APPENDIX 4. STANDARD SPOT PATTERNS

This appendix includes diagrams of standard spot diffraction patterns for both cubic and hexagonal crystal structures. In the cubic cases each pattern for a given zone axis (z, defined in appendix 1) has the same, six-, four-, three- or two-fold symmetry but the reflections that occur obey the rules outlined in table 2.1. The patterns for the hexagonal crystal structure are indexed using the Miller–Bravais system outlined in appendix 2, assuming exact close packing, that is an axial ratio (c/a) of 1.633. The positions of the spots will change when the c/a changes. It is recommended that standard patterns be constructed for the c/a value corresponding to the actual material studied using the tables of Rarey, Stringer and Edington (1966). In figures A4.1–A4.4, the indexing procedure outlined in section 2.7.2.1 has been followed.

The positions of superlattice reflections are also shown in figures A4.1 and A4.2. The intensities of the spots will depend upon their structure factor as described in section 2.3.1. The reflections that occur in cubic crystal structures are shown in tables A4.1 and A4.2.

Appendix 4: Reference

Rarey, C. R., Stringer, J., and Edington, J. W. (1966). *Trans. A.I.M.E.*, **236**, 811.

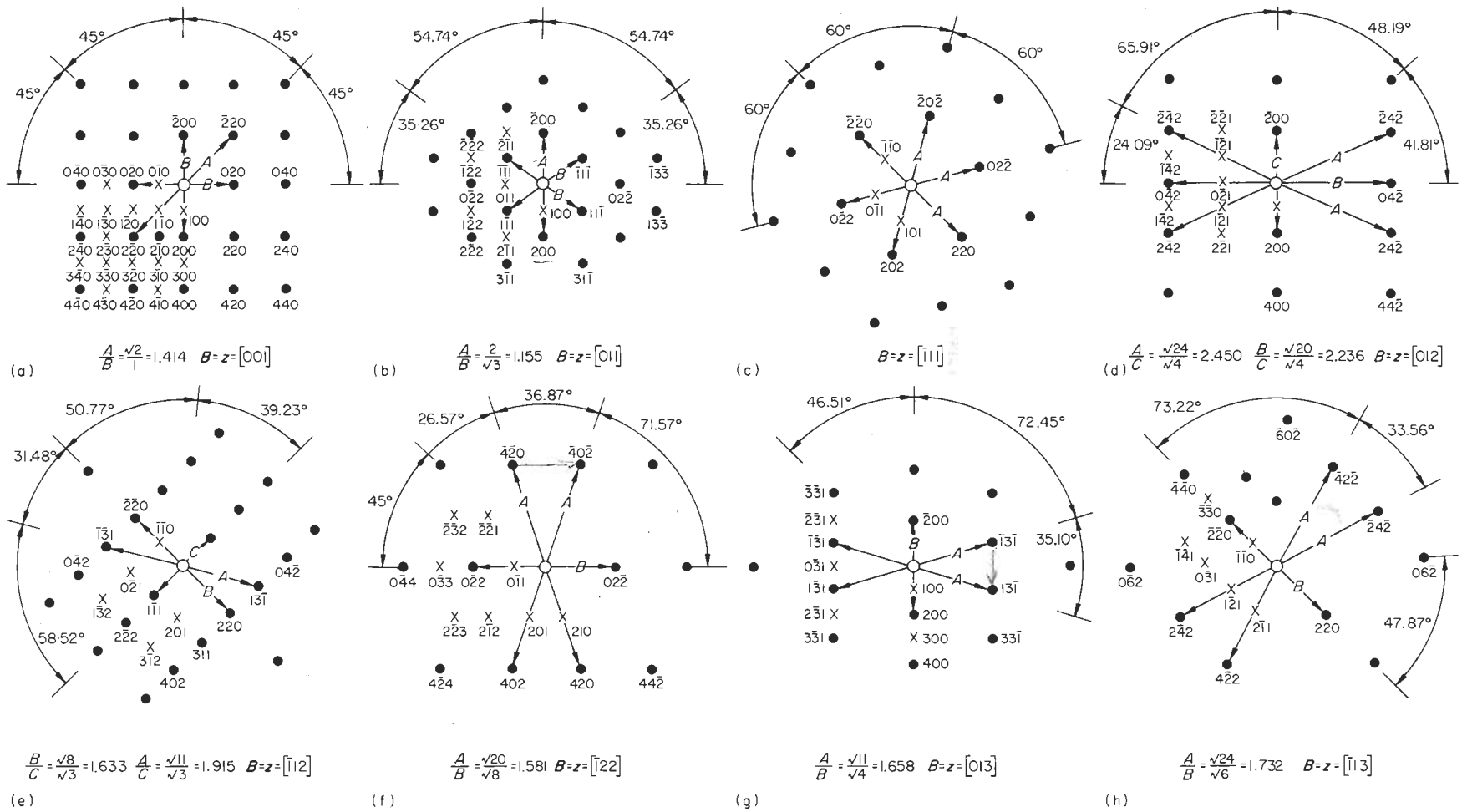


Figure A4.1 Single-crystal spot transmission electron diffraction patterns for the f.c.c. crystal structure ($u^2 + v^2 + w^2 < 22$). The zone axis z, defined in appendix 1, is the beam direction $\boldsymbol{B}$ defined in section 2.7.2, as indicated. The crosses in one quadrant of the diagram indicate the positions of the spots for the ordered f.c.c. ($L1_2$) unit cell. The complete pattern may be generated by repeating these spots in the remainder of the pattern and indexing using the addition of vectors, see section 2.7.2.1

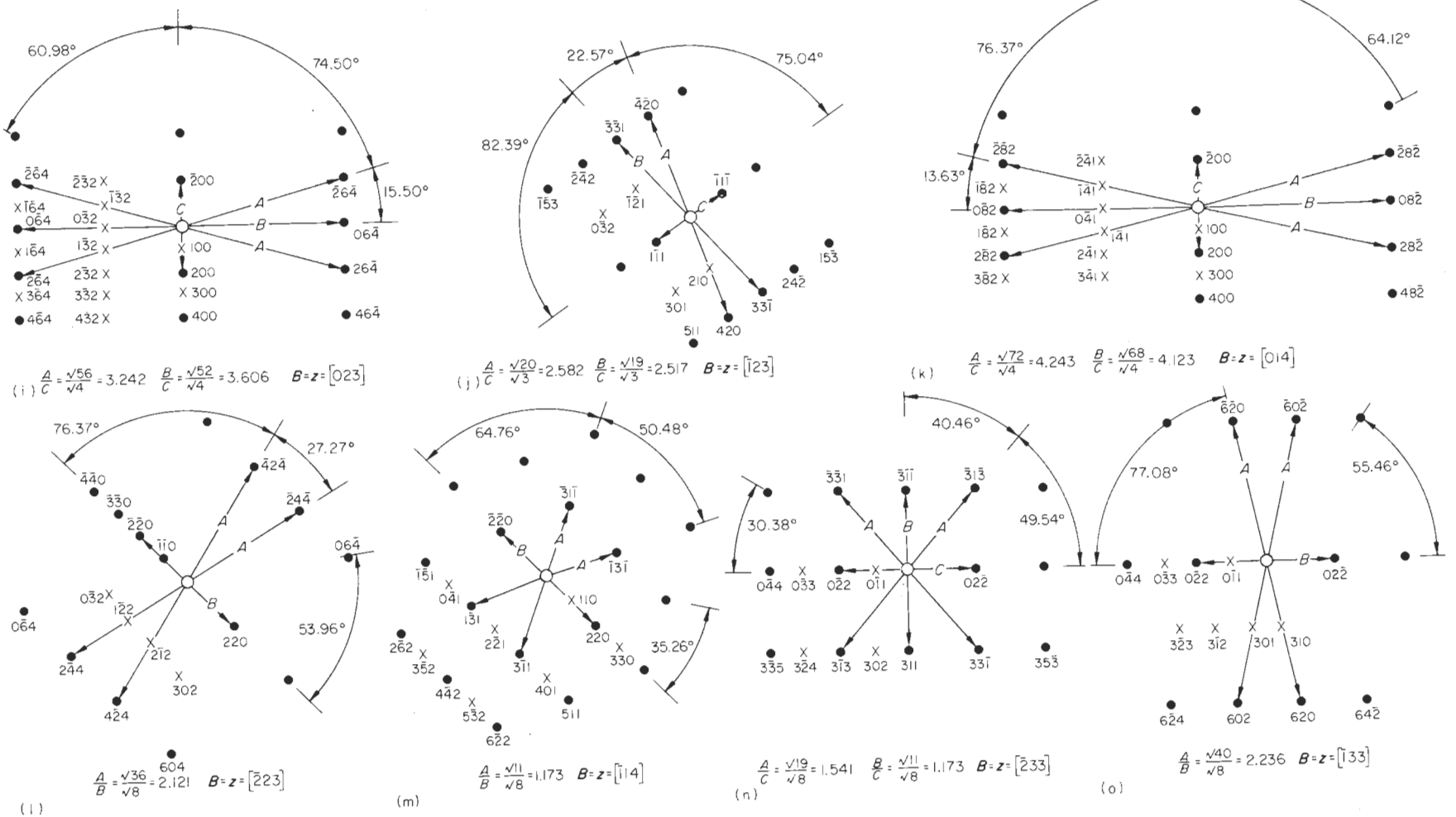


Figure A4.1 (*continued*)

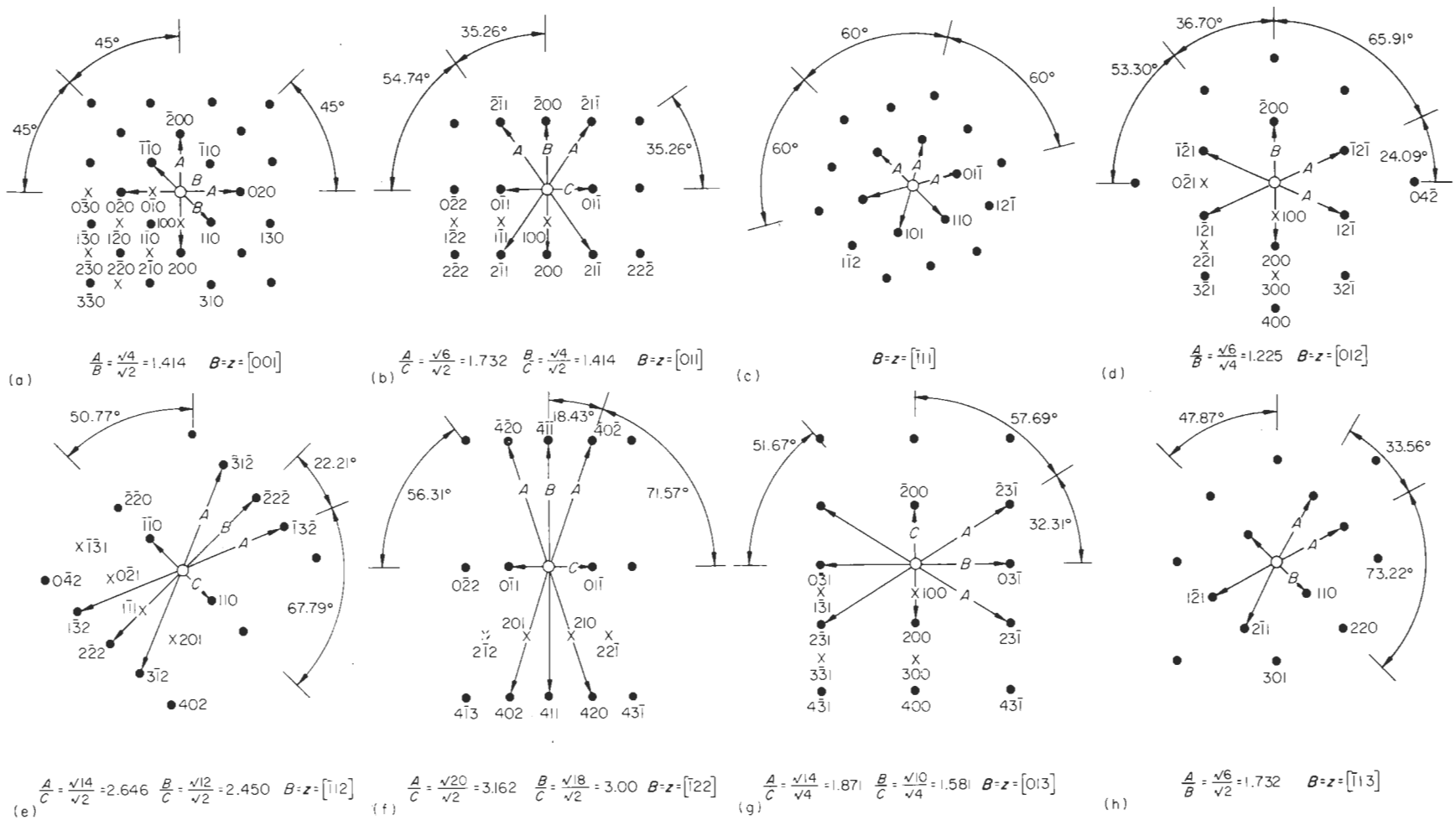
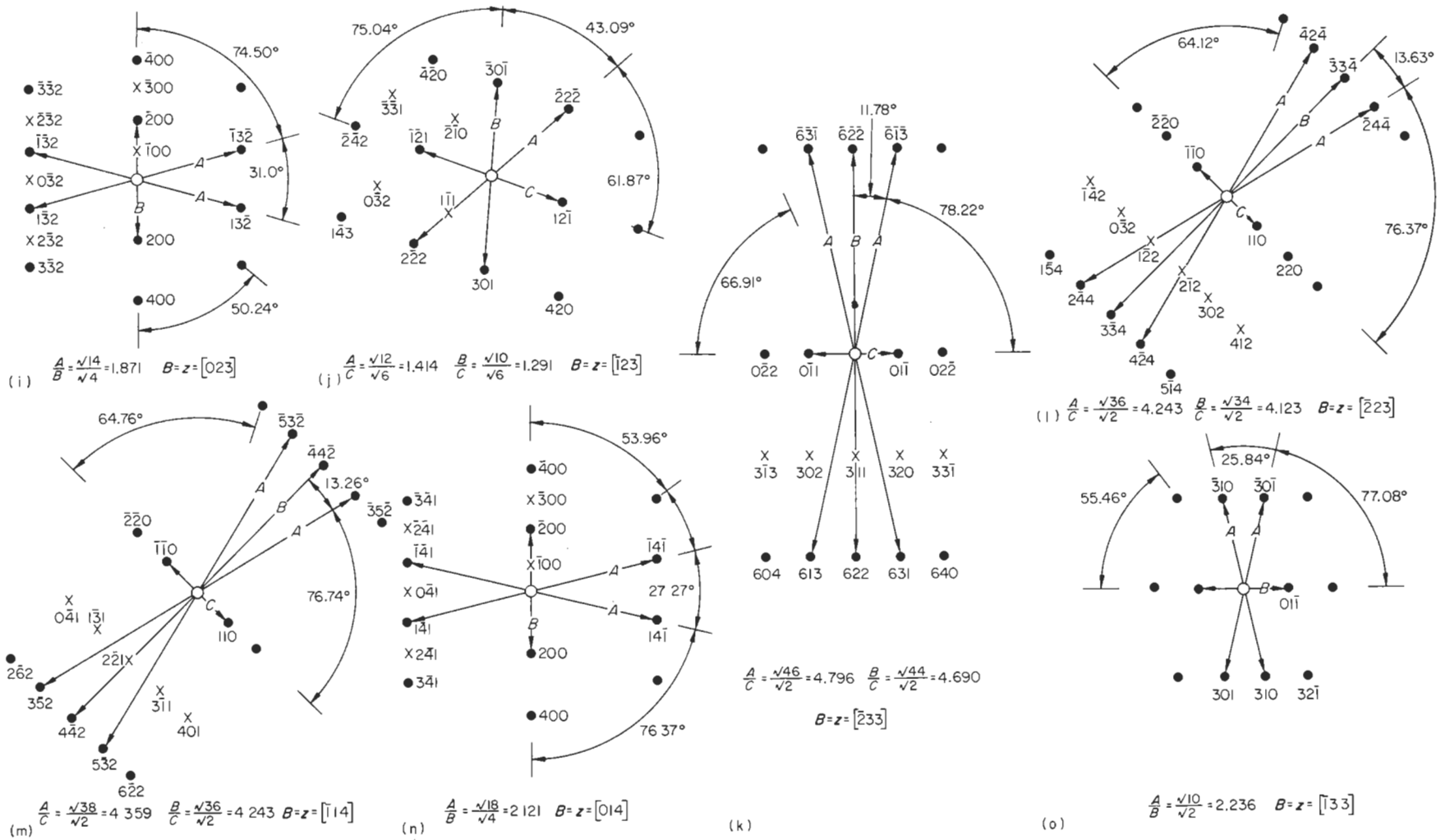


Figure A4.2 Single-crystal spot transmission electron diffraction patterns for the b.c.c. crystal structure ($u^2 + v^2 + w^2 \leqslant 22$). The zone axis z, defined in appendix 1, is the beam direction $\boldsymbol{B}$, defined in section 2.7.2, as indicated. The crosses in one quadrant of the diagram indicate the positions of the spots for the ordered b.c.c. (B_2) unit cell. The complete pattern may be generated by repeating these spots in the remainder of the pattern and indexing using the addition of vectors, see section 2.7.2.1



(i) $\frac{A}{B} = \frac{\sqrt{14}}{\sqrt{4}} = 1.871$ $B = z = [023]$

(j) $\frac{A}{C} = \frac{\sqrt{12}}{\sqrt{6}} = 1.414$ $\frac{B}{C} = \frac{\sqrt{10}}{\sqrt{6}} = 1.291$ $B = z = [\bar{1}23]$

(k) $\frac{A}{C} = \frac{\sqrt{46}}{\sqrt{2}} = 4.796$ $\frac{B}{C} = \frac{\sqrt{44}}{\sqrt{2}} = 4.690$ $B = z = [\bar{2}33]$

(l) $\frac{A}{C} = \frac{\sqrt{36}}{\sqrt{2}} = 4.243$ $\frac{B}{C} = \frac{\sqrt{34}}{\sqrt{2}} = 4.123$ $B = z = [\bar{2}23]$

(m) $\frac{A}{C} = \frac{\sqrt{38}}{\sqrt{2}} = 4\ 359$ $\frac{B}{C} = \frac{\sqrt{36}}{\sqrt{2}} = 4\ 243$ $B = z = [\bar{1}14]$

(n) $\frac{A}{B} = \frac{\sqrt{18}}{\sqrt{4}} = 2\ 121$ $B = z = [014]$

(o) $\frac{A}{B} = \frac{\sqrt{10}}{\sqrt{2}} = 2.236$ $B = z = [\bar{1}33]$

Figure A4.2 (*continued*)

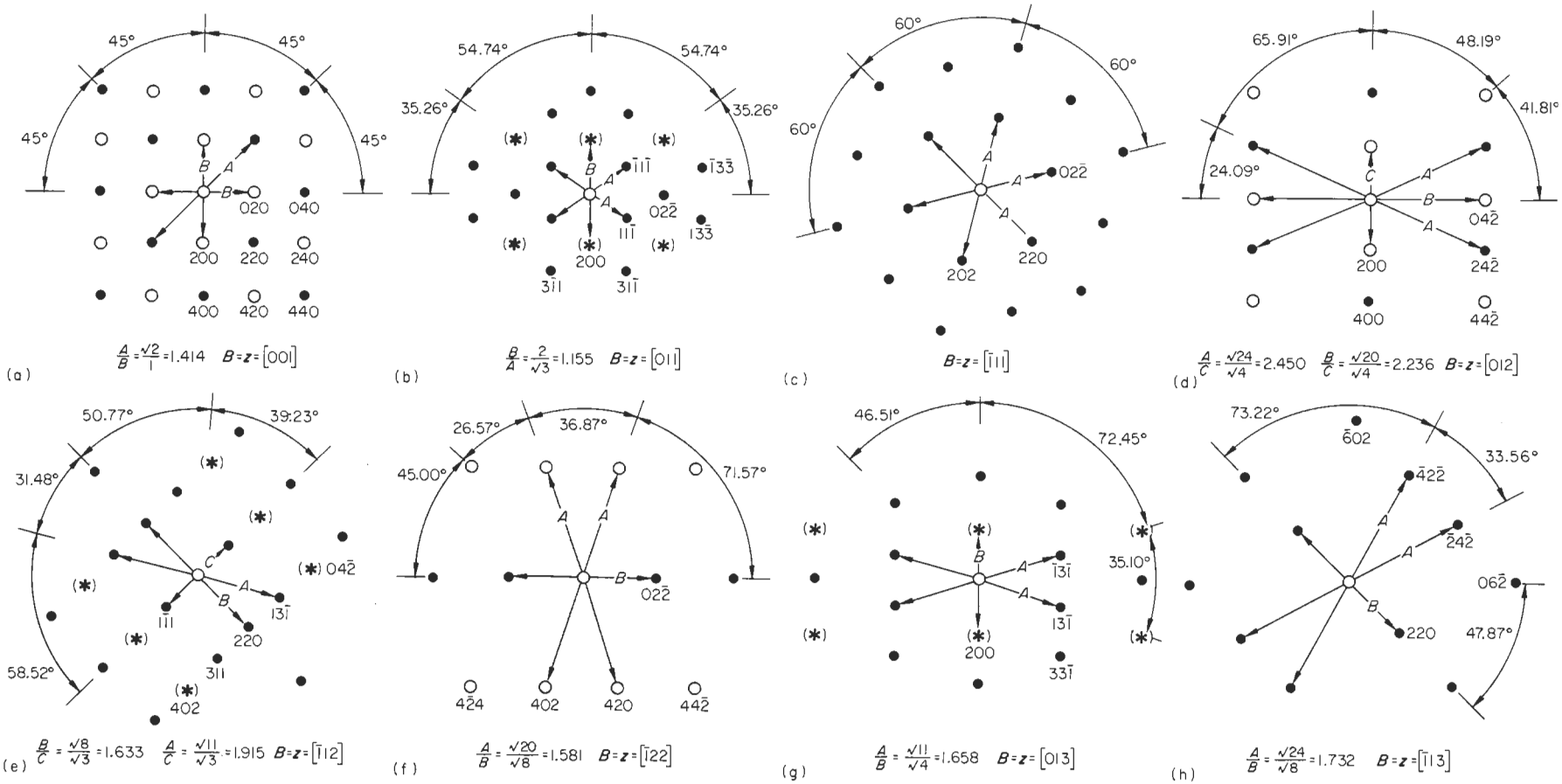


Figure A4.3 Single-crystal spot transmission electron diffraction patterns for diamond structures ($u^2 + v^2 + w^2 \leqslant 22$): ○ additional weaker spots; * spots that could arise from double diffraction. The zone axis z, defined in appendix 1, is the beam direction $\boldsymbol{B}$, defined in section 2.7.2, as indicated [After Andrews *et al.* (1971)]

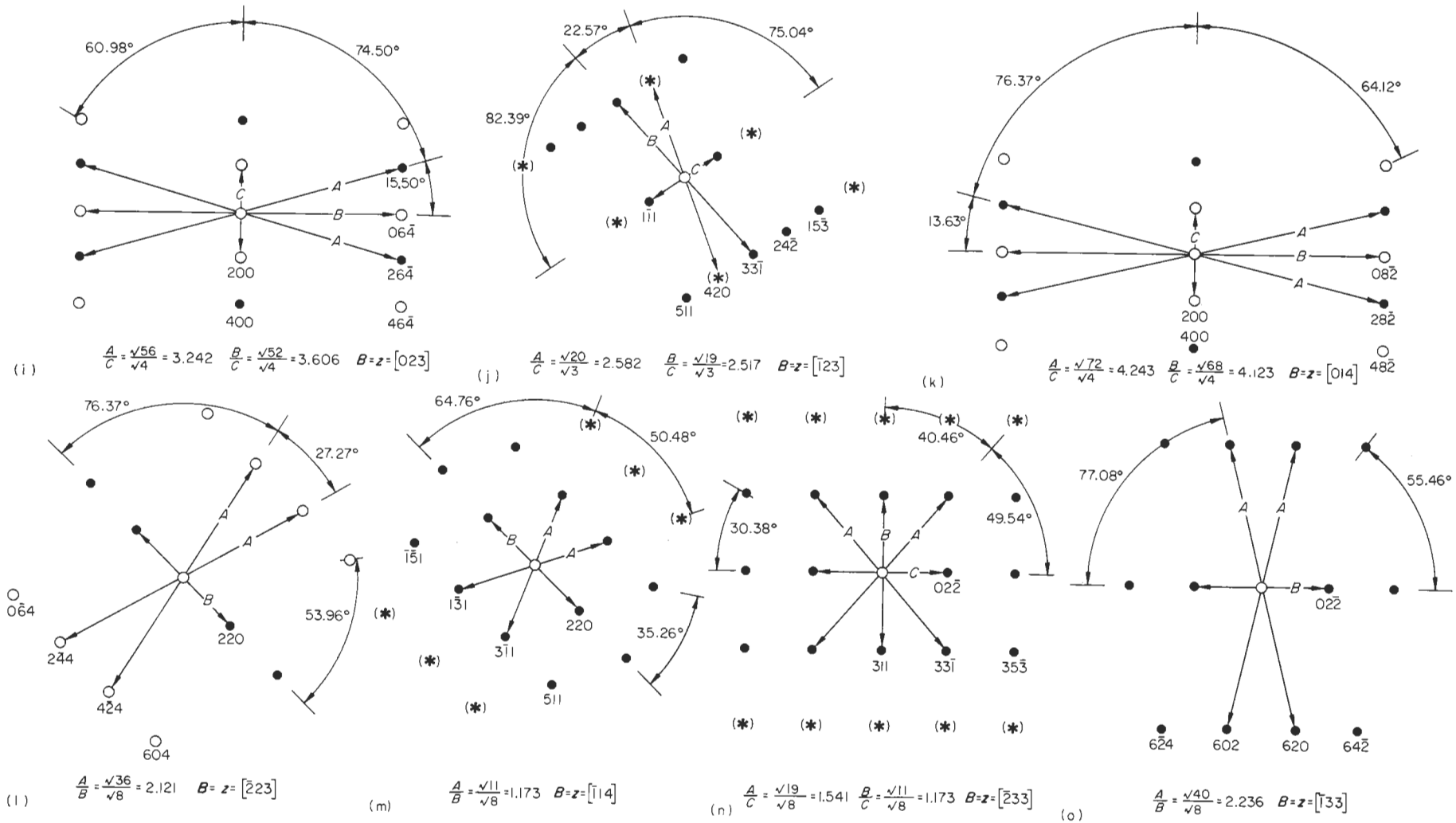


Figure A4.3 (*continued*)

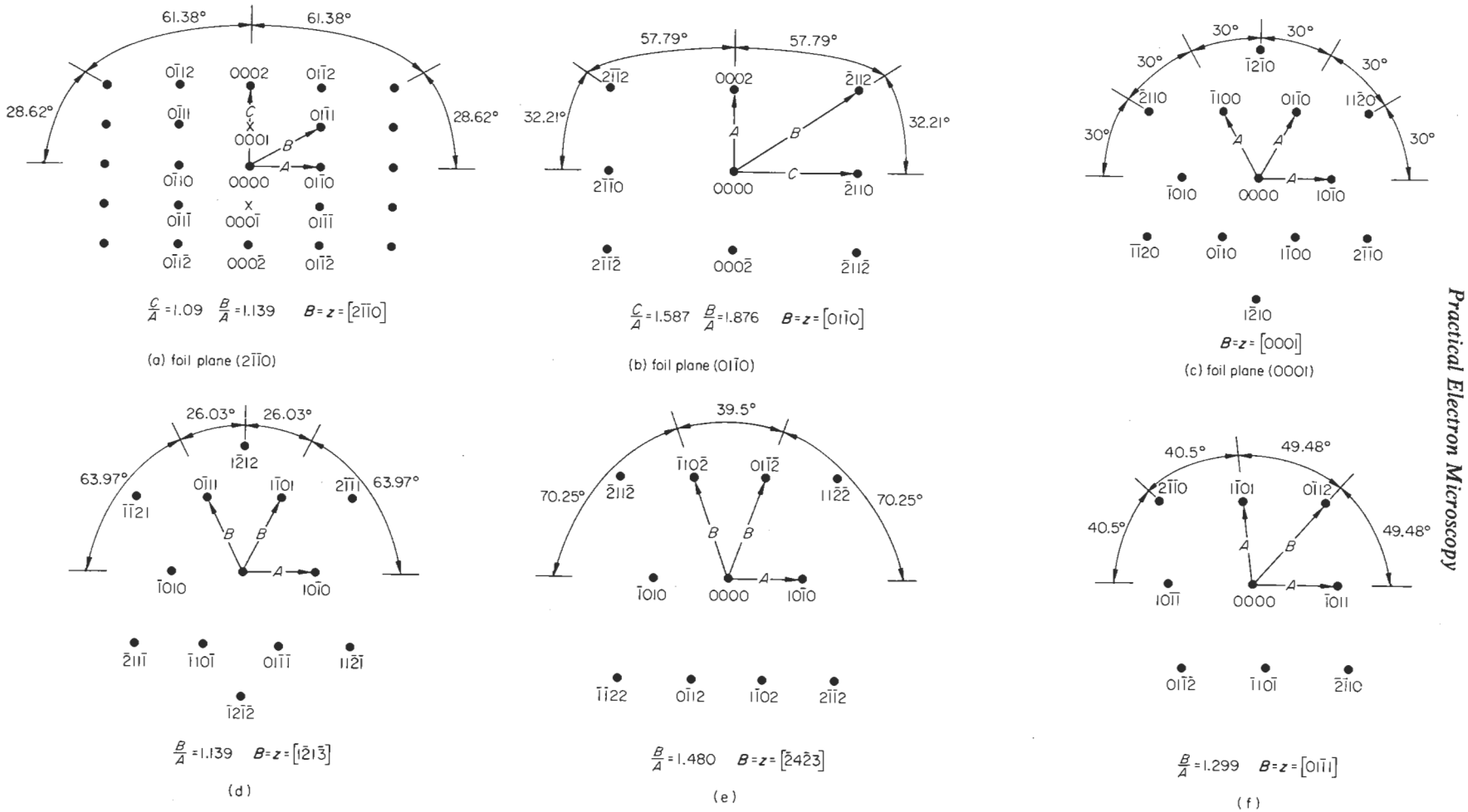
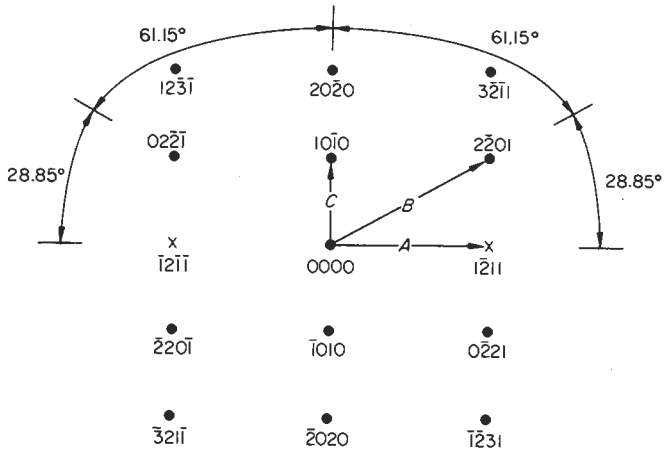
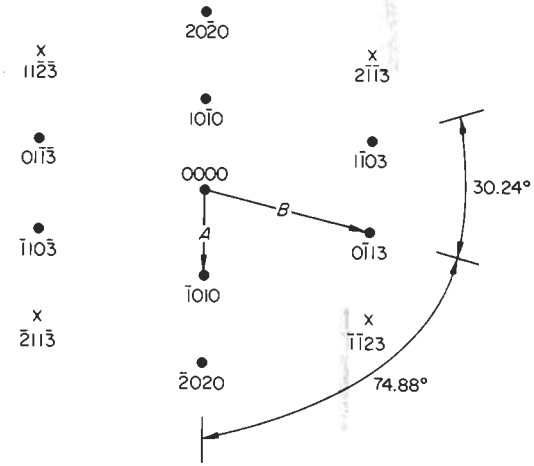


Figure A4.4 Single-crystal spot transmission electron diffraction patterns for the c.p.h. crystal structure. The zone axis, z, defined in appendix 1, is the beam direction **B**, defined in section 2.7.2. The crosses indicate the positions of reflections forbidden by the structure factor but occurring in the pattern by double diffraction



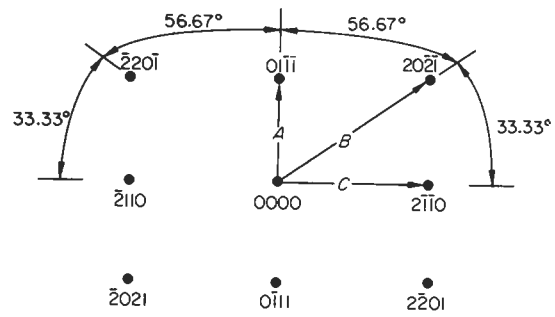
$\frac{A}{C}$ = 1.816 $\frac{B}{C}$ = 2.073 $B = z = [\bar{1}2\bar{1}6]$

(g)



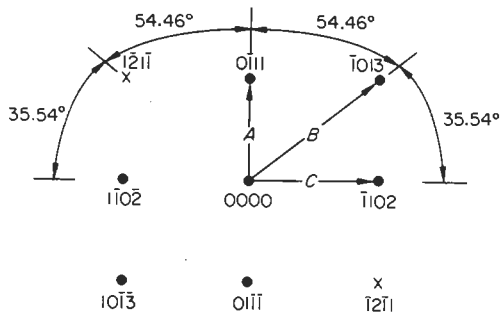
$\frac{B}{A}$ = 1.917 $B = z = [\bar{1}2\bar{1}\bar{1}]$

(h)



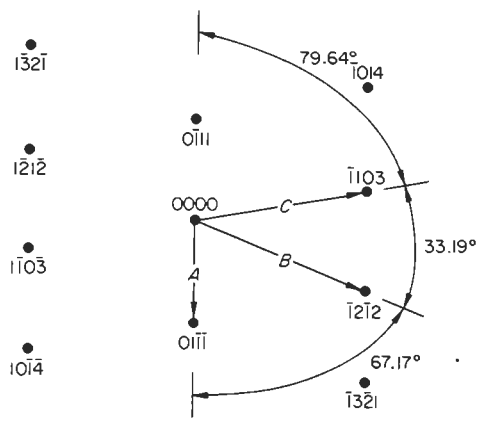
$\frac{C}{A}$ = 1.520 $\frac{B}{A}$ = 1.820 $B = z = [01\bar{1}2]$

(i)



$\frac{C}{A}$ = 1.299 $\frac{B}{A}$ = 1.683 $B = z = [5\bar{1}\bar{4}3]$

(j)



$\frac{B}{A}$ = 1.797 $\frac{C}{A}$ = 1.684 $B = z = [7\bar{2}\bar{5}3]$

(k)

Figure A4.4 *(continued)*