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## Site-Symmetry Restrictions on Thermal-Motion-Tensor Coefficients up to Rank 8

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#### Abstract

An extension of the tables for the site-symmetry restrictions on the thermal-motion-tensor coefficients to include tensors up to rank 6 (up to rank 8 for cubic, hexagonal, tetragonal and trigonal site symmetries) is presented. The dependence relationships of these symmetric polar tensors are calculated in their natural crystallographic lattice frames using a direct method.

#### Introduction

Recently there has been a growing interest in the study of anharmonicity in thermal motion; anharmonic parameters are essential, for example, in modelling the structures of fast ionic conductors or other disordered systems like ferroelectrics. These highly anharmonic systems very often need thermal parameters higher than fourth order to obtain a satisfactory description. Moreover, anisotropic modifications in a plane of hexagonal symmetry can be described only with sixth- (or higher) order terms. Nowadays the accuracy and precision of diffraction data are in general no longer an obstacle to a meaningful refinement of such high-order thermal parameters in a least-squares procedure, e.g. CsPbCl<sub>3</sub> (Hutton & Nelmes, 1981), Li<sub>3</sub>N (Zucker & Schulz, 1982), Ag<sub>3</sub>SI (Perenthaler & Schulz, 1981), PbF<sub>2</sub> (Schulz, Perenthaler & Zucker, 1982), RbAg<sub>4</sub>I<sub>5</sub> (Kuhs, 1983). Crystallographic program systems like PROMETHEUS (Zucker, Perenthaler, Kuhs, Bachmann & Schulz, 1983) allow for the routine insertion and refinement of parameters up to sixth order. To facilitate a general application, a tabulation of the symmetry constraints for all crystallographic site symmetries is clearly needed.

Whilst the symmetry restrictions of, for example, the elastic coefficients based on orthogonal lattice frames are at least partially available up to twelfth order (*i.e.* sixth-order elastic constants) (Chung & Li, 1974; Brendel, 1979; Fumi & Ripamonti, 1983), a tabulation for general (even- and odd-rank) symmetric polar tensors based on the natural crystallographic lattice frames is available only for tensors up to fourth order (Johnson & Levy, 1974). This paper presents the extension of that tabulation.

#### Method

The method used to derive the dependence relations for symmetric polar tensor coefficients is based on the fundamental transformation law for tensors ('direct method'). A tensor coefficient remains unchanged when the transformation corresponds to the site symmetry:

$$C_T^{jklmnp\ldots} = T_{jq}T_{kr}T_{ls}T_{ml}T_{nu}T_{pv}\ldots C^{qrsluv\ldots}$$

with  $C_T^{jklmnp...} = C^{qrstuv...}$  and  $l \leq j, k, l, m, n, p, q, r$ , s, t, u,  $v \dots \leq 3$ . The point-group generators T were taken from Johnson & Levy (1974). For site symmetries having several generators all of them have been treated simultaneously. The homogeneous system of equations obtained (one equation for each coefficient) was reduced using a Gaussian elimination procedure. The order of assignment of independency is with increasing indices of the coefficients, except for the unmixed coefficients  $C^{jjjjjj}$ , which have highest priority in every case.\* The correctness of the remaining system of equations giving the dependence relationships was checked algebraically by inserting numerical values. In addition, the number of unrestricted parameters was checked by comparison with results obtained by group-theoretical calculations (Sirotin, 1960).

<sup>\*</sup> This is the same ordering, as, for example, in the *PROMETHEUS* system (Zucker, Perenthaler, Kuhs, Bachmann & Schulz, 1983).

# Table 1. Site-symmetry table giving key to tables 2A, B, for restrictions on the symmetry of various thermal-motiontensors (Hex denotes hexagonal axes)

Symmetry axes         Point-group generators         x         y, z         2.4         2.8         Symmetry axes         Point-group generators         x, z, z         2.4         2.4         2.1	Point s	ymmetry	y at special	position		Position	Cro refere numbe	oss- ence er for	Poi	nt symm	netry at speci	al position	Position	Cr refer numb	oss- ence er for
	Symmetry	axes	Point-grou	ip genera	tors	x, y, z	2 <i>A</i>	2 <i>B</i>	Symmet	ry axes	Point-grou	p generators	x, y, z	2 <i>A</i>	2 <i>B</i>
	m3 m		4[0, 0, 1]	3[1, 1, 1]	Ī	0, 0, 0	EO	F١	mm		2[1,0,0]	2[0,0,1]	x, 0, 0	E44	F22
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c}$	43 <i>m</i>		4[0, 0, 1]	3[1, 1, 1]		0,0,0	E1	F1	mm		2[1, 0, 0]	2[0, 1, 1]	x, 0, 0	E45	F25
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	432 m3		4[0, 0, 1] 3[1, 1, 1]	2[0, 0, 1]	ī	0,0,0	E0 E0	F1 F2	mm mm		$2[1, \bar{1}, 0]$ $2[1, \bar{1}, 0]$	$\frac{2[0, 0, 1]}{2[0, 0, 1]}$	τ,τ,0 τ,τ,0	E 40 E 47	F23
$ \begin{array}{c} for mm \\ hex \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	23		3[1, 1, 1]	2[0, 0, 1]	-	0,0,0	<i>E</i> 1	F2	mm		2[1, 0, 1]	2[0, 1, 0]	x, 0, x	E 48	F24
$ \begin{array}{c} \begin{array}{c} 1 \\ 1 \\ 2 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	6/ mmm šm2	Hex	6[0, 0, 1] 6[0, 0, 1]	2[1, 0, 0]	1	0,0,0	E0	F3	mm		2[1, 0, 1]	2[0, 1, 0]	x, 0, x	E 49	F24
	6m2	Hex	$\overline{6}[0, 0, 1]$	2[1, 0, 0] 2[1, 2, 0]		0,0,0	E 5 E 6	F3	mm mm		2[0, 1, 1] $2[0, 1, \overline{1}]$	$\frac{2[1, 0, 0]}{2[1, 0, 0]}$	0, y, y 0, v, v	E 50 E 51	F 25 F 25
$ \begin{array}{c} 0.21 \\ 0.7$	6 <i>mm</i>	Hex	6[0,0,1]	2[1,0,0]		0, 0, z	E 17	F3	mm	Hex	2[0, 0, 1]	<b>2</b> [1,0,0]	0, 0, z	E 52	F26
	622 6/m	Hex	6[0,0,1]	$\frac{2[1,0,0]}{7}$		0,0,0	E0 E0	F4 F4	mn	Hex	2[0, 0, 1]	2[1, 1, 0]	0, 0, z	E41	F23
	ō,	Hex	$\bar{6}[0, 0, 1]$	•		0, 0, 0	E 24	F4	mm	Hex	2[1, 0, 0]	$\bar{2}[0, 1, 0]$ $\bar{2}[0, 0, 1]$	0, 0, 2 x, 0, 0	E 53 E 54	F 27 F 26
$ \begin{array}{c} ymmm & q_{0}(h) & q_{1}(h) & q_{1}(h) & q_{1}(h) & q_{0}(h) & q_{1}(h) & q_{1}(h$	6	Hex	6[0, 0, 1]	2(1 0 0)	÷	0, 0, z	E 17	F4	mm	Hex	2[2, 1, 0]	2[0,0,1]	2x, x, 0	E 55	F27
$ \begin{array}{c} mmm & 4 1,0,0  & 20,1,0  & 1 & 0,0,0 & E0 & F7 & mm & Hex & 20,1,0  & 20,0,1  & 0,0,0 & E3 & F57 & F33 \\ 42m & 40,0,1  & 21,1,0,0  & 0,0,0 & E8 & F5 & 222 & 21,0,1,0  & 21,0,0  & 0,0,0 & E18 & F23 \\ 42m & 40,1,0  & 21,0,1  & 0,0,0 & E9 & F6 & 222 & 21,0,1,0  & 21,0,0  & 0,0,0 & E19 & F23 \\ 42m & 40,1,0  & 21,0,1  & 0,0,0 & E10 & F7 & 222 & 21,0,1,0  & 21,0,0  & 0,0,0 & E10 & F4 \\ 42m & 40,1,0  & 21,0,0  & 0,0,0 & E10 & F7 & 222 & 21,0,1,0  & 21,0,0  & 0,0,0 & E12 & F23 \\ 4mm & 40,0,1  & 21,0,0  & 0,0,0 & E10 & F7 & 222 & Hex & 21,0,0  & 21,0,0  & 0,0,0 & E12 & F23 \\ 4mm & 40,0,1  & 21,0,0  & 0,0,0 & E12 & F5 & 222 & Hex & 21,0,0,1  & 0,0,0 & E12 & F23 \\ 4mm & 40,0,0  & 21,0,0  & 0,0,0 & E27 & F7 & 22m & 21,0,0,0  & 1 & 0,0,0 & E23 & F27 \\ 4mm & 41,0,0  & 20,0,1  & 0,0,0 & E3 & F5 & 22m & Hex & 21,0,0,1  & 0,0,0 & E0 & F33 \\ 422 & 40,0,0  & 20,0,0  & 0,0,0 & E3 & F5 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 423 & 40,0,0  & 20,0,0  & 0,0,0 & E3 & F5 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 424 & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 424 & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 42m & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 21,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E0 & F14 & 22m & 42,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E3 & F14 & 22m & 42,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E3 & F14 & 22m & 42,0,0,0  & 1 & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E3 & F14 & 22m & Hex & 21,0,0,0  & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E3 & F14 & 22m & Hex & 21,0,0,0  & 0,0,0 & E0 & F34 \\ 4mm & 40,0,0  & 0,0,0 & E3 & F14 & 22m & Hex & 21,0,0,0  & 0,0,0 & E0 & F34 \\ 5mm & 31,1,1,0  & 21,0,0  & 0,0,0 & E0 & F14 & 22m & Hex & 21,0,0  & 0,0,0 & E0 & F34 \\ 5mm & 31,1,1,0  & 21,0,0  & 0,0,0 & E0 & F14 & 22m & Hex & 21,0,0  & 0,0,0 & E0 & F37 \\ 5mm & 31,1,1,0$	4/mmm 4/mmm		4[0,0,1] 4[0,1,0]	2[1,0,0] 2[0,0,1]	ī	0,0,0	E0 E0	F5 F6	mm	Hex	2[1, 1, 0]	2[0, 0, 1]	x x 0	E 46	F23
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4/ mmm		4[1,0,0]	2[0, 1, 0]	ĩ	0, 0, 0	EO	F7	mm	Hex	2[0, 1, 0]	$\bar{2}[0, 0, 1]$	0, y, 0	E 57	F20
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	42 m 42 m		4[0, 0, 1]	2[1, 0, 0]		0,0,0	E7	F5	mm	Hex	2[1, 1, 0]	2[0,0,1]	x, x, 0	E47	F23
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	42 <i>m</i>		$\bar{4}[0, 0, 1]$ $\bar{4}[0, 1, 0]$	2[0, 0, 1]		0,0,0	E 8 E 9	F6	222		2[0, 0, 1] 2[0, 0, 1]	2[1,0,0] 2[1,1,0]	0,0,0	E 18 F 19	F22 F23
	42 <i>m</i>		<b>4</b> [0, 1, 0]	2[1,0,1]		0, 0, 0	E10	F6	222		2[0, 1, 0]	2[1,0,1]	0, 0, 0	E 20	F24
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	42 <i>m</i> Ā2m		4[1,0,0] $\bar{4}[1,0,0]$	2[0, 1, 0]		0,0,0	E11 E12	F7	222		2[1, 0, 0]	2[0, 1, 1]	0,0,0	E 21	• F25
4mm         4(10,0)         2(0,0) $x$ , $x$ , $x$ , $x$ , $z$	4mm		4[0, 0, 1]	2[0, 1, 1] 2[1, 0, 0]		0, 0, 0 0, 0, z	E 25	F5	222	Hex	2[0, 0, 1]	2[1, 0, 0] 2[1, 1, 0]	0,0,0	E 22 E 19	F26 F23
and         4,0,0 $40,1,0$ $\lambda$ , $0,0$ $E27$ $F7$ $2m$ $20,0,0$ $1$ $0,0,0$ $E50$ $F73$ 422         40,0,0 $20,1,0$ $0,0,0$ $E3$ $F75$ $2/m$ $21,0,0$ $1$ $0,0,0$ $E50$ $F73$ 422         40,0,0 $1$ $0,0,0$ $E50$ $F74$ $2/m$ $21,0,0$ $1$ $0,0,0$ $E50$ $F73$ 4/m         40,0,0 $1$ $0,0,0$ $E0$ $F14$ $2/m$ $21,0,0$ $1$ $0,0,0$ $E50$ $F74$ $4/m$ 40,0,0 $1$ $0,0,0$ $E53$ $F14$ $2/m$ $20,0,1$ $1$ $0,0,0$ $E50$ $F16$ $2/m$ $20,0,1$ $1$ $0,0,0$ $E50$ $F16$ $2/m$ $E10,01$ $1$ $0,0,0$ $E0$ $F33$ $4$ $40,0,01$ $0,0,0$ $E0$ $F80$ $2/m$ $Hex$ $20,0,01$ $0,0$ $E0$ $F33$	4 <i>mm</i>		4[0, 1, 0]	2[0,0,1]		0, y, 0	E 26	F6	222	Hex	2[0, 0, 1]	2[0, 1, 0]	0, 0, 0	E 23	F27
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4 <i>mm</i> 422		4[1,0,0] 4[0,0,1]	2[0, 1, 0] 2[1, 0, 0]		x, 0, 0 0, 0, 0	E 27 E 2	F7 F5	2/m 2/m		2[0, 0, 1]	1	0, 0, 0	E0	F28
422       4[1,0]       2[0,1,0]       0,0,0       E4       F7       2/m       2[1,1,0]       1       0,0,0       E60       F13         4/m       4[0,0,1]       1       0,0,0       E60       F14       2/m       2[1,1,0]       1       0,0,0       E60       F53         4/m       4[0,0,1]       0,0,0       E60       F16       2/m       2[1,0,1]       1       0,0,0       E60       F53         4       4[0,0,0]       0,0,0       E20       F15       2/m       2[0,1,1]       1       0,0,0       E60       F53         4       4[0,0,0]       0,0,0       E20       F15       2/m       Hex       2[0,0,1]       0,0,0       E60       F53         4       4[0,0,0]       0,0,0       E0       F54       2/m       Hex       2[1,1,0]       1       0,0,0       E60       F53         5m       31[1,1]       2[1,0]       1       0,0,0       E60       F61       2/m       Hex       2[1,1,0]       1       0,0,0       E60       F63         5m       3[1,1,1]       2[1,1,0]       1       0,0,0       E60       F10       2/m       Hex       2[1,1,0]       0,0,0       E6	422		4[0, 1, 0]	2[0, 0, 1]		0, 0, 0	E 3	F6	2/m		2[1,0,0]	ī	0, 0, 0	E0	F30
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	422 4/m		4[1,0,0]	$\frac{2}{1}[0, 1, 0]$		0,0,0	E4 E0	F7	2/ m		2[1, 1, 0]	1	0, 0, 0	E0	F31
	4/m		4[0, 1, 0]	i		0,0,0	E0	F15	2/m 2/m		2[1, 1, 0] 2[1, 0, 1]	Ī	0,0,0	E0 E0	F 32 F 33
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4/m		4[1,0,0]	Ī		0, 0, 0	E0	F16	2/ m		2[1, 0, Ī]	Ī	0, 0, 0	E0	F34
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4 Ā		$\frac{4[0, 0, 1]}{4[0, 1, 0]}$			0,0,0	E 28 E 29	F14 F15	2/m		2[0, 1, 1]	1	0,0,0	E0	F35
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4		4[1, 0, 0]			0, 0, 0	E 30	F16	2/m 2/m	Hex	2[0, 1, 1] 2[0, 0, 1]	i	0,0,0	E0 E0	F 30 F 28
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4		4[0, 0, 1]			0, 0, z	E31	F14	2/m	Hex	2[1,0,0]	Ī	0, 0, 0	E0	F37
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4		4[1,0,0]			x, 0, 0	E 32 E 33	F16	2/m 2/m	Hex Hex	2[2, 1, 0]	Ī	0,0,0	E0 E0	F 38 F 31
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	<u>3</u> m		3[1, 1, 1]	2[1, 1, 0]	Ī	0, 0, 0	EO	F8	2/ m	Hex	2[1, 2, 0]	ĩ	0, 0, 0	EO	F39
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\frac{3m}{3m}$		3[1, 1, 1]	2[1, 1, 0] 2[1, 1, 0]	1	0,0,0	E0 E0	F9 E10	2/m	Hex	2[0, 1, 0]	1	0, 0, 0	E0	F40
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	<u>3</u> m		3[1, 1, 1]	2[1,1,0]	ī	0, 0, 0	E0	FII	2/ <i>m</i>	пех	$\bar{2}[0, 0, 1]$	1	x, v, 0	E76	F28
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3 <i>m</i> 3 m	Hex	3[0, 0, 1]	2[1, 0, 0]	$\frac{1}{1}$	0, 0, 0	E0	F12	m		2[0, 1, 0]		x, 0, z	E77	F29
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3m 3m	nex	3[0, 0, 1] 3[1, 1, 1]	2[1, 2, 0] $2[1, \overline{1}, 0]$	I	0,0,0 x, x, x	E0 E34	F13	m		2[1, 0, 0] $\overline{2}[1, 1, 0]$		0, y, z	E78 E79	F30
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3 <i>m</i>		3[1, 1, 1]	2[1, Ī, 0]		x, x, x	E35	F9	m		Ž[1, Ī, 0]		x, x, z	E80	F32
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3m 3m		3[1,1,1]	$\frac{2[1, 1, 0]}{2[1, 1, 0]}$		x	E 36	F10	m		$\frac{\bar{2}[1, 0, 1]}{\bar{2}[1, 0, 1]}$		x, y, x	E81	F33
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3 <i>m</i>	Hex	3[0, 0, 1]	2[1,0,0]		0, 0, z	E 38	F12	m		$\bar{2}[0, 1, 1]$		<i>x, y, x</i> <i>x, v, v</i>	E 82 E 83	F 34
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 <i>m</i> 37	Hex	3[0, 0, 1]	$\bar{2}[1, 2, 0]$		0, 0, z	E 39	F13	m		2[0, 1, 1]		x, y, y	E84	F36
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	32		$3[1, 1, \overline{1}]$	$2[1, \bar{1}, 0]$ $2[1, \bar{1}, 0]$		0,0,0	E13 E14	F 8 F 9	n m	Hex Hex	2[0,0,1] 5[1,0,0]		x, y, 0 x 2 x z	E76 E85	F28 F37
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	32		3[1, 1, 1]	2[1,1,0]		0, 0, 0	E15	F10	m	Hex	Ī[2, 1, 0]		0, y, z	E 86	F38
32Hex $3[0,0,1]$ $2[1,2,0]$ $0,0,0$ $E_6$ $F_{13}$ $m$ Hex $2[1,2,0]$ $2,0,2$ $E_88$ $F_{32}$ $3$ $3[1,1,1]$ $0,0,0$ $E_0$ $F_{17}$ $m$ Hex $2[1,1,0]$ $x,x,z$ $E_88$ $F_{32}$ $3$ $3[1,1,1]$ $0,0,0$ $E_0$ $F_{18}$ $2$ $2[0,0,1]$ $0,0,z$ $E_{63}$ $F_{28}$ $3$ $3[1,1,1]$ $0,0,0$ $E_0$ $F_{19}$ $2$ $2[0,1,0]$ $0,0,z$ $E_{64}$ $F_{29}$ $3$ $3[1,1,1]$ $0,0,0$ $E_0$ $F_{20}$ $2$ $2[1,0,0]$ $x,0,0$ $E_{66}$ $F_{30}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{58}$ $F_{17}$ $2$ $2[1,1,0]$ $x,x,0$ $E_{66}$ $F_{30}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{58}$ $F_{17}$ $2$ $2[1,0,0]$ $x,0,x$ $E_{68}$ $F_{33}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{58}$ $F_{17}$ $2$ $2[1,0,1]$ $x,0,x$ $E_{68}$ $F_{33}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{59}$ $F_{18}$ $2$ $2[1,0,1]$ $x,0,x$ $E_{68}$ $F_{33}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{59}$ $F_{18}$ $2$ $2[1,0,1]$ $x,0,x$ $E_{68}$ $F_{33}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{59}$ $F_{18}$ $2$ $2[1,0,1]$ $x,0,x$ $E_{68}$ $F_{33}$ $3$ $3[1,1,1]$ $x,x,x$ $E_{59}$ $F_{18}$ $2$ $2[1,0,1]$	32 32	Hex	3[1, 1, 1]	2[1, 1, 0] 2[1, 0, 0]		0,0,0	E 16 E 5	F11 F12	m	Hex	2[1, 1, 0]		<b>Χ</b> , Χ, Ζ × Ο -	E79	F31
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	32	Hex	3[0, 0, 1]	2[1, 2, 0]		0, 0, 0	E6	F13	m	Hex	$\bar{2}[0, 1, 0]$		2x, x, z	E 88	F 40
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3		3[1, 1, 1] $\overline{3}(1, 1, \overline{1})$			0,0,0	E0 E0	F17 F18	m	Hex	2[1, 1, 0]		x, x, z	E 80	F32
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3		3[1, 1, 1]			0, 0, 0	E0	F19	2		2[0, 0, 1] 2[0, 1, 0]		0,0,z 0,v0	E 63 E 64	F28 F29
3Hex $[0,0,1]$ $0,0,0$ $E0$ $F21$ $2$ $2[1,1,0]$ $x,x,0$ $E66$ $F31$ 3 $3[1,1,1]$ $x,x,x$ $E58$ $F17$ $2$ $2[1,1,0]$ $x,x,0$ $E67$ $F32$ 3 $3[1,1,1]$ $x,x,x$ $E59$ $F18$ $2$ $2[1,0,1]$ $x,0,x$ $E68$ $F33$ 3 $3[1,1,1]$ $x,x,x$ $E59$ $F19$ $2$ $2[1,0,1]$ $x,0,x$ $E68$ $F34$ 3 $3[1,1,1]$ $x,x,x$ $E60$ $F19$ $2$ $2[1,0,1]$ $0,y,y$ $E71$ $F35$ 3 $3[1,1,1]$ $x,x,x$ $E61$ $F20$ $2$ $2[0,1,1]$ $0,y,y$ $E71$ $F35$ 3 $3[1,1,1]$ $0,0,0$ $E0$ $F22$ $2$ $2[0,1,1]$ $0,y,y$ $E71$ $F35$ mmm $2[0,0,1]$ $2[1,0,0]$ $\overline{1}$ $0,0,0$ $E0$ $F22$ $2$ $Hex$ $2[1,0,0]$ $x,0,0$ $E72$ $F37$ mmm $2[0,1,0]$ $2[1,0,0]$ $\overline{1}$ $0,0,0$ $E0$ $F24$ $2$ $Hex$ $2[1,0,0]$ $x,x,0$ $E73$ $F38$ mmm $2[1,0,0]$ $2[1,0,0]$ $\overline{1}$ $0,0,0$ $E0$ $F24$ $2$ $Hex$ $2[1,0,0]$ $x,x,0$ $E74$ $F39$ mmm $2[0,0,1]$ $2[1,0,0]$ $\overline{1}$ $0,0,0$ $E0$ $F26$ $2$ $Hex$ $2[1,0,0]$ $x,x,0$ $E74$ $F39$ mmm $4[0,0,1]$ $2[1,0,0]$ $\overline{1}$ $0,0,0$ $E0$ $F2$	3	11	$\bar{3}[\bar{1}, 1, 1]$			0, 0, 0	E0	F20	2		2[1, 0, 0]		x, 0, 0	E 65	F30
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3	nex	3[1, 1, 1]			0,0,0 X X X	E0 E58	F21 F17	2		2[1, 1, 0]		x x 0 x = 0	E66	F31
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3		3[1, 1, 1]			x, x, x	E 59	F18	2		2[1,0,1]		χ0, x	E68	F33
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3		3[1, 1, 1] 3[1, 1, 1]			X, X, X 	E60	F19	2		2[1, 0, Ī]		x, 0, x	£69	F34
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	3	Hex	3[0, 0, 1]			1, 1, 1 0, 0, <i>z</i>	E 61	F 20 F 21	2		2[0, 1, 1] 2[0, 1, 1]		0,y,y 0,v,ÿ	E70 E71	F35
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	mmm		2[0, 0, 1]	2[1,0,0]	Ī	0, 0, 0	E0	F22	2	Hex	2[0, 0, 1]		0, 0, z	E63	F28
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	mmm mmm		2[0, 0, 1]	2[1, 1, 0]	1 ī	0,0,0	E0 E0	F23	2	Hex	2[1,0,0]		x, 0, 0	E72	F37
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	mmm		2[1,0,0]	2[0, 1, 1]	i	0, 0, 0	EO	F25	2	нех Нех	2[2, 1, 0]		2x x U x x O	E/3 E66	F38 F31
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	mmm	Hex	2[0, 0, 1]	2[1, 0, 0]	Ī	0, 0, 0	E0	F26	2	Hex	2[1, 2, 0]		x, 2x, 0	E74	F39
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	mmm	Hex	2[0, 0, 1] 2[0, 0, 1]	2[1, 1, 0] 2[0, 1, 0]	1	0,0,0	E0 E0	F23 F27	2	Hex	2[0, 1, 0]		0, y, 0	E75	F40
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	mm		2[0, 0, 1]	2[1, 0, 0]		0, 0, z	E40	F22	ź	TICX .	2[1, 1, 0] 1		0, 0, 0	E0	F41
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	mm mm		2[0, 0, 1]	2[1, 1, 0] $\overline{2}[0, 0, 1]$		0, 0, z	E41 E42	F23	Ī	Hex	Ī		0, 0, 0	E0	F41
	mm		2[0, 1, 0]	Ž[1, 0, 1]		0, y, 0 0, y, 0	E 43	F24	1	Hex	1		x, y, z x, y, z	E 89 E 89	F41 F41

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# W. F. KUHS

# Table 2A. Symmetry restrictions on coefficients in fifth-rank symmetric polar tensors

			_	-	_	_	_	-								_		_		_		
		Α	В	С	D	Е	F	G	н	1	J	ĸ	L	м	N	Р	Q	R	5	7	U	V
		1	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2
	Number	1	2	3	1	1	1	I.	t	1	I	1	1	2	2	2	2	3	2	2	2	3
	of	1	2	3	1	1	1	i i	1	2	2	2	3	2	2	2	3	3	2	2	3	3
Cross	independent	i		3	i	i	,	,	ì	- 2	2	3	3	,	2	3	3	3	2	3	3	3
Closs	maependen		2	,			-	-	2	2	2	-		2	-	-	2	2	-	-	2	,
reference	coemcients	1	2	5	2	,	2	3	3	2	3	5	5	2	5	3	3	3	5	5	5	3
E0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
El	1	0	0	0	0	0	0	G	0	0	0	0	0	0	G	0	G	0	0	0	0	0
<u></u>		0	0	0	0	0	0	6	0	0	0	0	0	0	-0	0	0	0	0	0	0	0
E2	1	0						0	0		0		~			0	°,		0			
ES	1	U	0	0	0	U	0	0	0	0	0	0	0	0	0	0	-0	0	0	0	0	0
E4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	N	0	- N	0	0	0	0	0
E5	2	0	0	0	D	0	D	0	0	D	0	ĸ	0	D	0	ĸ	0	0	0	0	0	0
E6	2	Α	-A	0	A/2	0	A/10	0	н	-A/10	0	H/2	0	-A/2	0	-H/2	0	0	0	0	-H	0
F7	2	0	0	0	Ó	0	0	G	0	Ó	0	, n	0	0	G	0	0	0	0	0	0	0
59	-	õ		Å	õ	ř	Å	~	õ	õ	Å	ő	,	ő	0	ő	à	ň	· _	ò	Ĩ,	ŏ
20	2			0		L				0			L.	0			0		-L		-L	
E9	2	0	0	0	0	0	0	G	0	0	0	0	0	0	N	U	G	0	0	0	0	0
E10	2	0	0	0	D	0	0	0	0	1	0	0	0	0	0	0	0	0	0	-1	0	-D
E11	2	0	0	0	0	0	0	G	0	0	0	0	0	0	N	0	N	0	0	0	0	0
E12	,	0	0	0	0	0	F	0	~F	0	0	0	0	м	0	0	0	- M	0	0	0	0
E12	-	Å	ů.	ő	ņ		-	0	- F	F	0	0	F	- 0	0	0	0	D.	- D	F	- F	
615	2		0	0		-0	<u>'</u>	0	-7	-/		0	ʻ_			0		5	5	· _	-1	-0
E14	2	0	0	0	D	D	F	0	-+	-F	0	0	-+	-D	U	0	0	D	-D	F	F	-D
E15	2	0	0	0	D	D	F	0	-F	F	0	0	F	D	0	0	0	- D	-D	- F	-F	-D
E16	2	0	0	0	D	- D	F	0	-F	F	0	0	-F	D	0	0	0	- D	D	- F	F	-D
E17	3	0	0	с	0	E	0	E/2	0	0	E/2	0	L	0	E/2	0	L/2	0	Ε	0	L	0
F19	- 1	é	0	ñ	0	õ	, n	C	, O	0	0	n.	0	0	Ň	0	0	0	0	0	0	0
E 10	2	0	°	~	0	, ,	0	ç	~	~	0	~	,	, ,		Č,	č	õ		õ	_'	ň
E 19	د -	U		0	-	E .	U	2	0				۲.		-0	~	~	~	~ 5	ι.	-L	<u> </u>
E 20	3	0	0	0	D	0	0	G	0	1	0	0	0	0	U	U	-G	U	U	-1	U	-D
E21	3	0	0.	0	0	0	F	0	-F	0	0	0	0	м	N	0	~ N	- <i>M</i>	0	0	0	0
E22	3	0	0	0	0	0	0	G	0	0	2 <i>G</i>	0	L	0	2 <i>G</i>	0	L	0	5	0	0	0
E23	3	0	0	0	0	0	0	G	0	0	G	0	0	0	N	0	0	0	14*	0	0	0
E74	,	~	^	Å	, n	é	1.	0	μ		0	ĸ	0 0	7.	0	12*	ò	0	0	- H	ò	0
E 24	*	~	-A	~	2	-		~	^	~		^			~		~	~	5	~		~
E25	4	0	0	С	0	Ε	Û	U	0	U	J	U	L	U	U	U	U	U	E	U	L	0
E26	4	0	В	0	D	0	0	0	0	1	0	ĸ	0	0	0	0	0	0	0	1	0	D
E27	4	Α	0	0	0	0	F	0	F	0	0	0	0	м	0	Р	0	м	0	0	0	0
E 28	4	0	0	0	0	Ε	0	G	0	0	0	0	L	0	G	0	0	0	- E	0	-L	0
E 20			0	0	n	0	0	G	0	,	٥	0	٥	0	N	0	à	٥	0	-1	0	- D
E 29		0	0	0	0	0	5	ĉ	, E	,	0	õ	Å	Ň	N	ů	Ň	- 14	õ	o,	õ	0
E 30	4		0				, r	0		0	Ÿ.			141		0		- 14	, ,			~
E31	5	0	0	С	0	E	0	G	0	0	5	0	L	0	-0	U	U	U	E	U	L	0
E 32	5	0	В	0	D	0	0	G	0	1	0	ĸ	0	0	0	0	-G	0	0	1	0	D
E33	5	Α	0	0	0	0	F	0	F	0	0	0	0	м	N	Р	-N	м	0	0	0	0
E34	5	Α	Α	Α	D	D	F	G	F	F	J	J	F	D	G	J	G	D	D	F	F	D
E35	5	A	A	- A	D	-D	F	G	F	F	J	-1	-F	D	G	-J	G	D	-D	F	-F	D
E 35	5	2	~	~	5	5		ĉ			,	, i	Ē	- 0	õ	i	õ		- 0	- F	F	-
2.50	3		-7	<u>_</u>	5	-0	· _	6	· _	-/	<i>.</i>	_,	·_		č	΄,	č	5	5			5
E37	5	Α	-A	A	D	D	F	G	F	- F	,	J	-+	-D	6	-J	0	-D	D	- F	- F	D
E 38	5	Α	A	С	A/2	E	A/10	E/2	н	-A/10	E/2	H/2	L	-A/2	E/2	-H/2	L/2	0	E	-H	L	0
E 39	5	0	0	С	D	E	D	E/2	0	D	E/2	ĸ	L	D	E/2	ĸ	L/2	0	Ε	0	L	0
E40	6	0	0	С	0	Ε	0	0	0	0	J	0	L	0	0	0	0	0	5	0	U	0
EAL	6	0	0	Ċ	0	F	0	G	0	0	1	0	1	0	G	0	0	0	F	0	L	0
E 41				د م	Š	2	Å	õ	0	,	0	ř	~	ő	0	0	õ	ő	0	Ť		v
E42	0	0	B	0	0	0	0	0	0		0	2	0	0	. U	0	ĉ	0	0	;	0	,
E43	0	U	в	0	D	0	0	0	0	1	U	<u>^</u>	U	U	N	0	0	U	0			
E44	6	Α	0	0	0	0	F	0	н	0	0	0	0	м	0	Р	0	R	0	0	0	0
E45	6	Α	0	0	0	0	F	G	н	0	0	0	0	м	N	Р	N	м	0	0	0	0
E46	6	Α	-A	0	<b>D</b> .	0	F	0	н	F	0	ĸ	0	D	0	ĸ	0	R	0	н	0	R
F47	6	A	- A	٥	ת	0	F	0	н	~ F	0	к	0	- D	0	- K	0	R	0	- H	0	- R
E 49	٠ ۲			Å	0	Ē	E	õ			,	0	ц	м	0	1	0	F	M	0	F	0
E40	0		0	A.		-	· -			0	,					΄,	0	5		~	·	ő
E49	6	Α	0	-A	0	E	F	U	н	0	6	U	-H	м	0	-,	U		- M	0		U
E50	6	0	В	В	D	D	0	0	0	/	J	J	1	0	0	0	0	0	5	T	Т	5
E51	6	0	B	- <b>B</b>	D	- D	0	0	0	1	J	-J	-1	0	0	0	0	0	5	т	T	-5
E52	6	0	0	с	0	Ε	0	G	0	0	J	0	L	0	10*	0	Q	0	15*	0	2Q	0
E 53	6	0	0	с	0	E	0	E/2	0	0	J	0	L	0	11*	0	L/2	.0	5	0	U	0
ESA	6	Å	ñ	0	, D	0	F	0	Ĥ	4*	0	ĸ	0	4	0	ĸ	0	R	0	0	0	0
C/4		7				õ	, E	õ			õ	ц (л	õ		Å		Å		Å	16*	ő	<b>P</b> 17
E 33		-	2	~	714	~		~		2. <b>.</b>	~	··/2	۰ ۰		Å	1.24	ň	5	ň	17*	ň	20
£ 36	0	A	5	U	-	0	2-	U	н	0-	U A	<u>,</u>	0	0/2		14	~	~	~	' <del>'</del>	~	27
E57	6	0	В	0	D	0	D	0	0	I	0	к	U	9-	U	ĸ	U	U	U _	'_	U	V
E 58	7	Α	Α	Α	D	Е	F	G	н	н	J	J	F	E	G	J	G	D	D	F	н	E
E 59	7	Α	Α	-A	D	Ε	F	G	н	н	J	-J	~ F	- E	G	-J	G	D	- D	F	- H	- E
E60	7	A	A	A	D	E	F	G	н	- H	J	_J	F	E	G	J	G	- D	- D	F	н	- E
E41	7		- 4	_ 4	- -	- F	F	ĉ	н	_ H	1	i	-F	- F	Ġ	-1	G	- D	מ	- F	- H	F
EOI	<i>'</i>		- 4	- 4		5		5.0		-11	-	, v			5/2	120		~	5		;	2
E62	7	Α	-A	C	D	E	1.	E/2	н	3-	E/2	•	L	1-	E/2	13	L/2		E	- 7	L	
E63	9	0	0	С	0	E	0	G	0	0	J	0	L	0	N	U	Q	0	5	U	U	U
E64	9	0	В	0	D	0	0	G	0	1	0	ĸ	0	0	N	0	Q	0	0	т	0	v
E65	9	Α	0	0	0	0	F	G	н	0	0	0	0	м	N	Р	Q	R	0	0	0	0
E66		A	Å	ň	ת	Ē	F	G	Ĥ	F	0	ĸ	L	D	- G	к	ò	R	- E	н	-L	R
E 47	é			~	2	5	F	c	 µ		, ,	ĸ	ĩ	_n	-0	- K	0	P	_ F	- H		_ R
E0/	4	A	-A		0	-	ŕ,	6		-r		^		- 0	~	, ,	~				г. г	
E68	9	A	0	Α	<i>D</i> ·	E	r	U Q	н			Ű	н.	M	0	΄.	-0	5	m	-1		-0
E69	9	Α	0	-A	D	Е	F	G	н	1	J	0	- H	м	U	-J	-G	-E	- M	-1	-+	-0
E70	9	0	В	B	D	D	F	0	-F	1	J	J	1	м	N	0	- N	- M	5	т	т	\$
E71	9	0	В	- B	D	-D	F	0	-F	1	J	J	-1	м	N	0	- N	- M	5	т	- T	-5
E77		^	0	<u> </u>	 Л	F	F	G	, H	4.	20	ĸ	i	4*	20	ĸ	1	R	0	0	0	0
E /2	7			~		<u>с</u>	, ,	c			.0	ц. 11. 12.	õ			 P	õ	P	14.	16*	Ô	817
E73	9	Α	в	U	A/2	0		U C	н	5-	0	n/2	,	0			Ŷ.	~		10	ž	20
E74	9	A	B	0	D	Е	2*	G	н	6"	2G	ĸ	L	B/2	2 <i>G</i>	12*	L	ĸ	U	1/*	U	28
E75	9	0	B	0	D	0	D	G	0	1	G	ĸ	0	9*	N	ĸ	Q	0	14*	т	Q	v
E76	12	Α	B	0	D	0	F	0	н	1	0	ĸ	0	м	0	Р	0	R	0	т	0	v
E77	12	A	0	C	0	E	F	0	н	0	J	0	L	м	0	Р	0	R	s	0	U	0
E70	12	6	, D	ĉ	, Л	- F	0	0	0	,	,	ĸ	ī	0	0	0	ò	0	s	τ	U	v
E /8	12	4		~	2	Б Г	F	ć	у Ц	, _ F	Ϊ,	 V	ĩ		ċ	v	ò	P	F	_H	ĩ	_ P
E79	12	A	- A	C	J	E	r	U C	н	-r	,	<u>^</u>	Ļ	-0	0	-^	Ŷ	л Г	5	-11	L 1	- K
E80	12	Α	Α	С	D	Ε	F	G	н	r.	,	ĸ	L	U	U	,	Ų	ĸ	E	n	L	ĸ

#### Table 2A (cont.)

		Α	B	С	D	E	F	G	н	1	J	ĸ	L	м	N	Р	0	R	5	т	U	v
		ı	2	3	1	1	1	1	1	1	1	1	1	I.	1	1	i	1	2	2	2	2
	Number	1	2	3	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	2	2	3
	of	1	2	3	1	1	1	1	1	2	2	2	3	2	2	2	3	3	2	2	3	3
Cross	independent	1	2	3	1	1	2	2	3	2	2	3	3	2	2	3	3	3	2	3	3	3
reference	coefficients	1	2	3	2	3	2	3	3	2	3	3	3	2	3	3	3	3	3'	3	3	3
E81	12	Α	B	-A	D	Ε	F	G	н	1	J	к	- H	м	N	-J	G	- E	- M	1	-F	D
E82	12	Α	B	Α	D	Ε	F	G	н	1	J	ĸ	н	м	N	J	G	E	м	1	F	D
E83	12	Α	B	- B	D	- D	F	G	F	1	J	-J	-1	м	N	Р	N	м	5	т	- T	-5
E84	12	Α	B	В	D	D	F	G	F	1	J	J	1	м	N	P	N	м	5	т	т	5
E85	12	Α	В	С	D	Ε	2*	G	н	6*	J	ĸ	L	<b>B</b> /2	10*	12*	N	м	15*	17.	2 N	2 <i>M</i>
E 86	12	0	В	С	D	Ε	D	E/2	0	1	J	ĸ	L	21	11*	ĸ	L/2	0	5	т	υ	v
E87	12	Α	0	С	D	Ε	F	G	н	4•	J	ĸ	L	4*	10*	ĸ	N	м	15*	0	2 N	0
E88	12	Α	В	С	A/2	Ε	F	E/2	н	5*	J	H/2	L	8°	11*	Р	L/2	R	5	16*	υ	UI
E89	21	Α	В	С	D	E	F	G	н	1	J	к	L	м	N	Р	ò	R	5	т	υ	v

\* Notes, 1 - 2A/5 + D; 2 - 3A/5 + B/10 + 3D/2; 3 - 3A/5 + D; 4 - D + 2F; 5 - A/4 + 3F/2; 6 - 2A/5 + B/5 + D; 7 - A + D; 8 - A/5 + 2B/5 + F; 9 - D + 2I; 10 - 2G + 3J; 11 - E/4 + 3J/2; 12 - 2H + 3K; 13 - H + K; 14 - G + 2N; 15 - 4G + 6J; 16 - H/4 + 3P/2; 17 - 4H + 6K.

## Table 2B. Symmetry restrictions on coefficients in sixth-rank symmetric polar tensors

Number         1         2         3         1 </th <th></th> <th></th> <th>A</th> <th>В</th> <th>С</th> <th>D</th> <th>Ε</th> <th>F</th> <th>G</th> <th>н</th> <th>1</th> <th>J</th> <th>ĸ</th> <th>L</th> <th>м</th> <th>N</th> <th>Р</th> <th>Q</th> <th>R</th> <th>5</th> <th>Т</th> <th>U</th> <th>v</th> <th>W</th> <th>x</th> <th>Y</th> <th>Z</th> <th>a</th> <th>ь</th> <th>c</th>			A	В	С	D	Ε	F	G	н	1	J	ĸ	L	м	N	Р	Q	R	5	Т	U	v	W	x	Y	Z	a	ь	c
Namber         1         2         3         1 <td></td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>ı</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>L.</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>I</td> <td>1</td> <td>1</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td>			1	2	3	1	1	1	1	1	1	ı	1	1	1	1	1	L.	1	1	1	1	I	1	1	2	2	2	2	2
of         1         2         3         1         2         2         3         3         2         2         3		Number	1	2	3	1	1	1	I I	t	1	ı	1	1	1	- I	1	ı	1	2	2	2	2	2	3	2	2	2	2	3
independent         I <thi< th="">         I</thi<>		of	1	2	3	1	1	1	1	i i	1	1	1	1	2	2	2	2	3	2	2	2	2	3	3	2	2	2	3	3
Cross         para-         1         2         3         3         2         2         3         3         2         2         3         3         2         3		independent	1	2	3	1	1	1	1	1	2	2	2	3	2	2	2	3	3	2	2	2	3	3	3	2	2	3	3	3
reference         i	Cross	para-	1	2	3	1	1	2	2	3	2	2	3	3	2	2	3	3	3	2	2	3	3	3	3	2	3	3	3	3
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	reference	meters	1	2	3	2	3	2	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Fl	3	A	A	Α	0	0	F	0	F	0	0	0	0	F	0	Р	0	F	0	0	0	0	0	0	0	F	0	F	0
F3       5       A       A       C       A/2       0       F       0       H/2       0       R       A/2       0       H/2       0       R/2       0       H/2       0       R/2       0       H/2       0       R/2       0       H/2       0       R/2       0       0       0       0       R/2       0       R/2     <	F2	4	A	Α	Α	0	0	F	0	н	Q	0	0	0	н	0	Р	0	F	0	0	0	0	0	0	0	F	0	н	0
	F3	5	A	Α	С	A/2	0	F	0	н	1*	0	H/2	0	F	0	H/2	0	R	A/2	0	H/2	0	R/2	0	0	н	0	R	0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	F4	6	A	Α	С	D	0	F	0	н	2°	0	H/2	0	5*	0	H/2	0	R	11.	0	H/2	0	R/2	0	0	н	0	R	0
F6       6       A       B       A       0       0       F       0       H       0	F5	6	A	Α	С	0	0	F	0	н	0	0	0	0	F	0	P	0	R	0	0	0	0	0	0	0	н	0	R	0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	F6	6	A	B	A	0	0	F	0	н	0	0	0	0	м	0	Р	0	н	0	0	0	0	0	0	0	м	0	F	0
F8       7       A       A       A       D       D       F       I       J       J       I       F       J       F       D       G       J       J       G       D       D       D       D       D       D       D       G       D       D       D       F       I       F       J       I       F       D       D       G       J       J       F       F       D       D       G       J       J       F       F       D       P       J       F       D       D       G       J       J       F       D       F       D       G       F       J       J       J       I       F       F       D       C       G       J       J       J       F       F       D       G       G       J       J       J       J       J       J       F       D       D       G       J	F7	6	A	B	B	0	0	F	0	F	0	0	0	0	м	0	Р	0	м	0	0	0	0	0	0	0	z	0	z	0
F9       7       A       A       A       D       -D       F       G       F       I       F       D       F       D       G       -J       -J       -G       -D       C       D       F       -I       F       -J       -I       F       D       G       G       D       D       D       D       F       I       I       F       -J       F       D       -G       -J       -J       G       F       D	F8	7	Α	Α	Α	D	D	F	G	F	1	J	J	1	F	J	Р	J	F	D	G	J	J	G	D	D	F	1	F	D
FI0       7       A       A       A       D       -D       F       G       F       I       J       I       F       P       -J       F       D       -G       -J       -G       D       D       D       F       I       F       D       D       D       D       F       D       D       D       F       D       D       D       F       D       D       D       F       D       P       D       P       D       D       D       D       F       D       P       P       D       D       C       D	F9	7	A	Α	.А	D	-D	F	G	F	1	J	-J	-1	F	J	Р	J	F	D	G	-J	J	- G	- D	-D	F	-1	F	~ D
FI1       7       A       A       A       D       D       F       G       F       I       J       I       I       F       -I       P       -J       F       D       -G       J       -J       -G       D       -D       D       -D       D       -F       F       -I/2       P       -J       F       D       -G       J       H       I       F       D       D       D       -J       C       D	F10	7	A	Α	Α	D	D	F	G	F	1	J	~J	-1	F	-J	Р	- J	F	D	- G	-J	- J	G	-D	D	F	1	F	D
FI2       7       A       A       C       A/2       E       F       E/2       H 1'       F/10       H/2       1       F       F/10       H/2       1       F       E/10       H/2       1       R       A/2       C       H/2       Q       R       A/2       G       H/2       Q       R       A/2       Q       R       A/2       G       H<0       Q       R       A/2       D       C       C       A       A       A       D       E       G       H<1       J       K       I       H       K       P       J       F       E       G       J       J       K       I       H       C       J       J <t< td=""><td>F11</td><td>7</td><td>Α</td><td>Α</td><td>A</td><td>D</td><td>D</td><td>F</td><td>G</td><td>F</td><td>1</td><td>J</td><td>J</td><td>1</td><td>F</td><td>-J</td><td>Р</td><td>-J</td><td>F</td><td>D</td><td>- G</td><td>J</td><td>_J</td><td>-G</td><td>D</td><td>- D</td><td>F</td><td>-1</td><td>F</td><td>- D</td></t<>	F11	7	Α	Α	A	D	D	F	G	F	1	J	J	1	F	-J	Р	-J	F	D	- G	J	_J	-G	D	- D	F	-1	F	- D
F13       7       A       A       C       A/2       0       F       G       H/2       0       F       G       H/2       0       F       A       A       C       A/2       0       F       0 <t< td=""><td>F12</td><td>7</td><td>Α</td><td>Α</td><td>С</td><td>A/2</td><td>Ε</td><td>F</td><td>E/2</td><td>н</td><td>1*</td><td>E/10</td><td>H/2</td><td>1</td><td>F</td><td>-E/10</td><td>H/2</td><td>1/2</td><td>R</td><td>A/2</td><td>-E/2</td><td>H/2</td><td>-1/2</td><td>R/2</td><td>0</td><td>- E</td><td>н</td><td>-1</td><td>R</td><td>0</td></t<>	F12	7	Α	Α	С	A/2	Ε	F	E/2	н	1*	E/10	H/2	1	F	-E/10	H/2	1/2	R	A/2	-E/2	H/2	-1/2	R/2	0	- E	н	-1	R	0
Fi4       8       A       A       C       D       0       F       0       H       0       0       K       0       P       0       R       -D       0	F13	7	Α	Α	С	A/2	0	F	G	н	1*	G	H/2	0	F	G	H/2	Q	R	A/2	G	H/2	Q	R/2	0	0	н	0	R	0
FI5       8       A       B       A       0       E       F       0       H       0       0       P       0       H       0       0       -E       0       -E       0       F       0       H       0 <td>F14</td> <td>8</td> <td>A</td> <td>Α</td> <td>С</td> <td>D</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>0</td> <td>0</td> <td>κ</td> <td>0</td> <td>F</td> <td>0</td> <td>Р</td> <td>0</td> <td>R</td> <td>-D</td> <td>0</td> <td>- K</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>н</td> <td>0</td> <td>R</td> <td>0</td>	F14	8	A	Α	С	D	0	F	0	н	0	0	κ	0	F	0	Р	0	R	-D	0	- K	0	0	0	0	н	0	R	0
FI6       8       A       B       B       0       0       F       0       H       0	F15	8	Α	B	A	0	Ε	F	0	н	0	J	0	0	м	0	Р	0	н	0	0	0	-J	0	- E	0	м	0	F	0
Fi1       10       A       A       A       D       E       F       G       H       I       J       K       I       H       K       P       J       F       E       G       J       K       G       D       D       F       I       H       E       F       E       G       J       K       I       H       K       P       J       F       E       G       -J       K       I       H       K       P       J       F       E       G       J       K       I       H       K       P       J       F       E       G       J       K       I       H       K       P       J       F       E       G       J       K       I       H       K       P       J       F       E       G       J       K       I       H       K       P       J       F       E       G       J       K       I       H       K       I       I       I       K       I       I       K       I       I       K       I       I       K       I       I       K       I       I       K       I       I <td>F16</td> <td>8</td> <td>A</td> <td>B</td> <td>В</td> <td>0</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>м</td> <td>N</td> <td>Р</td> <td>- N</td> <td>м</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>Y</td> <td>z</td> <td>0</td> <td>z</td> <td>- Y</td>	F16	8	A	B	В	0	0	F	0	н	0	0	0	0	м	N	Р	- N	м	0	0	0	0	0	0	Y	z	0	z	- Y
FI8       10       A       A       A       D       E       F       G       H       I       J       K       -1       H       -K       P       J       F       -E       G       -J       -K       -G       -D       D       F       -I       H       -K       P       -J       F       -E       -G       -J       -K       -G       -D       D       F       -I       H       -K       P       -J       F       -E       -G       -J       K       -G       D       D       F       -I       H       -K       P       -J       F       -E       -G       J       K       -G       D	F17	10	Α	Α	Α	D	Ε	F	G	н	1	J	ĸ	1	н	к	Р	J	F	E	G	J	ĸ	G	D	D	F	- î	н	Ε
F19       10       A       A       A       D       E       F       G       H       I       J       K       -1       H       K       P       -1       F       -E       -G       -7       -K       G       -D       D       F       I       H       -E         F20       10       A       A       D       E       F       G       H       1       J       K       1       H       -K       P       -J       F       E       -G       J       K       -G       D       -D       F       -I       H       -E         F21       10       A       A       C       D       F       0       H       0       0       0       M       P       0       R       0       0       0       0       0       0       0       0       0       0       0       R       0       0       0       0       0       0       0       0       0       R       0       R       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       <	F18	10	A	A	Α	D	Ε	F	G	н	- 1	J	ĸ	-1	н	- K	Р	J	F	~ E	G	- J	- K	- G	- D	- D	F	-1	н	Ε
F20       10       A       A       A       D       E       F       G       H       I       J       K       I       H       -K       P       -J       F       E       -G       J       K       -G       D       -D       F       -I       H       -E       F       F       G       H       2'       4''       H/2       L       S''       T''       H/2       Q       R       11''       13''       H/2       18''       R/2       0       -E       H       -L       R       0	F19	10	A	Α	Α	D	Ε	F	G	н	1	J	κ	-1	н	к	Р	-J	F	- E	- G	- J	- K	G	- D	D	F	1	н	- E
F21       10       A       A       C       D       E       F       G       H       2*       4*       H/2       L       5*       7*       H/2       Q       R       11*       13*       H/2       18*       R/2       0 $-E$ H $-L$ R       0         F22       10       A       B       C       0       0       F       0       H       0	F20	10	Α	Α	Α	D	Ε	F	G	н	1	J	κ	1	н	- K	Р	~J	F	Ε	- G	J	к	-G	D	~ D	F	-1	н	- E
F22       10       A       B       C       0       0       F       0       H       0       0       0       0       0       R       0 <td>F21</td> <td>10</td> <td>Α</td> <td>Α</td> <td>С</td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> <td>н</td> <td>2*</td> <td>4*</td> <td>H/2</td> <td>L</td> <td>5*</td> <td>7•</td> <td>H/2</td> <td>Q</td> <td>R</td> <td>11*</td> <td>13<b>°</b></td> <td>H/2</td> <td>18*</td> <td>R/2</td> <td>0</td> <td>- E</td> <td>н</td> <td>~ L</td> <td>R</td> <td>0</td>	F21	10	Α	Α	С	D	E	F	G	н	2*	4*	H/2	L	5*	7•	H/2	Q	R	11*	13 <b>°</b>	H/2	18*	R/2	0	- E	н	~ L	R	0
F23       10       A       A       C       D       0       F       0       F       0       P       0       R       D       0       K       0       W       0       0       H       0       R       0       F       0       R       D       0       K       0       P       0       R       D       0       W       0       0       H       0       F       0       F       0       F       0       F       0       F       0       K       0       V       0       V       0       F       0       F       0       F       0       F       0       F       0       F       0       K       0       C       0       R       0 <td>F22</td> <td>10</td> <td>A</td> <td>B</td> <td>С</td> <td>0</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>м</td> <td>0</td> <td>Р</td> <td>0</td> <td>R</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>z</td> <td>0</td> <td>ь</td> <td>0</td>	F22	10	A	B	С	0	0	F	0	н	0	0	0	0	м	0	Р	0	R	0	0	0	0	0	0	0	z	0	ь	0
F24       10       A       B       A       0       E       F       0       H       0       J       0       L       M       0       P       0       H       0       T       0       J       0       E       0       M       0       F       0       H       0       J       0       E       0       M       0       F       0       J       0       E       0       M       0 <td>F23</td> <td>10</td> <td>Α</td> <td>Α</td> <td>С</td> <td>D</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>1</td> <td>0</td> <td>ĸ</td> <td>0</td> <td>F</td> <td>0</td> <td>Р</td> <td>0</td> <td>R</td> <td>D</td> <td>0</td> <td>к</td> <td>0</td> <td>w</td> <td>0</td> <td>0</td> <td>н</td> <td>0</td> <td>R</td> <td>0</td>	F23	10	Α	Α	С	D	0	F	0	н	1	0	ĸ	0	F	0	Р	0	R	D	0	к	0	w	0	0	н	0	R	0
F25       10       A       B       B       0       0       F       G       F       0 <td>F24</td> <td>10</td> <td>Α</td> <td>В</td> <td>Α</td> <td>0</td> <td>Ε</td> <td>F</td> <td>0</td> <td>н</td> <td>0</td> <td>J</td> <td>0</td> <td>L</td> <td>м</td> <td>0</td> <td>Р</td> <td>0</td> <td>н</td> <td>0</td> <td>т</td> <td>0</td> <td>J</td> <td>0</td> <td>Ε</td> <td>0</td> <td>м</td> <td>0</td> <td>F</td> <td>0</td>	F24	10	Α	В	Α	0	Ε	F	0	н	0	J	0	L	м	0	Р	0	н	0	т	0	J	0	Ε	0	м	0	F	0
F26       10       A       B       C       D       0       F       0       H       3*       0       K       0       6*       0       P       0       R       B/2       0       16*       0       W       0       0       22*       0       2W       0         F72       10       A       B       C       A/2       0       F       0       H       1*       0       H/2       0       M       0       P       0       R       B/2       0       17*       0       R/2       0       0       Z       0       b       0         F28       16       A       B       C       D       0       F       0       H       1       0       K       0       N       0       P       0       R       0       T       0       V       0       0       Z       0       b       0       b       0       0       0       L       M       0       P       0       R       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	F25	10	Α	В	B	0	0	F	G	F	0	0	0	0	м	N	Р	N	м	0	0	0	0	0	0	Y	z	a	z	Y
F27       10       A       B       C       A/2       0       F       0       H/1       0       H/2       0       M       0       P       0       R       12*       0       17*       0       R/2       0       0       Z       0       b       0         F28       16       A       B       C       D       0       F       0       H       1       0       K       0       M       0       P       0       R       5       0       U       0       W       0       0       Z       0       b       0         F29       16       A       B       C       0       F       0       H       0       J       0       L       M       0       P       0       R       0       0       0       0       M       N       P       Q       R       0       0       0       N	F26	10	Α	B	С	D	0	F	0	н	3*	0	ĸ	0	6"	0	Р	0	R	B/2	0	16*	0	w	0	0	22 <b>°</b>	0	2 W	0
F28       16       A       B       C       D       0       F       0       H       I       0       K       0       M       0       P       0       R       S       0       U       0       W       0       0       Z       0       b       0         F29       16       A       B       C       0       E       F       0       H       0       J       0       L       M       0       P       0       R       S       0       U       0       X       0       Z       0       b       0         F30       16       A       B       C       0       F       G       H       1       J       K       L       F       -J       P       Q       R       D       -G       K       -C       H       -L       R       X         F31       16       A       A       C       D       E       F       G       H       J       K       L       F       J       P       Q       R       D       G       K       L       R       X       D       G       K       L       R       X </td <td>F27</td> <td>10</td> <td>Α</td> <td>B</td> <td>с</td> <td>A/2</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>1*</td> <td>0</td> <td>H/2</td> <td>0</td> <td>м</td> <td>0</td> <td>Р</td> <td>0</td> <td>R</td> <td>12*</td> <td>0</td> <td>17*</td> <td>0</td> <td>R/2</td> <td>0</td> <td>0</td> <td>z</td> <td>0</td> <td>Ь</td> <td>0</td>	F27	10	Α	B	с	A/2	0	F	0	н	1*	0	H/2	0	м	0	Р	0	R	12*	0	17*	0	R/2	0	0	z	0	Ь	0
F29       16       A       B       C       0       E       F       0       H       0       J       0       L       M       0       P       0       R       0       T       0       V       0       X       0       Z       0       b       0         F30       16       A       B       C       0       0       F       G       H       0       0       0       M       N       P       Q       R       0       0       0       0       V       0       X       0       Z       0       b       0         F31       16       A       A       C       D       E       F       G       H       I       J       K       L       F       J       P       Q       R       D       G       K       Q       W       X       E       H       L       R       X         F33       16       A       B       A       D       E       F       G       H       I       K       L       M       N       P       -N       H       S       T       N       -0       -0       -1       F </td <td>F28</td> <td>16</td> <td>Α</td> <td>B</td> <td>С</td> <td>D</td> <td>0</td> <td>F</td> <td>0</td> <td>н</td> <td>1</td> <td>0</td> <td>ĸ</td> <td>0</td> <td>м</td> <td>0</td> <td>Р</td> <td>0</td> <td>R</td> <td>s</td> <td>0</td> <td>υ</td> <td>0</td> <td>Ŵ</td> <td>0</td> <td>0</td> <td>Ζ</td> <td>0</td> <td>Ь</td> <td>0</td>	F28	16	Α	B	С	D	0	F	0	н	1	0	ĸ	0	м	0	Р	0	R	s	0	υ	0	Ŵ	0	0	Ζ	0	Ь	0
F30       16       A       B       C       0       0       F       G       H       0       0       0       0       M       N       P       Q       R       0 <td>F29</td> <td>16</td> <td>A</td> <td>B</td> <td>С</td> <td>0</td> <td>Ε</td> <td>F</td> <td>0</td> <td>н</td> <td>0</td> <td>J</td> <td>0</td> <td>L</td> <td>м</td> <td>0</td> <td>P</td> <td>0</td> <td>R</td> <td>0</td> <td>т</td> <td>0</td> <td>v</td> <td>0</td> <td>x</td> <td>0</td> <td>z</td> <td>0</td> <td>ь</td> <td>0</td>	F29	16	A	B	С	0	Ε	F	0	н	0	J	0	L	м	0	P	0	R	0	т	0	v	0	x	0	z	0	ь	0
F31       16       A       A       C       D       E       F       G       H       I       J       K       L       F       -J       P       Q       R       D       -G       K       -Q       W       X       -E       H       -L       R       -X         F32       16       A       A       C       D       E       F       G       H       I       J       K       L       F       J       P       Q       R       D       G       K       Q       W       X       E       H       L       R       X         F33       16       A       B       A       D       E       F       G       H       I       J       K       L       M       N       P       -K       H       S       T       N       J       G       E       S       M       I       F       D       D       F       G       H       I       J       K       L       M       N       P       N       M       S       T       U       -U       -T       -S       M       I       F       D       D       D       F<	F30	16	A	В	С	0	0	F	G	н	0	0	0	0	М	N	Р	Q	R	0	0	0	0	0	0	Y	Ζ	a	ь	c
F32       16       A       A       C       D       E       F       G       H       I       J       K       L       F       J       P       Q       R       D       G       K       Q       W       X       E       H       L       R       X         F33       16       A       B       A       D       E       F       G       H       I       J       K       L       M       N       P       -K       H       S       T       -N       J       -G       E       -S       M       -I       F       -D       F       -D       F       -S       M       -I       F       -D       F       -S       M       I       J       K       L       M       N       P       -N       H       S       T       -N       J       -G       E       -S       M       I       F       -D       F       G       F       I       J       J       I       M       N       N       N       N       N       N       N       N       N       N       N       N       N       N       N       N       N       N	F31	16	Α	Α	С	D	Ε	F	G	н	- 1	J	ĸ	L	F	-J	Р	Q	R	D	- G	ĸ	-Q	w	x	- E	н	- L	R	- X
F33       16       A       B       A       D       E       F       G       H       I       J       K       L       M       N       P       -K       H       S       T       -N       J       -G       E       -S       M       -I       F       -D       F       -D       E       F       G       H       I       J       K       L       M       N       P       -K       H       S       T       -N       J       -G       E       -S       M       -I       F       -D         F35       16       A       B       D       D       F       G       F       I       J       -J       -I       M       N       P       N       M       S       T       U       -U       T       S       Y       Z       a       Z       Y         F36       16       A       B       D       D       F       G       F       I       J       J       I       M       N       P       N       M       S       T       U       U       T       S       Y       Z       a       Z       Y       Z	F32	16	Α	Α	С	D	Ε	F	G	н	- 1	J	ĸ	L	F	J	Р	Q	R	D	G	κ	Q	w	x	Ε	н	L	R	x
F34       16       A       B       A       D       E       F       G       H       I       J       K       L       M       N       P       K       H       S       T       N       J       G       E       S       M       I       F       D         F35       16       A       B       D       D       F       G       F       I       J       -J       -I       M       N       P       N       M       S       T       U       -U       -T       -S       Y       Z       a       Z       Y         F36       16       A       B       D       D       F       G       F       I       J       -J       -I       M       N       P       N       M       S       T       U       -U       -T       -S       Y       Z       a       Z       Y         F37       16       A       B       C       D       E       F       G       H       3''       J       K       L       6"       8"       P       Q       R       12"'       10"'       Q       10''       2"'       2"'       <	F33	16	Α	В	Α	D	Ε	F	G	н	1	J	ĸ	L	м	N	Р	- K	н	5	т	- N	J	- G	Ε	-5	м	-1	F	- D
F35       16       A       B       D       -D       F       G       F       I       J       -J       -I       M       N       P       N       M       S       T       U       -U       -T       -S       Y       Z       a       Z       Y         F36       16       A       B       D       D       F       G       F       I       J       J       I       M       N       P       N       M       S       T       U       -U       -T       -S       Y       Z       a       Z       Y         F37       16       A       B       C       D       E       F       G       H       3       K       L       6*       8*       P       Q       R       12*       15*       17*       Q       R/2       0       Y       Z       a       z       y       Q       R       12*       15*       17*       Q       R/2       0       Y       Z       a       b       c       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1<	F34	16	Α	В	Α	D	Ε	F	G	Н	- 1	J	ĸ	L	м	N	Р	ĸ	Н	s	т	N	J	G	Ε	5	м	1	F	D
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	F35	16	A	B	B	D	-D	F	G	F	- 1	J	-J	-1	м	N	Р	N	м	5	т	U	- U	- T	- S	Y	Ζ	a	Ζ	Y
F37       16       A       B       C       D       E       F       G       H       3*       J       K       L       6*       8*       P       Q       R       B/2       14*       16*       19*       W       X       20*       22*       23*       2W       2X         F38       16       A       B       C       A/2       0       F       G       H/2       0       M       N       P       Q       R       12*       15*       17*       Q       R/2       0       Y       Z       a       b       c         F39       16       A       B       C       D       E       F       G       H       3*       J       K       L       6*       9*       P       Q       R       12*       15*       17*       Q       R/2       0       22*       0       22*       0       22*       0       22*       0       22*       0       22*       0       22*       0       24*       0       16*       0       P       Q       R       12*       16*       0       22*       0       24*       0       24*       12*	F36	16	Α	B	B	D	D	F	G	F	- 1	J	J	1	м	N	Р	N	м	s	т	U	U	т	s	Y	z	a	Ζ	Y
F38       16       A       B       C       A/2       0       F       G       H/1       G       H/2       0       M       N       P       Q       R       12*       15*       17*       Q       R/2       0       Y       Z       a       b       c         F39       16       A       B       C       D       E       F       G       H       3*       J       K       L       6*       9*       P       Q       R       12*       16*       Q       W       X       0       22*       0       2W       0         F40       16       A       B       C       A/2       E       F       E/2       H       1*       J       H/2       L       M       10*       P       L/2       R       12*       T       17*       V       R/2       2       2*       b       X/2         F41       28       A       B       C       D       E       F       G       H       J       K       L       M       N       P       Q       R       S       T       U       W       X       Z       a       b       <	F37	16	Α	B	С	D	Ε	F	G	н	3*	J	ĸ	L	6"	8"	Ρ	Q	R	<b>B</b> /2	14*	16"	19"	w	x	20°	22*	23*	2 W	2 <i>X</i>
F39       16       A       B       C       D       E       F       G       H       3*       J       K       L       6*       9*       P       Q       R       B/2       9*       16*       Q       W       X       0       22*       0       2W       0         F40       16       A       B       C       A/2       E       F       E/2       H       1*       J       H/2       L       M       10*       P       L/2       R       12*       T       17*       V       R/2       X       21*       Z       24*       b       X/2         F41       28       A       B       C       D       E       F       G       H       I       J       K       L       M       N       P       Q       R       S       T       U       V       W       X       Z       a       b       c         F41       28       A       B       C       D       E       G       H       I       K       M       N       P       Q       R       S       T       U       V       W       X       Z       a	F38	16	A	B	С	A/2	0	F	G	н	1.	G	H/2	0	м	N	Р	Q	R	12*	15"	17*	Q	R/2	0	Y	Ζ	a	ь	c
F40       I6       A       B       C       A/2       E       F       I       I       I/2       L       M       I0*       P       L/2       R       12*       T       17*       V       R/2       X       21*       Z       24*       b       X/2         F41       28       A       B       C       D       E       F       G       H       J       K       L       M       N       P       Q       R       S       T       U       V       W       X       Z       a       b       c         *       Normal       A       A       D	F39	16	A	B	С	D	Ε	F	G	н	3*	J	к	L	6*	9°	Ρ	Q	R	<b>B</b> /2	9 <b>•</b>	16*	Q	w	x	0	22*	0	2 W	0
F41 28 A B C D E F G H I J K L M N P Q R S T U V W X Y Z $a$ $b$ $c$	F40	16	Α	B	С	A/2	E	F	E/2	н	1*	J	H/2	L	м	10*	P	L/2	R	12*	т	17*	v	<b>R</b> /2	x	21*	Ζ	24 <b>°</b>	þ	X/2
	F41	28	Α	B	С	D	Ε	F	G	н	1	J	ĸ	L	м	N	Р	Q	R	S	т	U	v	w	x	Y	Z	а	ь	c
	* 37-	400 1 4/		E.	<b>.</b>	A/2 ·	, n / <b>1</b>		E/3			D/6 ·	2 5 /2						<b>-</b> . /	D/2	20/2		254		0 7 5				<u> </u>	~ 1

 $\frac{1}{2} - \frac{1}{2} - \frac{1}$ 

#### **Results**

Calculations were carried out only for contravariant coefficients; only these enter into the standard crystallographic least-squares procedure. The present tabulation covers all crystallographic settings of special positions for tensors up to rank 6 and all cubic, hexagonal, tetragonal and trigonal settings for tensors up to rank 8. The orientation of the symmetry elements in the lattice must be identified (*e.g.* by inspection of *International Tables for X-ray Crystal lography*, 1952) before the tables can be used.

There is a key attributed to each site symmetry given in Table 1. The symmetry relations of this site

may be looked up under the corresponding entry in Table 2.\* The order of the coefficients corresponds exactly to the order of assignment of independency, *i.e.* in the case of linear relationships the independent parameters always enter on the left-hand side of the dependent ones. It is worth noting that three of the non-centrosymmetric groups have null third-rank tensors but one free coefficient as some higher level (rank 5 for 422, rank 7 for 622, rank 9 for 432).

It should also be remembered that, in a leastsquares refinement of a non-centrosymmetric structure, one parameter corresponding to a non-zero entry for the point group has to be kept fixed (Hazell & Willis, 1978).

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## The Solution of the One-Dimensional Sign Problem for Fourier Transforms

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#### Abstract

An iterative procedure for the determination of the signs of scattering amplitudes is considered. It is assumed that the scattering density is a onedimensional antisymmetric function with a limited range of definition. The convergence of the method to a rigorous solution is proved. The stability of the procedure with respect to various experimental errors is shown in model examples. The proof can be generalized for a one-dimensional phase determination of a continuous intensity distribution.

## Introduction

When non-crystalline objects are investigated by diffraction methods, the intensity of coherent scattering I(s) can often be measured as a continuous

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function of scattering vector s (for instance, intensity distribution along layer lines for one-dimensionally periodic structures, intensity of small-angle scattering). The restoration of the scattering density distribution frequently requires the solution of the phase problem. The latter is analogous to the phase problem in crystal-structure analysis and lies in finding the phases of scattering amplitudes A(s) when their moduli are known from the experimental intensities. In the present paper the case will be considered when the scattering density is a one-dimensional antisymmetric function, so that its connection with the scattering amplitude is given by the sine-Fourier transform

$$A(s) = \mathscr{F}_{s}[\rho(r)] = \int_{0}^{\infty} \rho(r) \sin sr \, \mathrm{d}r \tag{1}$$

and A(s) is a real function.

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<sup>\*</sup> The tables containing the symmetry restrictions of the seventhand eighth-rank tensors have been deposited with the British Library Lending Division as Supplementary Publication No. SUP 38913 (11 pp.). Copies may be obtained through The Executive Secretary, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England.