International Tables for Crystallography (2006). Vol. E, Section 1.2.7, pp. 13–14.

Table 1.2.6.2. *Distinct Hermann–Mauguin symbols for monoclinic and orthorhombic rod groups in different settings*

Rod group	Setting symbol					
	(abc)	$(b\bar{a}c)$	$(\bar{c}ba)$	(bca)	$(a\bar{c}b)$	$(\bar{c}\bar{a}b)$
	Hermann–Mauguin symbol					
R3	$\not{p}_c211$	$\not{p}_c121$	$\not{p}_a112$	$\not{p}_b112$	$\not{p}_b211$	$\not{p}_a121$
R4	$\not{p}_cm11$	$\not{p}_c1m1$	$\not{p}_a11m$	$\not{p}_b11m$	$\not{p}_bm11$	$\not{p}_a1m1$
R5	$\not{p}_cc11$	$\not{p}_c1c1$	$\not{p}_a11a$	$\not{p}_b11b$	$\not{p}_bb11$	$\not{p}_a1a1$
R6	$\not{p}_c2/m11$	$\not{p}_c12/m1$	$\not{p}_a112/m$	$\not{p}_b112/m$	$\not{p}_b2/m11$	$\not{p}_a12/m1$
R7	$\not{p}_c2/c11$	$\not{p}_c12/c1$	$\not{p}_a112/a$	$\not{p}_b112/b$	$\not{p}_b2/b11$	$\not{p}_a12/a1$
R8	$\not{p}_c112$	$\not{p}_c112$	$\not{p}_a211$	$\not{p}_b121$	$\not{p}_b121$	$\not{p}_a211$
R9	$\not{p}_c112_1$	$\not{p}_c112_1$	$\not{p}_a2_111$	$\not{p}_b12_11$	$\not{p}_b12_11$	$\not{p}_a2_111$
R10	$\not{p}_c11m$	$\not{p}_c11m$	$\not{p}_am11$	$\not{p}_b1m1$	$\not{p}_b1m1$	$\not{p}_am11$
R11	$\not{p}_c112/m$	$\not{p}_c112/m$	$\not{p}_a2/m11$	$\not{p}_b12/m1$	$\not{p}_b12/m1$	$\not{p}_a2/m11$
R12	$\not{p}_c112_1/m$	$\not{p}_c112_1/m$	$\not{p}_a2_1/m11$	$\not{p}_b12_1/m1$	$\not{p}_b12_1/m1$	$\not{p}_a2_1/m11$
R13	$\not{p}_c222$	$\not{p}_c222$	$\not{p}_a222$	$\not{p}_b222$	$\not{p}_b222$	$\not{p}_a222$
R14	$\not{p}_c222_1$	$\not{p}_c222_1$	$\not{p}_a2_122$	$\not{p}_b22_12$	$\not{p}_b22_12$	$\not{p}_a2_122$
R15	$\not{p}_cmm2$	$\not{p}_cmm2$	$\not{p}_a2mm$	$\not{p}_bm2m$	$\not{p}_bm2m$	$\not{p}_a2mm$
R16	$\not{p}_ccc2$	$\not{p}_ccc2$	$\not{p}_a2aa$	$\not{p}_bb2b$	$\not{p}_bb2b$	$\not{p}_a2aa$
R17	$\not{p}_cmc2_1$	$\not{p}_ccm2_1$	$\not{p}_a2_1am$	$\not{p}_bb2_1m$	$\not{p}_bm2_1b$	$\not{p}_a2_1ma$
R18	$\not{p}_c2mm$	$\not{p}_cm2m$	$\not{p}_amm2$	$\not{p}_bmm2$	$\not{p}_b2mm$	$\not{p}_am2m$
R19	$\not{p}_c2cm$	$\not{p}_cc2m$	$\not{p}_ama2$	$\not{p}_bbm2$	$\not{p}_b2mb$	$\not{p}_am2a$
R20	$\not{p}_cmmm$	$\not{p}_cmmm$	$\not{p}_ammm$	$\not{p}_bmmm$	$\not{p}_bmmm$	$\not{p}_ammm$
R21	$\not{p}_cccm$	$\not{p}_cccm$	$\not{p}_amaa$	$\not{p}_bbmb$	$\not{p}_bbmb$	$\not{p}_amaa$
R22	$\not{p}_cmcm$	$\not{p}_ccmm$	$\not{p}_amam$	$\not{p}_bbmm$	$\not{p}_bmmb$	$\not{p}_amma$

Table 1.2.6.3. *Distinct Hermann–Mauguin symbols for tetragonal, trigonal and hexagonal rod groups in different settings*

Rod group	Setting symbol	
	(abc)	$(a \pm b \quad b \mp a \quad c)$
	Hermann–Mauguin symbol	
R35	$\not{p}4_2cm$	$\not{p}4_2mc$
R37	$\not{p}\bar{4}2m$	$\not{p}\bar{4}m2$
R38	$\not{p}\bar{4}2c$	$\not{p}\bar{4}c2$
R41	$\not{p}4_2/mmc$	$\not{p}4_2/mcm$

Rod group	Setting symbol	
	(abc)	$(\pm 2a \pm b \quad \mp a \pm b \quad c)$ $(\pm a \pm 2b \quad \mp 2a \mp b \quad c)$ $(\mp a \pm b \quad \mp a \mp 2b \quad c)$
	Hermann–Mauguin symbol	
R46	$\not{p}312$	$\not{p}321$
R47	$\not{p}3_112$	$\not{p}3_121$
R48	$\not{p}3_212$	$\not{p}3_221$
R49	$\not{p}3m1$	$\not{p}31m$
R50	$\not{p}3c1$	$\not{p}31c$
R51	$\not{p}\bar{3}1m$	$\not{p}\bar{3}m1$
R52	$\not{p}\bar{3}1c$	$\not{p}\bar{3}c1$
R70	$\not{p}6_3mc$	$\not{p}6_3cm$
R71	$\not{p}\bar{6}m2$	$\not{p}\bar{6}2m$
R72	$\not{p}\bar{6}c2$	$\not{p}\bar{6}2c$
R75	$\not{p}6_3/mmc$	$\not{p}6_3/mcm$

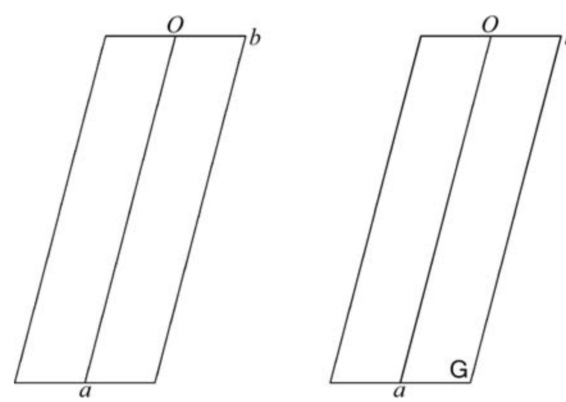

Fig. 1.2.6.16. Diagrams for oblique frieze groups.

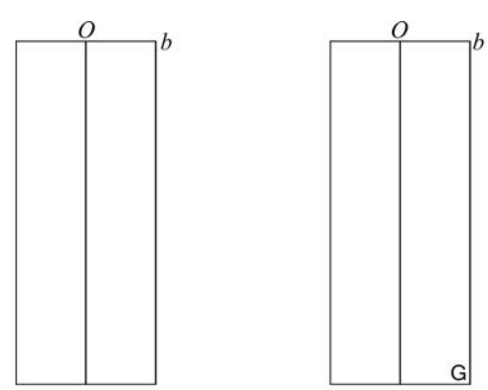

Fig. 1.2.6.17. Diagrams for rectangular frieze groups.

1.2.7. Origin

The origin has been chosen according to the following conventions:

(i) If the subperiodic group is centrosymmetric, then the inversion centre is chosen as the origin. For the three layer groups $p4/n$ (L52), $p4/nbm$ (L62) and $p4/nmm$ (L64), we give descriptions for two origins, at the inversion centre and at $(-\frac{1}{4}, -\frac{1}{4}, 0)$ from the inversion centre. This latter origin is at a position of high site symmetry and is consistent with having the origin on the fourfold axis, as is the case for all other tetragonal layer groups. The group symbols for the description with the origin at the inversion centre, *e.g.* $p4/n\,(\frac{1}{4}, \frac{1}{4}, 0)$, are followed by the shift $(\frac{1}{4}, \frac{1}{4}, 0)$ of the position of the origin used in the description having the origin on the fourfold axis.

(ii) For noncentrosymmetric subperiodic groups, the origin is at a point of highest site symmetry. If no symmetry is higher than 1, the origin is placed on a screw axis, a glide plane or at the intersection of several such symmetry elements.

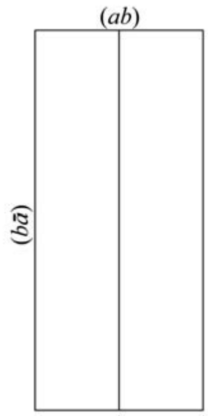

Fig. 1.2.6.18. The two settings for frieze groups. For the second setting, printed vertically, the page must be turned 90° clockwise or viewed from the right-hand side.

Origin statement: In the line *Origin* immediately below the diagrams, the site symmetry of the origin is stated if different from the identity. A further symbol indicates all symmetry elements that pass through the origin. For the three layer groups $p4/n$ (L52), $p4/nbm$ (L62) and $p4/nmm$ (L64) where the origin is on the fourfold axis, the statement 'at $-\frac{1}{4}, -\frac{1}{4}, 0$ from centre' is given to denote the position of the origin with respect to an inversion centre.

1.2.8. Asymmetric unit

An asymmetric unit of a subperiodic group is a simply connected smallest part of space from which, by application of all symmetry operations of the subperiodic group, the whole space is filled exactly. For three-dimensional (two-dimensional) space groups, because they contain three-dimensional (two-dimensional) translational symmetry, the asymmetric unit is a finite part of space [see Section 2.8 of *IT* A (1983)]. For subperiodic groups, because the translational symmetry is of a lower dimension than that of the space, the asymmetric unit is infinite in size. We define the asymmetric unit for subperiodic groups by setting the limits on the coordinates of points contained in the asymmetric unit.

1.2.8.1. *Frieze groups*

For all frieze groups, a limit is set on the x coordinate of the asymmetric unit by the inequality

$$0 \le x \le \text{ upper limit on } x.$$

For the y coordinate, either there is no limit and nothing further is written, or there is the lower limit of zero, *i.e.* $0 \le y$.

Example: The frieze group $\mathscr{p}2mm$ (F6)
Asymmetric unit $0 \le x \le 1/2;\ 0 \le y.$

1.2.8.2. *Rod groups*

For all rod groups, a limit is set on the z coordinate of the asymmetric unit by the inequality

$$0 \le z \le \text{ upper limit on } z.$$

For each of the x and y coordinates, either there is no limit and nothing further is written, or there is the lower limit of zero.

For tetragonal, trigonal and hexagonal rod groups, additional limits are required to define the asymmetric unit. These limits are given by additional inequalities, such as $x \le y$ and $y \le x/2$. Fig. 1.2.8.1 schematically shows the boundaries represented by such inequalities.

Table 1.2.6.4. *Distinct Hermann–Mauguin symbols for frieze groups in different settings*

	Setting symbol	
	(ab)	$(b\bar{a})$
Frieze group	Hermann–Mauguin symbol	
F1	$\mathscr{p}_a1$	$\mathscr{p}_b1$
F2	$\mathscr{p}_a211$	$\mathscr{p}_b211$
F3	$\mathscr{p}_a1m1$	$\mathscr{p}_b11m$
F4	$\mathscr{p}_a11m$	$\mathscr{p}_b1m1$
F5	$\mathscr{p}_a11g$	$\mathscr{p}_b1g1$
F6	$\mathscr{p}_a2mm$	$\mathscr{p}_b2mm$
F7	$\mathscr{p}_a2mg$	$\mathscr{p}_b2gm$

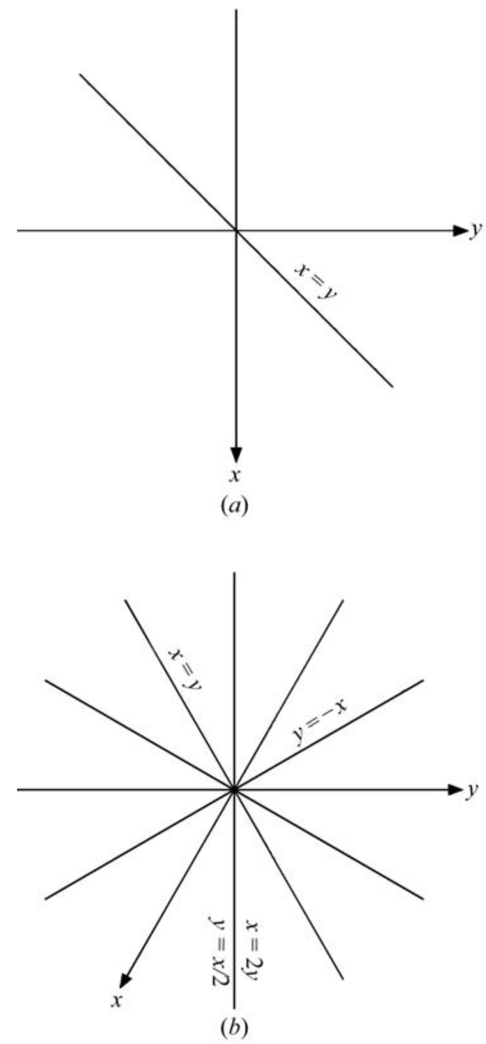

Fig. 1.2.8.1. Boundaries used to define the asymmetric unit for (*a*) tetragonal rod groups and (*b*) trigonal and hexagonal rod groups.

Example: The rod group $\mathscr{p}6_3mc$ (R70)
Asymmetric unit $0 \le x;\ 0 \le y;\ 0 \le z \le 1;\ y \le x/2.$

1.2.8.3. *Layer groups*

For all layer groups, limits are set on the x coordinate and y coordinate of the asymmetric unit by the inequalities

$$0 \le x \le \text{upper limit on } x$$
$$0 \le y \le \text{upper limit on } y.$$

For the z coordinate, either there is no limit and nothing further is written, or there is the lower limit of zero.

references