & -1 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{2}{3} \end{bmatrix}$ | −1 | 1 |
| 17 | $\{-3^{+}_{001}\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} 0 & 1 & 0 & \frac{1}{3} \\ -1 & 1 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{2}{3} \end{bmatrix}$ | −1 | 1 |
| 18 | $\{-3^{-}_{001}\|\frac{1}{3}\frac{2}{3}\frac{2}{3}\}$ | $\begin{bmatrix} 1 & -1 & 0 & \frac{1}{3} \\ 1 & 0 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{2}{3} \end{bmatrix}$ | −1 | 1 |
| 19 | $\{1'\|00\frac{1}{2}\}$ | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$ | 1 | −1 |
| 20 | $\{3^{+}_{001}{}'\|00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$ | 1 | −1 |
| 21 | $\{3^{-}_{001}{}'\|00\frac{1}{2}\}$ | $\begin{bmatrix} -1 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$ | 1 | −1 |
| 22 | $\{-1'\|00\frac{1}{2}\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | −1 | −1 |
| 23 | $\{-3^{+}_{001}{}'\|00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | −1 | −1 |
| 24 | $\{-3^{-}_{001}{}'\|00\frac{1}{2}\}$ | $\begin{bmatrix} 1 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | −1 | −1 |
| 25 | $\{1'\|\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} 1 & 0 & 0 & \frac{2}{3} \\ 0 & 1 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{5}{6} \end{bmatrix}$ | 1 | −1 |
| 26 | $\{3^{+}_{001}{}'\|\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} 0 & -1 & 0 & \frac{2}{3} \\ 1 & -1 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{5}{6} \end{bmatrix}$ | 1 | −1 |
| 27 | $\{3^{-}_{001}{}'\|\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} -1 & 1 & 0 & \frac{2}{3} \\ -1 & 0 & 0 & \frac{1}{3} \\ 0 & 0 & 1 & \frac{5}{6} \end{bmatrix}$ | 1 | −1 |

*continued ...*

Table 1

| No. | tag | matrix (polar) | det | TR |
|---|---|---|---|---|
| 28 | $\{-1'\vert\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} -1 & 0 & 0 & \frac{2}{3} \\ 0 & -1 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{5}{6} \end{bmatrix}$ | $-1$ | $-1$ |
| 29 | $\{-3^{+}_{001}{}'\vert\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} 0 & 1 & 0 & \frac{2}{3} \\ -1 & 1 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{5}{6} \end{bmatrix}$ | $-1$ | $-1$ |
| 30 | $\{-3^{-}_{001}{}'\vert\frac{2}{3}\frac{1}{3}\frac{5}{6}\}$ | $\begin{bmatrix} 1 & -1 & 0 & \frac{2}{3} \\ 1 & 0 & 0 & \frac{1}{3} \\ 0 & 0 & -1 & \frac{5}{6} \end{bmatrix}$ | $-1$ | $-1$ |
| 31 | $\{1'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} 1 & 0 & 0 & \frac{1}{3} \\ 0 & 1 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{1}{6} \end{bmatrix}$ | $1$ | $-1$ |
| 32 | $\{3^{+}_{001}{}'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} 0 & -1 & 0 & \frac{1}{3} \\ 1 & -1 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{1}{6} \end{bmatrix}$ | $1$ | $-1$ |
| 33 | $\{3^{-}_{001}{}'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} -1 & 1 & 0 & \frac{1}{3} \\ -1 & 0 & 0 & \frac{2}{3} \\ 0 & 0 & 1 & \frac{1}{6} \end{bmatrix}$ | $1$ | $-1$ |
| 34 | $\{-1'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} -1 & 0 & 0 & \frac{1}{3} \\ 0 & -1 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{1}{6} \end{bmatrix}$ | $-1$ | $-1$ |
| 35 | $\{-3^{+}_{001}{}'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} 0 & 1 & 0 & \frac{1}{3} \\ -1 & 1 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{1}{6} \end{bmatrix}$ | $-1$ | $-1$ |
| 36 | $\{-3^{-}_{001}{}'\vert\frac{1}{3}\frac{2}{3}\frac{1}{6}\}$ | $\begin{bmatrix} 1 & -1 & 0 & \frac{1}{3} \\ 1 & 0 & 0 & \frac{2}{3} \\ 0 & 0 & -1 & \frac{1}{6} \end{bmatrix}$ | $-1$ | $-1$ |