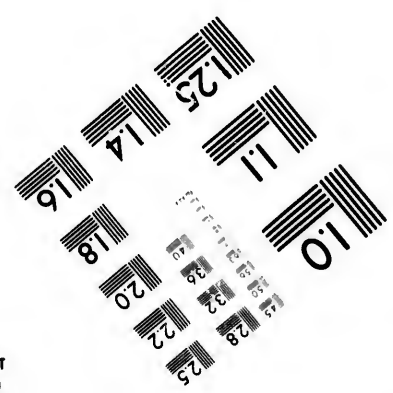
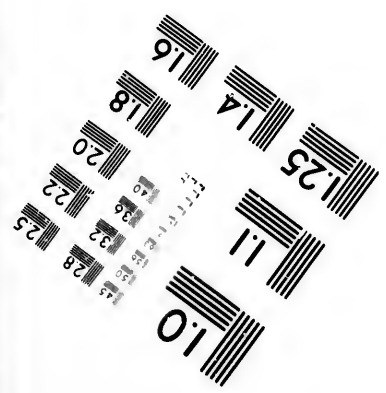
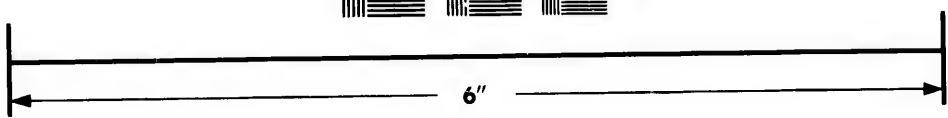
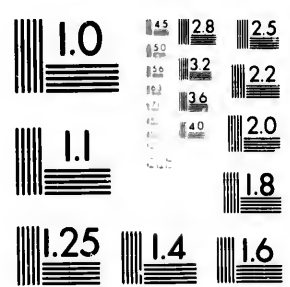


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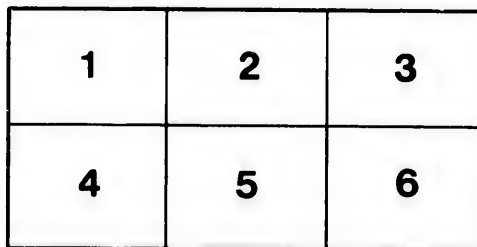
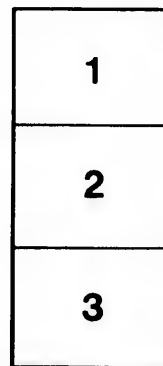
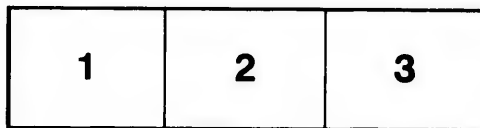
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T

TABLE

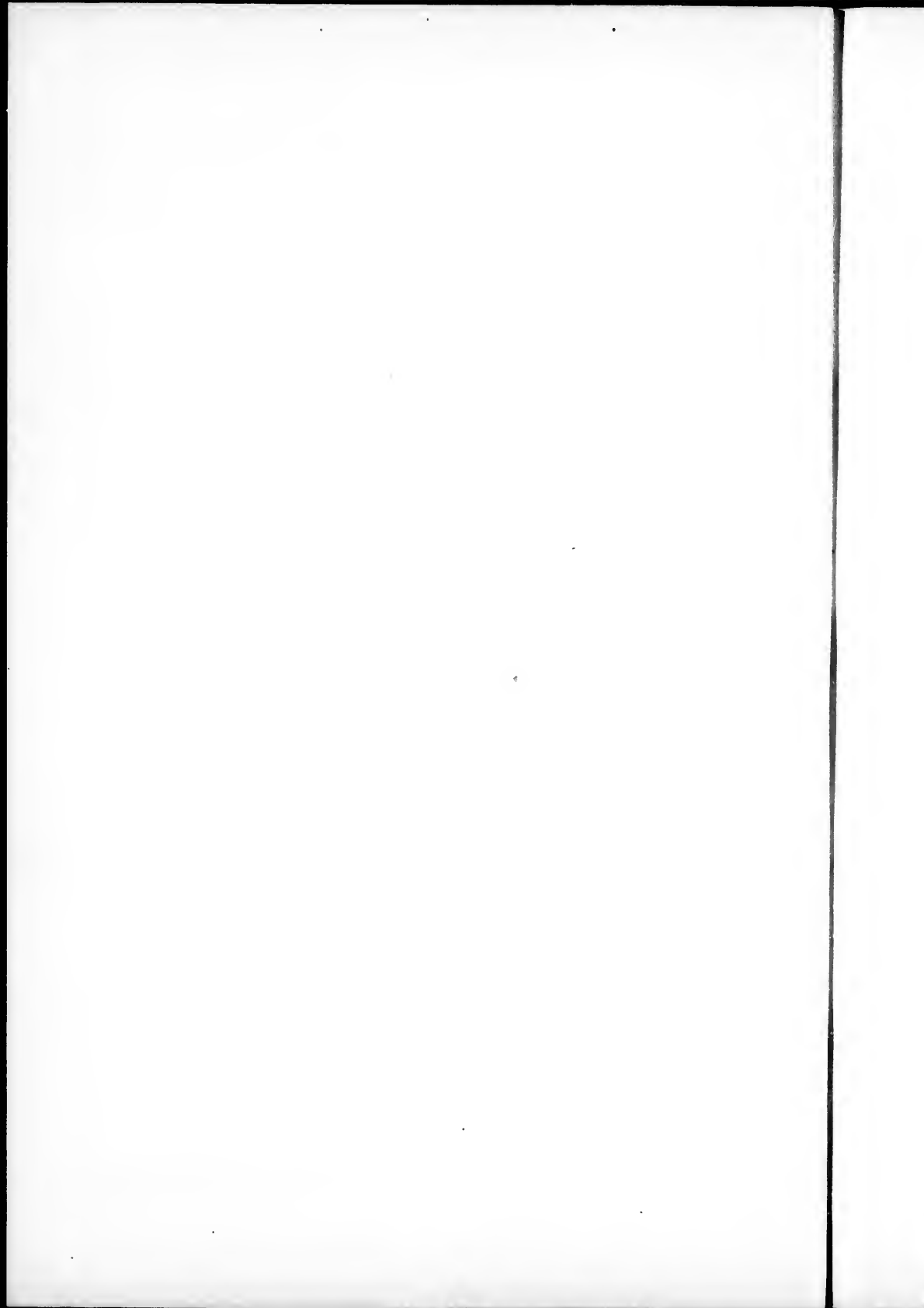
—FOR—

FINDING THE HOUR ANGLE

WITHOUT LOGARITHMS.

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PREFACE.

This Table was prepared for the use of Surveyors in Canada, to enable them to find the Hour Angle from a morning or afternoon altitude of the sun without the use of Logarithms, with sufficient accuracy to determine the Azimuth of Polaris at any time without waiting for an elongation (a Table for which is in preparation).

This Table, however, gives the Hour Angle so close that it is available for Navigators, the error varying from 0 to 4 seconds, the greatest error occurring where the Declination is 0, the Latitude 58 and the Altitude $28^{\circ} 45'$.

It can be used in the Northern or Southern Hemisphere between the Latitudes 40° and 60° .

EXPLANATION OF THE TABLE.

The column headed Alt. contains the altitudes of the sun's centre corrected for Parallax and Refraction.

The column headed H. A. contains the Hour Angle corresponding to the Altitude which is on the same line, and to the Latitude and Declination which is above it.

The column headed D. gives the variation of the Hour Angle for one minute of Altitude.

The Table is computed to the nearest second for every Degree of Declination from 0 to 24 N., for every degree of Latitude from 40 to 59 N., and for every 30 minutes of Altitude within limits of four degrees.

Bessels' Refractions from Altitude 24° to 44° will be found on page

METHOD OF USING THE TABLE.

(1.) On the day of observation the observer shall note the Declination of the sun, and consulting the Table, shall time his observation, so that it shall fall within the limits of the Altitudes for that degree of Declination and those of the one following.

Having taken his Altitude and corrected it for Refraction, Parallax and Semidiameter, he shall take from the Table the Hour Angle due to the next lower Altitude, next lower Latitude and next lower Declination. Multiply the minutes and seconds of the corrected observed Altitude by the number under D, and apply it to the Hour Angle with the sign minus.

Multiply the difference between the Hour Angles due to the two successive degrees of Latitude between which lies the Latitude of the place, by the minutes and seconds in the latter and apply to the Hour Angle with the sign minus. Call the result A.

Proceed in the same manner, but using the next higher Declination, and call the result B.

Subtract A from B, multiply the difference by the minutes and seconds of the Declination, add the product to A. The result will be the Hour Angle.

N.B.—The result of each of those multiplications is seconds of time.

The following examples will illustrate the method:

EXAMPLE 1.

Corrected Altitude.....	° ' "	41 48 20	or	° ' "	41 48.33
Latitude of place	° ' "	46 27 10	"	° ' "	46 27.17
Dec'n corrected for Lon.....	° ' "	19 23 38	"	° ' "	19 23.63
Tabular Hour Angle, Dec. 19°.....				h. m. sec.	
				3 17 9	
18.33 × 6 = 109.97.....	sec.		=	— 1 50	
27.17 × 1.83 = 49.72.....			=	— 49.7	h. m. sec.
					3 14 29.3 = A
Tabular Hour Angle, Dec. 20°.....				3 21 22	
18.33 × 6 = 109.97.....	sec.		=	— 1 50	
27.17 × 1.62 = 44.01.....			=	— 44	3 18 48 = B
				B-A =	4 18.7
B-A = 4.31 which multiplied by 23.63 gives	sec.		=	101.9. . .	=
					1 41.9
Adding to A gives Hour Angle					3 16 11.2

EXAMPLE 2.

Corrected Altitude	° ' "	39 14 50	or	° ' "	39 14.83
Latitude of place... ..	° ' "	57 12 40	"	° ' "	57 12.67
Dec'n corrected for Lon	° ' "	22 9 20	"	° ' "	22 9.33
Tabular Hour Angle, Dec. 22				h. m. sec.	
				3 25 32	
14.83 × 7.9 = 117.2.....	sec.		=	— 1 57.2	
12.67 × 3 = 38			=	— 38.0	h. m. sec.
					3 22 56.8 = A
Tabular Hour Angle, Dec. 23				3 32 3	
14.83 × 7.8 = 115.7.....	sec.		=	— 1 55.7	
12.67 × 2.65 = 33.6.....			=	— 33.6	3 29 33.7 = B
					6 36.9 = B-A
6.62 × 9.33 = 61.8.....	sec.		=	— 1 1.8	
Adding to A gives Hour Angle					3 23 58.6

(2.) If the minutes of the Observed Altitude when corrected lie between 15 and 30, or between 45 and 60, and the minutes of the Latitude and Declination are each greater than 30, or if any two of those three quantities fulfil these conditions, take out the Hour Angle due to the next higher Declination, Latitude and Altitude. Proceed as in (1) but using the sign plus where minus is mentioned, and subtracting from instead of adding the final result to A.

The following example will illustrate the method:

EXAMPLE.

Corrected Altitude	25 47 20
Latitude	56 34 40
Dec'n corrected for Lon.	5 36 10
Hour Angle, Dec. 6, Lat. 57, Alt. 26...	3 18 36
12 40 or $12.7 \times 8.8 = 111.8$ ^{sec.}	= + 1 51.8
25 20 or $25.3 \times 5.4 = 113.8$	= + 1 53 8
	3 22 21.6 = A

Hour Angle, Dec. 5, Lat. 57, Alt. 26...	3 10 44
$12.7 \times 9 = 114.3$ ^{sec.}	= + 1 54.3
$25.3 \times 4.9 = 124.0$	= + 2 4.0
	3 14 42.3 = B

$$7.6 \times 23.8 = 180.9 = 3 \ 0.9$$

$$A = 3 \ 22 \ 21.6$$

Hour Angle.....	3 19 20.7
-----------------	-----------

DECLINATION 0

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	17 1	6.0	14 2	6.1	10 52	6.3	7 29	6.5	3 52	6.7	0 0	7.0	55 51	7.2	51 24	7.5	46 36	7.9	41 23	8.2	35 44	8.7
30 30	14 1	6.0	10 58	6.2	7 42	6.4	4 13	6.6	0 30	6.8	56 31	7.0	52 15	7.3	47 39	7.6	42 40	8.0	37 17	8.4	31 25	8.8
31 0	11 1	6.1	7 52	6.2	4 31	6.4	0 56	6.6	57 6	6.9	53 0	7.1	48 35	7.4	43 50	7.7	38 41	8.1	33 6	8.5	27 0	9.0
31 30	7 59	6.1	4 45	6.3	1 18	6.5	57 37	6.7	53 40	6.9	49 27	7.2	44 53	7.5	39 58	7.8	34 39	8.2	28 50	8.7	22 30	9.2
32 0	4 55	6.1	1 36	6.3	58 3	6.5	54 16	6.8	50 12	7.0	45 51	7.3	41 8	7.6	36 3	8.0	30 32	8.4	24 30	8.9	17 53	9.4
32 30	1 51	6.2	58 26	6.4	54 47	6.6	50 53	6.8	46 42	7.1	42 12	7.4	37 20	7.7	32 4	8.1	26 20	8.5	20 4	9.1	13 10	9.7
33 0	58 45	6.3	55 14	6.4	51 29	6.7	47 28	6.9	43 9	7.2	38 30	7.5	33 28	7.8	28 1	8.2	22 4	8.7	15 32	9.3	8 19	10.0
33 30	55 37	6.3	52 1	6.5	48 9	6.7	44 1	6.9	39 34	7.3	34 45	7.6	29 33	7.9	23 54	8.4	17 42	8.9	10 53	9.5	3 20	10.3
34 0	52 27	6.3	48 45	6.5	44 47	6.8	40 13	7.0	35 55	7.3	30 57	7.7	25 34	8.0	19 41	8.5	13 15	9.0	6 7	9.7	58 11	10.6

DECLINATION 0

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
24 0	3h m s 22 59	7.4	3h m s 14 36	7.9	3h m s 14 36	7.9	3h m s 9 55	8.3	3h m s 4 51	8.7	3h m s 59 21	9.1	3h m s 53 20	9.6	3h m s 46 45	10.2	3h m s 39 28	10.9	3h m s 31 22	11.7
24 30	19 18	7.4	10 38	8.1	10 38	8.1	5 46	8.4	0 31	8.8	54 47	9.2	48 32	9.8	41 39	10.4	34 1	11.2	25 30	12.1
25 0	15 35	7.6	6 35	8.1	6 35	8.1	1 34	8.5	56 7	9.0	50 10	9.5	43 38	10.0	36 26	10.7	28 26	11.5	19 26	12.5
25 30	11 48	7.6	2 32	8.3	2 32	8.3	57 19	8.7	51 38	9.1	45 26	9.6	38 38	10.2	31 5	11.0	22 40	11.9	13 10	13.0
26 0	8 0	7.7	3 23	8.0	3 23	8.0	52 59	8.8	47 5	9.3	40 38	9.8	33 31	10.5	25 36	11.3	16 44	12.3	6 39	13.6
26 30	4 10	7.8	54 13	8.6	54 13	8.6	48 35	8.9	42 27	9.5	35 43	10.0	28 16	10.9	19 58	11.6	10 35	12.8	59 51	14.3
27 0	0 17	7.9	49 56	8.6	49 56	8.6	44 7	9.1	37 41	9.6	30 42	10.3	22 53	11.1	14 8	12.1	4 12	13.3	52 43	15.1
27 30	56 20	8.0	45 38	8.8	45 38	8.8	39 34	9.3	32 54	9.8	25 33	10.6	17 21	11.4	8 6	12.5	57 32	14.0	45 11	16.1
28 0	52 20	8.1	41 15	8.9	41 15	8.9	34 55	9.4	27 58	9.9	20 16	10.8	11 38	11.6	1 50	12.9	50 32	14.5	37 8	17.1

DECLINATION I N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		
'	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	
30	0 21 23	5.9	18 36	6.0	15 39	6.2	12 30	6.4	9 9	6.6	5 33	6.8	1 43	7.1	57 35	7.3	53 8	7.6	48 20	8.0	43 8	8.3	
30	30	18 26	5.9	15 35	6.1	12 33	6.3	9 19	6.4	5 51	6.6	2 9	6.9	58 11	7.1	53 56	7.4	49 20	7.7	44 21	8.0	38 58	8.5
31	0	15 28	5.9	12 33	6.1	9 25	6.3	6 6	6.5	2 32	6.7	58 43	6.9	54 38	7.2	50 14	7.5	45 29	7.8	40 20	8.2	34 44	8.6
31	30	12 30	6.0	9 29	6.2	6 17	6.4	2 51	6.5	59 11	6.8	55 15	7.0	51 2	7.3	46 30	7.6	41 35	7.9	36 15	8.3	30 26	8.8
32	0	9 30	6.1	6 24	6.2	3 6	6.4	59 35	6.6	55 48	6.8	51 45	7.1	47 24	7.4	42 42	7.7	37 37	8.1	32 5	8.5	26 2	9.0
32	30	6 28	6.1	3 17	6.2	59 54	6.4	56 17	6.7	52 23	6.9	48 13	7.2	43 43	7.5	38 51	7.8	33 35	8.2	27 50	8.7	21 33	9.2
33	0	3 26	6.1	0 10	6.3	56 41	6.5	52 57	6.7	48 56	7.0	44 38	7.2	39 59	7.6	34 57	7.9	29 30	8.3	23 30	8.8	16 58	9.4
33	30	0 22	6.2	57 0	6.3	53 25	6.6	49 35	6.8	45 27	7.1	41 1	7.3	36 12	7.7	30 59	8.1	25 20	8.5	19 6	9.0	12 17	9.6
34	0	57 17	6.2	53 50	6.3	50 8	6.6	46 11	6.8	41 55	7.1	37 20	7.4	32 22	7.7	26 57	8.1	21 5	8.6	14 37	9.1	7 28	9.8

DECLINATION I N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	Alt.	H.A. D.	3h m s	H.A. D.	3h m s	H.A. D.	3h m s	H.A. D.	3h m s	H.A. D.	3h m s	H.A. D.	3h m s	H.A. D.	2h m s	H.A. D.	2h m s	H.A. D.	2h m s	H.A. D.
24	0 29 3	7.2	25 19 7.5	21 18 7.7	17 0 8.1	12 20 8.4	7 16 8.8	2 53 9.3	1 47 9.3	55 44 9.7	49 10 10.3	41 52 11.1	36 19 11.3	30 39 11.7	24 48 12.1	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9
24	30 25 26	7.3	21 35 7.5	17 26 7.8	12 58 8.2	8 7 8.5	2 53 8.9	57 9 9.4	50 53 9.9	45 55 10.1	40 51 10.4	38 42 10.9	36 19 11.3	30 39 11.7	24 48 12.1	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9
25	0 21 47	7.3	17 51 7.7	13 31 7.9	8 53 8.3	3 52 8.6	58 25 9.1	52 27 9.6	47 40 9.8	45 55 10.1	40 51 10.4	38 42 10.9	36 19 11.3	30 39 11.7	24 48 12.1	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9
25	30 18 7	7.4	14 0 7.7	9 33 8.0	4 45 8.4	59 33 8.8	53 52 9.2	47 40 9.8	42 47 10.0	38 42 10.9	33 15 11.1	24 48 12.1	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9	52 10 14.9	52 10 14.9	52 10 14.9
26	0 14 25	7.5	10 9 7.7	5 33 8.1	0 34 8.5	55 9 8.9	49 15 9.4	42 47 10.0	37 48 10.2	35 39 10.7	30 19 10.9	27 42 11.5	24 48 12.1	21 58 11.8	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9	52 10 14.9
26	30 10 40	7.6	6 15 7.9	1 29 8.2	56 19 8.6	50 42 9.1	44 33 9.6	39 46 9.8	32 42 10.4	24 51 11.3	21 58 11.8	18 46 12.5	12 31 13.0	6 2 13.5	59 16 14.2	52 10 14.9	52 10 14.9	52 10 14.9	52 10 14.9	52 10 14.9
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28	0 59 10	7.8	54 16 8.2	48 58 8.6	43 11 9.0	36 51 9.5	29 52 10.2	22 7 10.9	13 26 11.9	9 56 12.7	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2	3 34 13.2

DECLINATION 2 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	25 37	5.8	23 3	6.0	20 18	6.1	17 23	6.3	14 15	6.5	10 55	6.7	7 21	6.9	3 32	7.2	59 25	7.4	54 59	7.7	50 11	8.0
30 30	22 43	5.9	20 4	6.0	17 15	6.2	14 14	6.3	11 2	6.6	7 36	6.7	3 55	7.0	59 58	7.2	55 42	7.5	51 7	7.8	46 10	8.1
31 0	19 48	5.9	17 5	6.0	14 11	6.2	11 5	6.4	7 47	6.6	4 15	6.8	0 27	7.1	56 23	7.3	51 59	7.6	47 15	8.0	42 6	8.3
31 30	16 52	5.9	14 4	6.1	11 5	6.2	7 54	6.4	4 30	6.6	0 52	6.9	56 57	7.1	52 44	7.4	48 12	7.7	43 17	8.1	37 57	8.4
32 0	13 55	5.9	11 3	6.1	7 59	6.3	4 42	6.5	1 12	6.7	57 27	7.0	53 24	7.2	49 4	7.5	44 22	7.8	39 17	8.2	33 45	8.6
32 30	10 57	5.9	8 0	6.2	4 51	6.3	1 28	6.5	57 52	6.8	54 0	7.0	49 50	7.3	45 20	7.6	40 29	8.0	35 13	8.3	29 28	8.7
33 0	7 58	6.0	4 56	6.2	1 41	6.4	58 13	6.6	54 30	6.8	50 30	7.1	46 13	7.4	41 34	7.7	36 32	8.1	31 4	8.5	25 6	8.9
33 30	4 58	6.1	1 50	6.2	58 30	6.4	54 56	6.6	51 6	6.9	46 59	7.1	42 33	7.5	37 45	7.8	32 32	8.2	26 57	8.6	20 38	9.0
34 0	1 56	6.1	58 43	6.3	55 18	6.5	51 37	6.7	47 40	6.9	43 25	7.2	38 50	7.6	33 52	7.9	28 28	8.3	22 33	8.7	16 4	9.2

DECLINATION 2 N

Lat. N.	50		51		52		53		54		55		56		57		58		59				
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.			
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	
24 0	34	56	7.1	31 30	7.4	27 48	7.6	23 50	7.9	19 32	8.2	14 54	8.6	9 52	9.0	4 23	9.4	58 22	10.0	51 45	10.7		
24 30	31 24	7.2	27 50	7.4	24 1	7.7	19 52	8.0	15 27	8.3	10 38	8.7	5 24	9.1	59 41	9.6	53 24	10.2	46 29	10.9			
25 0	27 50	7.2	24 9	7.5	20 11	7.8	15 55	8.1	11 18	8.4	6 18	8.8	0 52	9.3	54 54	9.7	48 21	10.4	41 6	11.2			
25 30	24 14	7.3	20 25	7.6	16 19	7.9	11 54	8.2	7 7	8.6	1 55	9.0	56 15	9.5	50 2	9.9	43 11	10.7	35 35	11.5			
26 0	20 36	7.4	16 40	7.6	12 25	7.9	7 51	8.3	2 52	8.7	57 28	9.1	51 34	9.6	45 5	10.0	37 55	10.9	29 55	11.8			
26 30	16 56	7.4	12 52	7.7	8 28	8.0	3 44	8.4	58 34	8.8	52 57	9.3	46 48	9.7	40 1	10.2	32 31	11.3	24 6	12.2			
27 0	13 15	7.5	9 2	7.8	4 29	8.2	59 33	8.5	54 12	9.0	48 21	9.5	41 56	9.9	34 51	10.3	26 58	11.6	18 5	12.8			
27 30	9 31	7.5	5 9	7.9	0 26	8.2	55 20	8.6	49 46	9.1	43 42	9.7	36 58	10.1	29 33	10.4	21 58	11.9	11 52	13.3			
28 0	5 44	7.6	1 13	7.9	56 20	8.3	51 2	8.7	45 15	9.2	38 54	9.9	31 54	10.3	24 6	10.5	15 22	12.2	5 19	13.9			

DECLINATION 3 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	29 45	5.7	27 22	5.9	24 49	6.0	22 7	6.2	19 13	6.3	16 7	6.5	12 48	6.7	9 15	6.9	5 28	7.2	1 22	7.5	56 57	7.8
30 30	26 53	5.7	24 26	5.9	21 49	6.0	19 2	6.2	16 3	6.4	12 52	6.6	9 26	6.8	5 47	7.0	1 52	7.5	57 38	7.6	53 3	7.9
31 0	24 1	5.7	21 30	6.0	18 48	6.1	15 55	6.2	12 51	6.4	9 34	6.6	6 3	6.9	2 17	7.1	58 14	7.4	53 51	7.7	49 7	8.0
31 30	21 7	5.7	18 31	6.0	15 45	6.1	12 48	6.3	9 38	6.5	6 17	6.7	2 37	6.9	58 44	7.2	54 33	7.4	50 1	7.8	45 7	8.1
32 0	18 13	5.7	15 33	6.0	12 42	6.2	9 39	6.4	6 24	6.5	2 55	6.8	59 10	7.0	55 9	7.2	50 50	7.5	46 8	7.9	41 3	8.2
32 30	15 18	5.9	12 34	6.1	9 35	6.2	6 28	6.4	3 9	6.6	59 32	6.8	55 41	7.0	51 33	7.3	47 4	7.6	42 12	8.0	36 56	8.4
33 0	12 21	5.9	9 32	6.1	6 31	6.2	3 18	6.4	59 51	6.6	56 9	6.9	52 10	7.1	47 53	7.4	43 15	7.7	38 13	8.1	32 45	8.5
33 30	9 24	5.9	6 30	6.1	3 24	6.3	0 5	6.5	56 32	6.7	52 43	6.9	48 36	7.2	44 11	7.5	39 23	7.9	34 10	8.2	28 29	8.7
34 0	6 26	6.0	3 26	6.2	0 15	6.3	56 51	6.5	53 11	6.7	49 15	7.0	45 0	7.2	40 25	7.6	35 27	8.0	30 3	8.3	24 8	8.8

DECLINATION 3 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
24	30 m 40	6.9	37 m 30	7.2	34 m 6	7.4	30 m 27	7.7	26 m 30	8.0	22 m 15	8.3	17 m 38	8.7	12 m 37	9.1	7 m 9	9.6	1 m 8	10.1	
24	30 m 37	7.0	33 m 55	7.2	30 m 23	7.5	26 m 36	7.8	22 m 31	8.1	18 m 6	8.4	13 m 18	8.8	8 m 5	9.2	2 m 22	9.7	56 m 6	10.3	
25	0 m 33	4.1	30 m 18	7.3	26 m 39	7.6	22 m 43	7.8	18 m 29	8.2	13 m 53	8.5	8 m 54	8.9	3 m 28	9.4	57 m 31	9.9	50 m 57	10.5	
25	30 m 30	7.1	26 m 39	7.4	22 m 52	7.6	18 m 48	7.9	14 m 24	8.2	9 m 38	8.6	4 m 27	9.0	58 m 47	9.5	52 m 34	10.1	45 m 42	10.7	
26	0 m 26	3.6	22 m 58	7.4	19 m 4	7.7	14 m 51	8.0	10 m 17	8.4	5 m 20	8.7	59 m 56	9.2	54 m 2	9.7	47 m 32	10.3	40 m 20	11.0	
26	30 m 23	7.2	19 m 15	7.5	15 m 13	7.8	10 m 50	8.1	6 m 6	8.5	0 m 58	8.9	55 m 21	9.3	49 m 11	9.9	42 m 24	10.5	34 m 51	11.3	
27	0 m 19	2.4	7.3	15 m 31	7.6	11 m 19	7.9	6 m 47	8.2	1 m 52	8.6	56 m 32	9.1	50 m 41	9.5	44 m 15	10.1	37 m 8	10.8	29 m 12	11.6
27	30 m 15	4.5	7.4	11 m 44	7.7	7 m 23	7.9	2 m 41	8.3	57 m 35	8.7	52 m 0	9.1	45 m 57	9.7	39 m 12	10.3	31 m 45	11.1	23 m 24	12.0
28	0 m 12	4.7	7.4	7.54	7.7	3.25	8.0	58.32	8.4	53.14	8.8	47.26	9.2	41.5	9.8	34.3	10.6	26.13	11.4	17.25	12.4

DECLINATION 4 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	33 46	5.7	31 34	5.8	29 13	5.9	26 42	6.1	24 1	6.2	21 10	6.4	18 6	6.6	14 49	6.8	11 18	7.1	7 31	7.3	3 26	7.6
30 30	30 57	5.7	28 40	5.8	26 15	6.0	23 40	6.1	20 54	6.3	17 57	6.4	14 48	6.7	11 25	6.9	7 47	7.1	3 52	7.4	59 49	7.6
31 0	28 6	5.7	25 46	5.8	23 16	6.0	20 37	6.2	17 46	6.3	14 44	6.5	11 29	6.7	7 59	6.9	4 14	7.2	0 11	7.5	55 49	7.7
31 30	25 15	5.7	2 51	5.9	20 17	6.0	17 33	6.2	14 37	6.3	11 29	6.6	8 8	6.8	4 31	7.0	0 39	7.3	56 28	7.6	51 57	7.8
32 0	22 23	5.8	19 55	5.9	17 16	6.1	14 27	6.2	11 26	6.4	8 13	6.6	4 45	6.8	1 2	7.1	57 2	7.4	52 42	7.7	48 1	7.9
32 30	19 30	5.8	16 58	5.9	14 15	6.1	11 21	6.3	8 14	6.4	4 55	6.7	1 21	6.9	57 30	7.2	53 22	7.5	48 54	7.8	44 2	8.1
33 0	16 37	5.8	14 0	6.0	11 12	6.1	8 13	6.3	5 1	6.5	1 35	6.7	57 54	7.0	53 57	7.3	49 40	7.6	45 2	7.9	40 0	8.2
33 30	13 42	5.8	11 1	6.0	8 8	6.2	5 4	6.3	1 46	6.5	58 14	6.8	54 26	7.0	50 20	7.4	45 55	7.7	41 7	8.0	35 54	8.3
34 0	10 47	5.9	8 1	6.0	5 3	6.2	1 53	6.4	58 30	6.6	54 51	6.8	50 56	7.1	46 42	7.5	42 7	7.8	37 9	8.1	31 44	8.4

DECLINATION 4 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
24 0	3h m s 46 16 6.9		3h m s 43 21 7.1		3h m s 40 14 7.3		3h m s 36 52 7.6		3h m s 33 15 7.8		3h m s 29 21 7.9		3h m s 25 21 8.1		3h m s 20 33 8.5		3h m s 15 34 9.3		3h m s 10 6 9.6	
24 30	42 50 6.9		39 49 7.1		36 35 7.4		33 6 7.6		29 21 7.9		25 18 8.2		20 55 8.6		16 9 9.0		10 56 9.5		5 14 10.0	
25 0	39 24 7.0		36 16 7.2		32 55 7.4		29 19 7.7		25 25 8.0		21 12 8.3		16 39 8.7		11 41 9.1		6 15 9.6		0 18 10.2	
25 30	35 55 7.0		32 41 7.2		29 13 7.5		25 29 7.8		21 26 8.1		17 4 8.4		12 19 8.8		7 9 9.2		1 29 9.8		55 15 10.3	
26 0	32 26 7.1		29 5 7.3		25 29 7.6		21 37 7.9		17 25 8.2		12 53 8.5		7 57 8.9		2 33 9.4		56 39 9.9		50 9 10.6	
26 30	28 55 7.1		25 27 7.4		21 43 7.6		17 42 7.9		13 21 8.3		8 38 8.6		3 30 9.1		57 54 9.6		51 44 10.1		44 55 10.8	
27 0	25 22 7.2		21 47 7.4		17 55 7.7		13 45 8.0		9 15 8.4		4 21 8.8		59 0 9.2		53 9 9.8		46 43 10.4		39 34 11.1	
27 30	21 48 7.2		19 5 7.5		14 5 7.7		9 46 8.0		5 5 8.5		0 0 8.9		54 26 9.3		48 19 10.0		41 35 10.6		34 6 11.4	
28 0	18 11 7.3		14 21 7.5		10 13 7.8		5 44 8.1		0 52 8.6		55 34 9.0		49 47 9.4		43 24 10.1		36 21 10.8		28 29 11.6	

DECLINATION 5 N

Lat. N.	40	41	42	43	44	45	46	47	48	49	50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h	3h	3h	3h	3h	3h	3h	3h	3h	3h	3h	3h
	m	m	m	m	m	m	m	m	m	m	m	m
	s	s	s	s	s	s	s	s	s	s	s	s
30	0 37 42	5 6 35 40	5 7 33 29	5 8 31 10	6 0 28 41	6 1 26 1	6 3 23 11	6 5 20 10	6 7 16 57	6 9 13 28	7 1 9 42	7 4
30	30 34	5 6 32 48	5 7 30 34	5 9 28 10	6 0 25 37	6 2 22 52	6 3 19 56	6 5 16 49	6 7 13 30	6 9 9 54	7 2 6 1	7 5
31	0 32 6	5 6 29 56	5 8 27 38	5 9 25 10	6 1 22 31	6 2 19 42	6 4 16 41	6 6 13 28	6 8 10 2	7 0 6 18	7 3 2 17	7 5
31	30 29	5 6 27 3	5 8 24 41	5 9 22 8	6 1 19 25	6 2 16 31	6 4 13 24	6 6 10 4	6 8 6 32	7 1 2 40	7 3 2 58	7 6
32	0 26 27	6 7 24 10	5 8 21 43	6 0 19 6	6 1 16 18	6 3 13 18	6 5 10 5	6 7 6 39	6 9 3 0	7 2 3 0	7 4 54 42	7 7
32	30 23	6 7 21 15	5 8 18 44	6 0 16 3	6 2 13 9	6 3 10 4	6 5 6 45	6 7 3 13	7 0 2 59	7 2 55 18	7 5 50 50	7 8
33	0 20 45	6 7 18 20	5 9 15 45	6 0 12 58	6 2 10 0	6 4 6 48	6 6 3 23	6 8 59 44	7 0 55 49	7 3 51 33	7 6 46 56	7 9
33	30 17	6 8 15 24	5 9 12 44	6 1 9 52	6 2 6 48	6 4 3 31	6 6 0 0	6 8 56 13	7 1 52 10	7 4 47 45	7 7 42 58	8 0
34	0 15 0	6 8 12 26	5 9 9 42	6 1 6 45	6 3 3 36	6 5 0 13	6 7 56 34	6 9 52 40	7 1 48 29	7 4 43 55	7 7 38 56	8 1

DECLINATION 5 N

Lat. N.	50		51		52		53		54		55		56		57		58		59					
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.				
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h			
24 0	51 44	6.8	49 4	7.0	46 12	7.2	43 8	7.4	39 49	7.6	36 15	7.9	32 24	8.2	28 13	8.6	23 40	9.0	18 42	9.4				
24 30	48 21	6.8	45 35	7.0	42 37	7.2	39 26	7.5	36 0	7.7	32 17	8.0	28 17	8.3	23 55	8.7	19 11	9.1	14 0	9.6				
25 0	44 58	6.8	42 6	7.0	39 1	7.2	35 42	7.5	32 8	7.8	28 17	8.1	29 7	8.4	19 35	8.8	14 38	9.2	9 13	9.7				
25 30	41 33	6.9	38 35	7.1	35 24	7.3	31 57	7.6	28 15	7.9	24 15	8.2	19 54	8.5	15 11	8.9	10 2	9.4	4 23	9.9				
26 0	38 6	6.9	35 2	7.1	31 44	7.4	28 10	7.6	24 19	7.9	20 10	8.3	15 39	8.6	10 44	9.0	5 21	9.5	59 27	10.0				
26 30	34 39	7.0	31 28	7.2	28 2	7.4	24 21	7.7	20 21	8.0	16 2	8.3	11 20	8.7	6 13	9.1	0 37	9.7	54 27	10.2				
27 0	31 10	7.0	27 52	7.2	24 19	7.5	20 29	7.8	16 21	8.1	11 52	8.5	6 59	8.9	1 39	9.3	55 47	9.8	49 20	10.4				
27 30	27 40	7.1	24 15	7.3	20 34	7.6	16 36	7.9	12 18	8.2	7 38	8.6	2 33	9.0	57 0	9.5	50 53	10.0	44 7	10.6				
28 0	24 8	7.1	20 36	7.3	16 47	7.6	12 40	7.9	8 12	8.3	3 21	8.7	58 4	9.1	52 16	9.6	45 53	10.2	38 48	10.8				

DECLINATION 6 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	3h 41 32	5 6	3h 39 40	5 7	3h 37 40	5 8	3h 35 32	5 9	3h 33 16	6 1	3h 30 50	6 2	3h 28 13	6 4	3h 25 26	6 6	3h 22 26	6 8	3h 19 13	7 0	3h 15 45	7 2
30 30	3h 38 46	5 6	3h 36 50	5 7	3h 34 47	5 8	3h 32 35	5 9	3h 30 14	6 1	3h 27 43	6 2	3h 25 2	6 4	3h 22 9	6 6	3h 19 3	6 8	3h 15 43	7 1	3h 12 8	7 3
31 0	3h 35 59	5 6	3h 34 0	5 7	3h 31 53	5 8	3h 29 37	6 0	3h 27 12	6 1	3h 24 36	6 3	3h 21 49	6 5	3h 18 51	6 7	3h 15 39	6 9	3h 12 12	7 1	3h 8 30	7 4
31 30	3h 33 12	5 6	3h 31 9	5 7	3h 28 58	5 9	3h 26 38	6 0	3h 24 8	6 2	3h 21 28	6 3	3h 18 36	6 5	3h 15 31	6 7	3h 12 13	6 9	3h 8 39	7 2	3h 4 49	7 4
32 0	3h 30 24	5 6	3h 28 18	5 8	3h 26 3	5 9	3h 23 38	6 0	3h 21 4	6 2	3h 18 18	6 4	3h 15 21	6 6	3h 12 10	6 8	3h 8 45	7 0	3h 5 5	7 3	3h 1 6	7 5
32 30	3h 27 36	5 7	3h 25 25	5 8	3h 23 6	5 9	3h 20 37	6 0	3h 17 58	6 2	3h 15 7	6 4	3h 12 4	6 6	3h 8 48	6 8	3h 5 16	7 1	3h 1 28	7 4	3h 57 21	7 6
33 0	3h 24 46	5 7	3h 22 32	5 8	3h 20 9	5 9	3h 17 36	6 1	3h 14 52	6 3	3h 11 56	6 5	3h 8 47	6 7	3h 5 23	6 9	3h 1 45	7 1	3h 57 49	7 4	3h 53 33	7 7
33 30	3h 21 57	5 7	3h 19 39	5 8	3h 17 11	6 0	3h 14 34	6 1	3h 11 44	6 3	3h 8 42	6 5	3h 5 27	6 7	3h 1 57	6 9	3h 58 11	7 2	3h 54 7	7 5	3h 49 43	7 8
34 0	3h 19 6	5 7	3h 16 44	5 8	3h 14 12	6 0	3h 11 29	6 1	3h 8 35	6 3	3h 5 28	6 6	3h 2 6	6 8	3h 58 30	7 0	3h 54 36	7 2	3h 50 23	7 6	3h 45 49	7 9

DECLINATION 6 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
24 0	3h m s 57 5 6.7		3h m s 54 30 6.9	7.1	3h m s 52 3 7.1	7.3	3h m s 49 14 7.3	7.5	3h m s 46 13 7.5	7.8	3h m s 42 58 7.8	39 27 8.1	3h m s 39 27 8.1	35 38 8.4	3h m s 35 38 8.4	31 30 8.8	3h m s 31 30 8.8	26 59 9.2			
24 30	53 45 6.7		51 14 6.9	48 31 7.1	45 36 7.4	42 28 7.6	39 5 7.9	35 25 8.2	31 26 8.5	27 7 8.9	22 25 9.3										
25 0	50 24 6.7		47 47 7.0	44 58 7.2	41 56 7.4	38 41 7.7	35 9 7.9	31 21 8.3	27 12 8.6	22 42 9.0	17 47 9.4										
25 30	47 2 6.8		44 18 7.0	41 24 7.2	38 15 7.4	34 52 7.7	31 12 8.0	27 14 8.4	22 55 8.7	18 14 9.1	13 6 9.6										
26 0	43 39 6.8		40 49 7.0	37 48 7.3	34 32 7.5	31 1 7.8	27 13 8.1	23 5 8.4	18 56 8.8	13 42 9.3	8 21 9.8										
26 30	40 14 6.9		37 19 7.1	34 11 7.3	30 48 7.6	27 8 7.9	23 11 8.2	18 53 8.5	14 13 8.9	9 7 9.4	3 31 9.9										
27 0	36 40 6.9		33 47 7.1	30 32 7.4	27 1 7.6	23 13 7.9	19 7 8.3	14 30 8.6	9 47 9.1	4 27 9.5	58 36 10.0										
27 30	33 22 6.9		30 13 7.1	26 51 7.4	23 13 7.7	19 16 8.0	15 0 8.4	10 21 8.7	5 17 9.2	59 44 9.6	53 36 10.2										
28 0	29 54 7.0		26 39 7.2	23 9 7.5	19 22 7.7	15 16 8.0	10 50 8.5	6 0 8.8	0 43 9.3	54 55 9.7	48 31 10.3										

DECLINATION 7 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s
30 0	45 16	5.5	43 34	5.6	41 45	5.7	39 48	5.8	37 43	6.0	35 29	6.1	33 5	6.3	30 31	6.5	27 46	6.7	24 48	6.9	21 37	7.1
30 30	42 32	5.5	40 46	5.6	38 53	5.7	36 53	5.9	34 43	6.0	32 25	6.2	29 56	6.3	27 17	6.5	24 26	6.7	21 22	6.9	18 5	7.1
31 0	39 47	5.5	37 58	5.6	36 1	5.7	33 57	5.9	31 43	6.0	29 20	6.2	26 47	6.4	24 2	6.5	21 6	6.7	17 56	7.0	14 31	7.2
31 30	37 1	5.5	35 9	5.7	33 9	5.8	31 0	5.9	28 42	6.1	26 15	6.2	23 36	6.4	20 46	6.6	17 44	6.8	14 27	7.0	10 55	7.3
32 0	34 15	5.5	32 19	5.7	30 15	5.8	28 2	5.9	25 4	6.1	23 8	6.3	20 24	6.4	17 29	6.6	14 20	6.8	10 57	7.1	7 17	7.3
32 30	31 29	5.6	29 29	5.7	27 21	5.8	25 4	6.0	22 38	6.1	20 0	6.3	17 11	6.5	14 10	6.7	10 55	6.9	7 25	7.1	3 38	7.4
33 0	28 41	5.6	26 38	5.7	24 26	5.8	22 5	6.0	19 34	6.2	16 51	6.3	13 57	6.5	10 50	6.7	7 28	6.9	3 51	7.2	59 55	7.5
33 30	25 54	5.6	23 46	5.7	21 31	5.9	19 5	6.0	16 29	6.2	13 41	6.4	10 42	6.6	7 28	6.8	4 0	7.0	0 15	7.3	56 11	7.6
34 0	23 5	5.6	20 54	5.8	18 34	5.9	16 4	6.0	13 23	6.2	10 3	6.4	7 24	6.6	4 5	6.8	0 29	7.1	56 30	7.4	52 24	7.6

DECLINATION 7 N

Lat. N.	50	51	52	53	54	55	56	57	58	59											
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.											
	4th	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.											
24	0 2 19 3	6.6	0 7 5	6.8	57 45 3	6.9	55 13 5	7.2	52 28 3	7.4	49 31 3	7.7	46 09 3	7.9	42 51 3	8.2	39 06 3	8.6	35 06 3	8.9	
24	30 59	2	6.6	50 44	6.8	54 17	7.0	51 38	7.2	48 49	7.4	45 41	7.7	42 21	8.0	38 45	8.3	34 49	8.6	30 33	9.0
25	0 55 43	6.6	53 29	6.8	50 47	7.1	48 1	7.3	45 3	7.5	41 59	7.7	38 22	8.0	34 36	8.4	30 39	8.7	26 3	9.1	
25	30 52 24	6.7	49 55	6.9	47 15	7.1	44 23	7.3	41 18	7.6	37 58	7.8	34 21	8.1	30 25	8.4	26 0	8.8	21 29	9.2	
26	0 49 3	6.7	46 29	6.9	43 43	7.1	40 44	7.4	37 31	7.6	34 3	7.9	30 17	8.2	26 12	8.5	21 45	8.9	16 52	9.3	
26	30 45 42	6.8	43 2	6.9	40 0	7.2	37 3	7.4	33 43	7.7	30 6	8.0	26 11	8.3	21 56	8.7	17 17	9.0	12 12	9.5	
27	0 42 19	6.8	39 33	7.0	36 34	7.2	33 21	7.5	29 53	7.7	26 7	8.0	22 3	8.4	17 36	8.8	12 46	9.2	7 27	9.6	
27	30 38 55	6.8	36 3	7.0	32 57	7.3	29 37	7.5	26 1	7.8	22 6	8.1	17 52	8.5	13 13	8.8	8 11	9.3	2 38	9.8	
28	0 35 30	6.9	32 32	7.1	29 19	7.3	25 51	7.6	22 7	7.9	18 3	8.2	13 38	8.6	8 49	9.0	3 33	9.4	2 35	10.0	
28	30 32 4	6.9	28 59	7.1	25 39	7.4	22 3	7.6	18 10	8.0	13 57	8.3	9 21	8.7	4 20	9.1	38 50	9.6	52 46	10.1	
29	0 28 37	6.9	25 25	7.2	21 58	7.5	18 14	7.7	14 11	8.0	9 48	8.4	5 1	8.8	59 47	9.2	54 3	9.8	47 42	10.3	
29	30 25 8	7.0	21 49	7.3	18 14	7.5	14 22	7.8	10 10	8.1	5 36	8.5	0 38	8.9	55 19	9.4	49 10	9.9	42 32	10.6	
30	0 21 37	7.0	18 11	7.3	14 28	7.6	10 27	7.9	6 6	8.2	1 21	8.6	50 10	9.0	50 20	9.5	44 12	10 0	37 14	10.8	

DECLINATION 8 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	3h m s 48 57 5.4	5.4	3h m s 47 24 5.6	5.6	3h m s 45 44 5.7	5.7	3h m s 43 58 5.8	5.8	3h m s 42 4 5.9	5.9	3h m s 40 1 6.0	6.0	3h m s 37 50 6.2	6.2	3h m s 35 29 6.4	6.4	3h m s 32 57 6.6	6.6	3h m s 30 14 6.7	6.7	3h m s 27 19 7.0	7.0
30 30	46 13 5.4	5.4	44 37 5.6	5.6	42 55 5.7	5.7	41 4 5.8	5.8	39 6 5.9	5.9	37 0 6.1	6.1	34 44 6.3	6.3	32 18 6.4	6.4	29 41 6.6	6.6	26 52 6.8	6.8	23 50 7.0	7.0
31 0	43 30 5.5	5.5	41 51 5.6	5.6	40 4 5.7	5.7	38 10 5.8	5.8	36 8 6.0	6.0	33 57 6.1	6.1	31 37 6.3	6.3	29 6 6.5	6.5	26 23 6.6	6.6	23 29 6.8	6.8	20 21 7.1	7.1
31 30	40 46 5.5	5.5	39 3 5.6	5.6	37 13 5.7	5.7	35 16 5.9	5.9	33 9 6.0	6.0	30 54 6.1	6.1	28 29 6.3	6.3	25 53 6.5	6.5	23 5 6.7	6.7	20 4 6.9	6.9	16 49 7.1	7.1
32 0	38 1 5.5	5.5	36 15 5.6	5.6	34 22 5.8	5.8	32 20 5.9	5.9	30 10 6.0	6.0	27 50 6.2	6.2	25 20 6.3	6.3	22 38 6.5	6.5	19 45 6.7	6.7	16 38 7.0	7.0	13 16 7.2	7.2
32 30	35 17 5.5	5.5	33 27 5.7	5.7	31 30 5.8	5.8	29 24 5.9	5.9	27 9 6.1	6.1	24 45 6.2	6.2	22 10 6.4	6.4	19 23 6.6	6.6	16 23 6.8	6.8	13 10 7.0	7.0	9 41 7.2	7.2
33 0	32 31 5.5	5.5	30 38 5.7	5.7	28 37 5.8	5.8	26 27 5.9	5.9	24 8 6.1	6.1	21 39 6.2	6.2	18 59 6.4	6.4	16 6 6.6	6.6	13 0 6.8	6.8	9 40 7.1	7.1	6 4 7.3	7.3
33 30	29 45 5.6	5.6	27 48 5.7	5.7	25 43 5.8	5.8	23 30 6.0	6.0	21 6 6.1	6.1	18 32 6.3	6.3	15 46 6.4	6.4	12 48 6.6	6.6	9 36 6.8	6.8	6 9 7.1	7.1	2 25 7.4	7.4
34 0	26 58 5.6	5.6	24 58 5.7	5.7	22 49 5.8	5.8	20 31 6.0	6.0	18 3 6.1	6.1	15 24 6.3	6.3	12 33 6.4	6.4	9 29 6.7	6.7	6 10 6.9	6.9	2 36 7.2	7.2	58 44 7.4	7.4

DECLINATION 8 N

Lat. N.	50		51		52		53		54		55		56		57		58		59												
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.											
26	3h m s	54 21 6.6	3h m s	52 1 6.8	3h m s	49 30 7.0	3h m s	46 47 7.3	3h m s	43 52 7.5	3h m s	40 42 7.8	3h m s	37 16 8.0	3h m s	33 33 8.4	3h m s	29 31 8.8	3h m s	25 6 9.2											
26	30	51	2	6.7	48	36	6.9	43	10	7.3	40	7	7.5	36	50	7.8	33	16	8.1	29	23	8.5	25	10	8.9	20	33	9.3			
27	0	47	42	6.7	45	11	6.9	38	31	7.3	36	21	7.6	32	56	7.9	29	13	8.2	25	10	8.6	20	46	9.0	15	57	9.4			
27	30	44	21	6.7	41	44	7.0	35	51	7.4	32	34	7.7	29	0	8.0	25	8	8.3	20	55	8.7	16	19	9.1	11	17	9.5			
28	0	40	59	6.8	38	17	7.0	32	10	7.5	28	44	7.7	25	2	8.0	21	0	8.4	16	37	8.8	11	49	9.2	6	33	9.7			
28	30	37	36	6.8	34	40	7.1	31	44	7.3	28	26	7.5	24	53	7.8	21	2	8.1	16	50	8.5	12	16	8.9	7	15	9.3	1	45	9.8
29	0	34	12	6.9	31	16	7.1	28	0	7.3	24	41	7.6	20	59	7.9	16	59	8.2	12	37	8.6	7	51	9.0	2	38	9.5	50	53	10.0
29	30	30	46	6.9	27	42	7.2	24	27	7.4	20	54	7.6	17	4	7.9	12	53	8.3	8	20	8.7	3	22	9.1	57	56	9.6	51	56	10.2
30	0	27	19	6.9	24	9	7.2	17	5	7.7	13	6	8.0	8	46	8.4	4	2	8.8	58	51	9.2	53	9	9.7	46	52	10.3			

DECLINATION 9 N

Lat. N.	40	41	42	43	44	45	46	47	48	49	50
ALT.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.
	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s
30	52 32 5.4	51 9 5.5	49 39 5.6	48 2 5.7	46 19 5.9	44 27 6.0	42 28 6.1	40 19 6.3	38 1 6.5	35 22 6.5	32 52 6.8
30	30 49 50 5.4	48 24 5.5	46 51 5.6	45 11 5.8	43 23 5.9	41 27 6.0	39 24 6.2	37 11 6.3	34 47 6.5	32 8 6.5	29 27 6.9
31	0 47 8 5.4	45 38 5.5	44 2 5.6	42 18 5.8	40 27 5.9	38 28 6.0	36 19 6.2	34 1 6.3	31 33 6.5	28 53 6.7	26 1 6.9
31	30 44 25 5.4	42 53 5.6	41 13 5.7	39 26 5.8	37 30 5.9	35 26 6.0	33 14 6.2	30 51 6.4	28 17 6.6	25 31 6.7	22 33 7.0
32	0 41 42 5.4	40 6 5.6	38 23 5.7	36 32 5.8	34 33 5.9	32 25 6.1	30 7 6.2	27 39 6.4	25 0 6.6	22 9 6.8	19 4 7.0
32	30 38 59 5.5	37 19 5.6	35 33 5.7	33 38 5.8	31 35 6.0	29 22 6.1	27 0 6.3	24 27 6.5	21 42 6.6	18 44 6.8	15 33 7.1
33	0 36 15 5.5	34 32 5.6	32 42 5.7	30 43 5.9	28 36 6.0	26 19 6.1	23 52 6.3	21 13 6.5	18 23 6.7	15 19 6.9	12 0 7.1
33	30 33 30 5.5	31 44 5.6	29 50 5.7	27 47 5.9	25 36 6.0	23 15 6.2	20 42 6.3	17 58 6.5	15 2 6.7	11 52 7.0	8 26 7.2
34	0 30 45 5.5	28 55 5.6	26 58 5.8	24 51 5.9	22 35 6.0	20 9 6.2	17 32 6.3	14 42 6.6	11 40 6.7	8 23 7.0	4 50 7.2

DECLINATION 9 N

Lat. N.	40		41		42		43		44		45		46		47		48		49			
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.		
	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s
36	0 19 39	5.6	17 35	5.7	15 21	5.9	12 58	6.0	10 23	6.2	7 30	6.3	4 38	6.6	1 24	6.8	57 56	7.0	54 9	7.3		
36	30 16 51	5.6	14 43	5.8	12 25	5.9	9 58	6.1	7 18	6.2	4 26	6.4	1 21	6.6	58 1	6.8	54 25	7.1	50 31	7.4		
37	0 14 2	5.6	11 50	5.8	9 28	5.9	6 55	6.1	4 11	6.3	1 14	6.5	58 2	6.7	54 36	6.9	50 52	7.1	46 50	7.5		
37	30 11 13	5.7	8 57	5.8	6 30	6.0	3 53	6.1	1 3	6.3	58 0	6.5	54 42	6.7	51 9	7.0	47 18	7.3	43 6	7.5		
38	0 8 22	5.7	6 2	5.8	3 31	6.0	0 49	6.2	57 53	6.3	54 45	6.6	51 20	6.8	47 40	7.1	43 40	7.3	39 20	7.7		
38	30 5 31	5.7	3 7	5.9	0 31	6.0	57 44	6.2	54 43	6.4	51 28	6.6	47 57	6.9	44 8	7.1	40 0	7.4	35 30	7.7		
39	0 2 40	5.8	0 11	5.9	57 30	6.1	54 37	6.3	51 31	6.5	48 9	6.7	44 31	6.9	40 35	7.2	36 19	7.5	31 38	7.9		
39	30 50 47	5.8	57 13	5.9	54 28	6.1	51 29	6.3	48 17	6.5	44 49	6.7	41 4	7.0	36 59	7.3	32 33	7.6	27 42	8.0		
40	0 50 53	5.8	54 7	5.9	51 24	6.1	48 20	6.3	45 2	6.5	41 27	6.8	37 33	7.1	33 20	7.3	28 44	7.7	23 42	8.1		

DECLINATION 9 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
26 0	3h 59 33	m 6.6	3h 57 26	m 6.7	3h 55 10	m 6.9	3h 52 42	m 7.1	3h 50 3	m 7.4	3h 47 11	m 7.6	3h 44 5	m 7.9	3h 40 43	m 8.2	3h 37 5	m 8.5	3h 33 3	m 8.9
26 30	54 16	6.6	54 4	6.8	51 42	7.0	49 8	7.2	46 22	7.4	43 23	7.7	40 9	8.0	36 38	8.3	32 48	8.6	28 37	9.0
27 0	52 58	6.6	50 41	6.8	48 13	7.0	45 33	7.2	42 40	7.5	39 33	7.7	36 10	8.0	32 30	8.3	28 30	8.7	24 8	9.1
27 30	49 40	6.7	47 17	6.8	44 42	7.0	41 56	7.3	38 56	7.5	35 42	7.8	32 10	8.1	28 21	8.4	24 10	8.8	19 36	9.2
28 0	46 20	6.7	43 52	6.9	41 11	7.1	38 18	7.3	35 11	7.6	31 48	7.8	28 8	8.1	24 9	8.5	19 47	8.9	15 1	9.3
28 30	43 0	6.7	40 25	6.9	37 39	7.1	34 39	7.4	31 24	7.6	27 53	7.9	24 4	8.2	19 54	8.6	15 21	9.0	10 22	9.4
29 0	39 38	6.7	36 58	7.0	34 5	7.2	30 58	7.4	27 35	7.7	23 55	8.0	19 57	8.3	15 36	8.7	10 52	9.1	5 39	9.5
29 30	36 16	6.8	33 29	7.0	30 29	7.2	27 15	7.5	23 44	7.7	19 56	8.1	15 47	8.4	11 16	8.8	6 19	9.2	0 54	9.6
30 0	32 52	6.8	29 59	7.0	26 52	7.2	23 30	7.5	19 52	7.8	15 54	8.1	11 35	8.5	6 52	8.9	1 42	9.3	56 5	9.7

DECLINATION 10 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	3h m ^s 23 27	5.6	3h m ^s 21 34	5.7	3h m ^s 19 31	5.8	3h m ^s 17 20	5.9	3h m ^s 14 58	6.1	3h m ^s 12 26	6.3	3h m ^s 9 41	6.5	3h m ^s 6 43	6.7	3h m ^s 3 31	6.9	3h m ^s 0 4	7.1	3h m ^s 56 19	7.4
36 30	20 41	5.6	18 44	5.7	16 38	5.9	14 22	6.0	11 55	6.1	9 18	6.3	6 28	6.5	3 24	6.7	0 5	6.9	56 31	7.2	52 37	7.5
37 0	17 54	5.6	15 53	5.7	13 43	5.9	11 23	6.0	8 52	6.2	6 9	6.4	3 13	6.6	0 3	6.8	56 38	7.0	52 55	7.3	48 53	7.6
37 30	15 7	5.6	13 2	5.7	10 47	5.9	8 23	6.0	5 47	6.2	2 59	6.4	59 57	6.6	56 40	6.8	53 8	7.1	49 17	7.4	45 6	7.6
38 0	12 19	5.6	10 10	5.8	7 51	5.9	5 22	6.1	2 41	6.3	59 47	6.4	56 39	6.7	53 16	6.9	49 36	7.2	45 37	7.5	41 17	7.8
38 30	9 30	5.7	7 17	5.8	4 54	5.9	2 20	6.1	59 34	6.3	56 34	6.5	53 20	6.7	49 50	7.0	46 2	7.3	41 55	7.6	37 25	7.8
39 0	6 40	5.7	4 23	5.8	1 56	6.0	59 17	6.2	56 25	6.3	53 20	6.6	49 59	6.8	46 22	7.1	42 26	7.3	38 9	7.7	33 29	8.0
39 30	3 50	5.7	1 29	5.8	58 57	6.0	56 12	6.2	53 15	6.4	50 4	6.6	46 36	6.8	42 52	7.1	38 47	7.4	34 21	7.8	29 30	8.1
40 0	0 59	5.7	58 33	5.9	55 56	6.0	53 7	6.2	50 4	6.4	46 46	6.7	43 12	6.9	39 19	7.2	35 6	7.5	30 29	7.9	25 27	8.2

DECLINATION 10 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
26	4 38	6.5	2 45	6.7	0 42	6.9	58 30	7.1	56 7	7.3	53 32	7.5	50 44	7.8	47 41	8.1	44 23	8.3	40 46	8.7	
26	30	1 24	59 25	6.7	57 17	6.9	54 58	7.1	52 29	7.3	49 47	7.6	46 51	7.8	43 40	8.1	40 13	8.4	36 26	8.8	
27	0 58	8 6.6	56 4	6.7	53 51	6.9	51 26	7.1	48 50	7.4	46 1	7.6	42 57	7.9	39 38	8.2	36 1	8.5	32 1	8.8	
27	30	54 52	6.6	52 42	6.8	50 23	7.0	47 52	7.2	45 9	7.4	42 13	7.7	39 1	7.9	35 33	8.3	31 46	8.6	27 38	8.9
28	0 51	34 6.6	49 22	6.8	49 55	7.0	44 18	7.2	41 28	7.5	38 23	7.7	35 4	8.0	31 29	8.3	27 29	8.7	23 10	9.0	
28	30	48 16	6.6	45 56	6.8	43 25	7.0	40 41	7.3	37 45	7.5	34 33	7.8	31 4	8.0	27 18	8.4	23 10	8.8	18 39	9.1
29	0 44	57 6.7	42 32	6.9	39 54	7.1	37 4	7.3	34 0	7.6	30 40	7.9	27 3	8.1	23 6	8.5	18 48	8.9	14 5	9.3	
29	30	41 38	6.7	39 6	6.9	36 22	7.1	33 25	7.4	30 13	7.6	26 45	7.9	22 50	8.2	18 52	8.6	14 23	9.0	9 27	9.4
30	0 38	17 6.8	35 40	7.0	32 49	7.2	29 45	7.4	26 25	7.7	22 49	8.0	18 53	8.2	14 36	8.7	9 54	9.1	4 45	9.5	

DECLINATION 11 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	27 9	5 5	25 20	5 6	23 35	5 7	21 35	5 9	19 20	6 0	17 6	6 2	14 35	6 3	11 52	6 5	8 56	6 7	5 46	7 0	2 20	7 2
36 30	24 25	5 5	22 38	5 6	20 43	5 7	18 30	5 9	16 25	6 0	14 1	6 2	11 25	6 4	8 37	6 6	5 34	6 8	2 17	7 0	58 43	7 3
37 0	21 39	5 5	19 50	5 6	17 51	5 8	15 43	5 9	13 24	6 1	10 55	6 2	8 14	6 4	5 10	6 6	2 11	6 8	58 47	7 1	55 5	7 4
37 30	18 54	5 5	17 1	5 7	14 58	5 8	12 45	5 9	10 22	6 1	7 48	6 3	5 1	6 5	2 1	6 7	58 46	6 9	55 14	7 2	51 24	7 4
38 0	16 8	5 6	14 10	5 7	12 4	5 8	9 47	6 0	7 19	6 1	4 30	6 3	1 47	6 5	58 41	6 7	55 10	7 0	51 39	7 2	47 41	7 5
38 30	13 21	5 6	11 20	5 7	9 9	5 9	6 47	6 0	4 15	6 2	1 30	6 4	58 32	6 6	55 19	6 8	51 50	7 0	48 3	7 3	43 55	7 6
39 0	10 34	5 6	8 28	5 7	6 13	5 9	3 47	6 0	1 10	6 2	58 19	6 4	55 15	6 6	51 55	6 8	48 19	7 1	44 24	7 4	40 7	7 7
39 30	7 45	5 6	5 30	5 8	3 17	5 9	0 46	6 0	58 3	6 3	55 7	6 5	51 57	6 7	48 30	6 9	44 46	7 2	40 42	7 5	36 16	7 8
40 0	4 56	5 6	2 43	5 8	0 19	5 9	57 44	6 1	54 55	6 3	51 53	6 5	48 37	6 7	45 3	6 9	41 11	7 2	30 58	7 5	32 21	7 9

DECLINATION 11 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
26 0	4h m ^s 9 39	6.4	4h m ^s 7 58	6.6	4h m ^s 6 9	6.7	4h m ^s 4 11	7.0	4h m ^s 2 3	7.2	59 45	7.4	57 14	7.6	54 30	7.9	51 32	48 18	45 5		
26 30	6 26	6.5	4 40	6.6	2 47	6.8	0 42	7.0	58 28	7.2	56 3	7.4	53 25	7.7	50 33	7.9	47 26	44 2	41 2	38 6	
27 0	3 12	6.5	1 22	6.7	59 22	6.8	57 12	7.0	54 52	7.3	52 20	7.5	49 34	7.7	46 35	8.0	43 19	39 45	36 8.6		
27 30	59 58	6.5	58 2	6.7	55 57	6.9	53 41	7.1	51 14	7.3	48 35	7.5	45 42	7.8	42 34	8.1	39 9	35 26	32 8.7		
28 0	56 43	6.5	54 42	6.7	52 31	6.9	50 9	7.1	47 36	7.3	44 49	7.6	41 49	7.8	38 32	8.1	34 58	31 4	28 8.8		
28 30	53 27	6.6	51 20	6.7	49 4	6.9	46 30	7.1	43 56	7.4	41 2	7.6	37 54	7.9	34 28	8.2	30 44	26 39	23 8.9		
29 0	50 10	6.6	47 58	6.8	45 36	7.0	43 2	7.2	40 15	7.4	37 13	7.7	33 57	8.0	30 22	8.3	26 28	22 12	19 9.0		
29 30	46 52	6.6	44 35	6.8	42 7	7.0	39 26	7.2	36 32	7.5	33 23	7.7	29 58	8.0	26 14	8.4	22 9	17 42	14 9.1		
30 0	43 34	6.6	41 11	6.8	38 39	7.1	35 49	7.3	32 48	7.5	29 31	7.8	25 57	8.1	22 3	8.4	17 48	13 8	10 9.3		
30 30	40 15	6.7	37 46	6.9	35 5	7.1	32 11	7.3	29 2	7.6	25 37	7.9	21 54	8.2	17 50	8.5	13 23	8 30	5 9.3		
31 0	36 54	6.7	34 20	6.9	31 32	7.1	28 31	7.4	25 15	7.6	21 41	7.9	17 48	8.3	13 34	8.6	8 56	3 50	0 9.4		

DECLINATION 12 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	30 46	5-4	29 11	5-5	27 33	5-7	25 44	5-8	23 46	5-9	21 39	6-1	19 21	6-3	16 52	6-4	14 12	6-6	11 17	6-8	8 9	7-1
36 30	28 3	5-4	26 27	5-6	24 43	5-7	22 50	5-8	20 48	6-0	18 36	6-1	16 14	6-3	13 40	6-5	10 53	6-7	7 52	6-9	4 37	7-1
37 0	25 20	5-5	23 40	5-6	21 52	5-7	19 55	5-8	17 49	6-0	15 33	6-2	13 5	6-3	10 26	6-5	7 33	6-7	4 26	7-0	1 3	7-2
37 30	22 36	5-5	20 52	5-6	19 1	5-7	17 0	5-9	14 49	6-0	12 28	6-2	9 56	6-4	7 11	6-6	4 12	6-8	0 58	7-0	57 27	7-3
38 0	19 51	5-5	18 4	5-6	16 9	5-8	14 4	5-9	11 49	6-0	9 23	6-2	6 45	6-4	3 54	6-6	0 49	6-8	57 28	7-1	53 50	7-3
38 30	17 6	5-5	15 16	5-7	13 16	5-8	11 7	5-9	8 48	6-1	6 17	6-3	3 33	6-4	0 36	6-7	57 25	6-9	53 57	7-2	50 10	7-4
39 0	14 20	5-5	12 26	5-7	10 23	5-8	8 9	6-0	5 45	6-1	3 9	6-3	0 20	6-5	57 17	6-7	53 59	7-0	50 23	7-2	46 28	7-5
39 30	11 34	5-6	9 30	5-7	7 29	5-8	5 11	6-0	2 42	6-1	0 0	6-3	57 6	6-5	53 56	6-7	50 31	7-0	46 47	7-3	42 44	7-6
40 0	8 47	5-6	6 45	5-7	4 34	5-9	2 11	6-0	59 37	6-2	56 51	6-3	53 50	6-5	50 34	6-8	47 1	7-1	43 0	7-3	38 56	7-7

DECLINATION 12 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h		4h		4h		4h		4h		4h		4h		4h		4h		4h	
27 0	8 11	6.4	6 33	6.6	4 47	6.8	2 52	7.0	0 47	7.2	58 30	7.4	56 3	7.5	53 22	7.9	50 26	8.2	47 15	8.5
27 30	4 58	6.4	3 15	6.6	1 24	6.8	59 23	7.0	57 12	7.2	54 49	7.4	52 14	7.6	49 25	8.0	46 21	8.3	43 0	8.6
28 0	1 45	6.5	59 56	6.6	58 0	6.8	55 54	7.0	53 36	7.2	51 6	7.5	48 24	7.7	45 27	8.0	42 14	8.3	38 43	8.7
28 30	58 31	6.5	50 38	6.7	54 36	6.9	52 23	7.1	49 59	7.3	47 23	7.5	44 33	7.8	41 27	8.1	38 5	8.4	34 24	8.8
29 0	55 16	6.5	53 18	6.7	51 10	6.9	48 52	7.1	46 21	7.3	43 37	7.6	40 40	7.8	37 26	8.1	33 54	8.5	30 3	8.8
29 30	52 1	6.6	49 57	6.7	47 44	6.9	45 10	7.1	42 41	7.4	39 51	7.6	36 45	7.9	33 22	8.2	29 41	8.6	25 39	8.9
30 0	48 45	6.6	46 36	6.8	44 16	7.0	41 45	7.2	39 1	7.4	36 3	7.7	32 49	8.0	29 17	8.3	25 26	8.7	21 13	9.0
30 30	45 27	6.6	43 13	6.8	40 48	7.0	38 10	7.2	35 19	7.5	32 13	7.7	28 51	8.0	25 9	8.3	21 8	8.8	16 43	9.1
31 0	42 9	6.7	39 49	6.8	37 18	7.0	34 34	7.2	31 35	7.5	28 21	7.8	24 50	8.1	20 59	8.4	16 47	8.0	12 10	9.2

DECLINATION 13 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	34 18	5.4	32 55	5.5	31 25	5.6	29 46	5.7	28 0	5.9	26 5	6.0	24 0	6.2	21 44	6.3	19 18	6.5	16 39	6.7	13 47	6.9
36 30	31 36	5.4	30 10	5.5	28 30	5.6	26 34	5.7	25 4	5.9	23 4	6.0	20 55	6.2	18 34	6.4	16 2	6.5	13 17	6.7	10 19	7.0
37 0	28 54	5.4	27 24	5.5	25 47	5.6	24 2	5.8	22 7	5.9	20 3	6.1	17 49	6.2	15 23	6.4	12 46	6.6	9 55	6.8	6 49	7.0
37 30	20 11	5.4	24 39	5.6	22 58	5.7	21 8	5.8	19 10	6.0	17 1	6.1	14 42	6.3	12 11	6.4	9 28	6.6	6 31	6.9	3 18	7.1
38 0	23 28	5.4	21 52	5.6	20 8	5.7	18 14	5.8	16 11	6.0	13 58	6.1	11 34	6.3	8 58	6.5	6 9	6.7	3 5	6.9	59 45	7.2
38 30	20 45	5.5	19 5	5.6	17 17	5.7	15 19	5.8	13 12	6.0	10 55	6.2	8 26	6.4	5 44	6.5	2 48	6.7	59 38	7.0	56 11	7.2
39 0	18 1	5.5	16 17	5.6	14 25	5.7	12 24	5.8	10 12	6.0	7 50	6.2	5 15	6.4	2 28	6.6	50 26	6.8	56 9	7.0	52 34	7.3
39 30	15 10	5.5	13 26	5.6	11 33	5.7	9 28	5.9	7 12	6.1	4 44	6.2	2 4	6.4	59 11	6.6	56 3	6.9	52 38	7.1	48 55	7.4
40 0	12 31	5.5	10 40	5.7	8 41	5.8	6 31	5.9	4 10	6.1	1 37	6.2	58 52	6.4	55 53	6.7	52 37	6.9	49 5	7.2	45 14	7.4

DECLINATION 13 N

Lat. N.	50	51	52	53	54	55	56	57	58	59
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s
27	6 13 6 0.4	11 40 6.5	7 6.7	8 25 6.9	6 35 7.1	4 30 7.3	2 23 7.5	0 0 7.8	57 24 8.0	54 33 8.3
27 30	9 54 6.4	8 24 6.6	6 40 6.7	4 50 6.9	3 2 7.1	0 57 7.3	58 38 7.6	56 7 7.8	53 23 8.1	50 23 8.4
28	0 6 43 6.4	5 7 6.6	3 24 6.8	1 31 7.0	59 29 7.1	57 17 7.4	54 51 7.6	52 12 7.9	49 20 8.2	46 11 8.5
28 30	3 30 6.4	1 50 6.6	0 1 6.8	58 2 7.0	55 55 7.2	53 36 7.4	51 2 7.6	48 16 7.9	45 15 8.2	41 57 8.5
29	0 0 17 6.5	58 32 6.6	50 38 6.8	54 34 7.0	52 19 7.2	49 54 7.5	47 13 7.7	44 19 8.0	41 9 8.3	37 41 8.6
29 30	3 6.5	55 13 6.6	53 14 6.8	51 4 7.0	48 43 7.3	46 10 7.5	43 22 7.7	40 20 8.0	37 1 8.4	33 23 8.7
30	0 53 49 6.5	51 54 6.7	49 49 6.9	47 33 7.1	45 5 7.3	42 20 7.5	39 30 7.8	36 10 8.1	32 50 8.4	29 2 8.8
30 30	50 34 6.5	48 33 6.7	46 23 6.9	44 1 7.1	41 26 7.3	38 40 7.6	35 39 7.9	32 16 8.2	28 38 8.5	24 39 8.9
31	0 47 18 6.6	45 12 6.7	42 50 6.9	40 27 7.1	37 46 7.4	34 52 7.6	31 40 7.9	28 11 8.2	24 23 8.6	20 13 9.0

(2)

DECLINATION 14 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50		
M.T.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		
	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	
36	0	37 45	5-4	36 30	5-4	35 11	5-6	33 43	5-7	32 8	5-8	30 24	5-9	28 31	6-1	26 20	6-3	24 16	6-4	21 52	6-6	19 15	6-8
36	30	5	5-4	33 48	5-5	32 24	5-6	30 53	5-7	29 13	5-8	27 20	6-0	25 28	6-1	23 21	6-3	21 3	6-4	18 33	6-6	15 51	6-9
37	0	32 23	5-4	31 4	5-5	29 37	5-6	28 2	5-7	26 19	5-9	24 27	6-0	22 25	6-2	20 13	6-3	17 50	6-5	15 14	6-7	12 25	6-9
37	30	29 42	5-4	28 10	5-5	26 49	5-6	25 10	5-8	23 23	5-9	21 27	6-0	19 21	6-2	17 4	6-4	14 35	6-5	11 53	6-7	8 58	7-0
38	0	27 0	5-4	25 34	5-5	24 0	5-6	22 18	5-8	20 27	5-9	18 26	6-0	16 15	6-2	13 53	6-4	11 10	6-6	8 31	6-8	5 29	7-0
38	30	24 18	5-4	22 48	5-5	21 11	5-7	19 25	5-8	17 39	5-9	15 25	6-1	13 9	6-2	10 42	6-4	8 2	6-6	5 8	6-8	1 59	7-1
39	0	21 35	5-4	20 2	5-5	18 21	5-7	16 31	5-8	14 32	5-9	12 23	6-1	10 2	6-3	7 29	6-5	4 43	6-6	1 43	6-9	58 27	7-1
39	30	18 52	5-4	17 19	5-6	15 31	5-7	13 37	5-8	11 34	6-0	9 19	6-1	6 54	6-3	4 15	6-5	1 24	6-7	58 17	7-0	54 53	7-2
40	0	16 0	5-4	14 29	5-6	12 41	5-7	10 43	5-9	8 35	6-0	6 13	6-1	3 45	6-3	1 0	6-5	58 2	6-7	54 48	7-0	51 17	7-2

DECLINATION 14 N

Lat. N.	50	51	52	53	54	55	56	57	58	59
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s	4h m s
27	6 17 56	6.3 16 42	6.5 15 22	6.7 13 54	6.9 12 18	7.0 10 32	7.2 8 37	7.4 6 31	7.7 4 14	7.9 1 43
27	30 14 46	6.4 13 28	6.5 12 2	6.7 10 29	6.9 8 47	7.0 6 50	7.3 4 54	7.5 2 41	7.7 0 16	8.0 57 36
28	0 11 35	6.4 10 13	6.5 8 42	6.7 7 3	6.9 5 16	7.1 3 18	7.3 1 10	7.5 58 49	7.7 56 16	8.0 53 28
28	30 8 24	6.4 6 57	6.6 5 21	6.7 3 37	6.9 1 43	7.1 59 39	7.3 57 24	7.6 54 58	7.8 52 15	8.1 49 18
29	0 5 13	6.4 3 49	6.6 2 0	6.7 0 10	6.9 58 10	7.1 56 0	7.3 53 38	7.6 51 2	7.8 48 13	8.2 45 7
29	30 2 1	6.4 0 23	6.6 58 38	6.8 56 42	7.0 54 37	7.2 52 20	7.4 49 50	7.6 47 7	7.9 44 8	8.2 40 52
30	0 58 48	6.4 57 6	6.6 55 15	6.8 53 13	7.0 51 2	7.2 48 38	7.4 46 1	7.7 43 10	8.0 40 3	8.3 36 38
30	30 55 35	6.5 53 47	6.6 51 51	6.8 49 44	7.0 47 26	7.3 44 55	7.5 42 11	7.7 39 11	8.0 35 55	8.3 32 20
31	0 52 21	6.5 50 29	6.7 48 26	6.9 46 14	7.1 43 48	7.3 41 11	7.5 38 19	7.8 35 11	8.1 31 45	8.4 28 0
31	30 49 6	6.5 47 8	6.7 45 1	6.9 42 41	7.1 40 10	7.3 37 25	7.6 34 25	7.8 31 9	8.1 27 34	8.5 23 38
32	0 45 51	6.6 43 48	6.7 41 34	6.9 39 10	7.2 39 31	7.4 33 38	7.6 30 30	7.9 27 5	8.2 23 20	8.6 19 12
32	30 42 34	6.6 40 27	6.7 38 7	6.9 35 35	7.2 32 50	7.4 29 50	7.7 26 33	8.0 22 58	8.3 19 3	8.6 14 44
33	0 30 17	6.6 37 4	6.7 34 38	6.9 32 0	7.2 29 7	7.4 26 0	7.7 22 34	8.0 18 50	8.3 14 44	8.7 10 13

DECLINATION 15 N

Lat N	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
°	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h	
36 0	41 8	5.3	40 3	5.4	38 53	5.5	37 35	5.6	36 10	5.8	34 38	5.9	32 57	6.0	31 6	6.2	29 7	6.4	20 56	6.5	24 35	6.7
36 30	38 8	5.3	37 22	5.5	36 7	5.5	34 40	5.7	33 17	5.8	31 41	5.9	29 56	6.1	28 1	6.2	25 56	6.4	23 41	6.6	21 13	6.8
37 0	35 48	5.3	34 38	5.5	33 21	5.6	31 56	5.7	30 24	5.8	28 41	5.9	20 54	6.1	24 55	6.2	22 45	6.4	20 24	6.6	17 51	6.8
37 30	33 8	5.4	31 54	5.5	30 34	5.6	29 6	5.7	27 3	5.8	25 46	6.0	23 52	6.1	21 48	6.3	19 33	6.4	17 7	6.6	14 27	6.8
38 0	30 27	5.4	29 11	5.5	27 47	5.6	26 15	5.7	24 39	5.8	22 47	6.0	20 49	6.1	18 4	6.3	16 29	6.5	13 48	6.7	11 2	6.8
38 30	27 46	5.4	26 29	5.5	24 59	5.6	23 24	5.7	21 41	5.9	19 48	6.0	17 45	6.2	15 31	6.3	13 6	6.5	10 28	6.7	7 36	6.9
39 0	25 5	5.4	23 42	5.5	22 11	5.6	20 33	5.8	18 44	5.9	16 48	6.0	14 40	6.2	12 21	6.3	9 51	6.6	7 6	6.7	4 8	6.9
39 30	22 25	5.4	20 57	5.5	19 23	5.6	17 40	5.8	15 49	5.9	13 47	6.1	11 35	6.2	9 11	6.4	6 34	6.6	3 44	6.8	0 38	7.0
40 0	19 41	5.4	18 11	5.5	16 34	5.6	14 47	5.8	12 51	5.9	10 45	6.1	8 28	6.2	5 59	6.4	3 17	6.6	0 20	6.8	57 7	7.0

DECLINATION 15 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
29 0	4 m	6.4	4 m	6.5	4 m	6.7	4 m	6.9	4 m	7.0	4 m	7.1	4 m	7.3	4 m	7.5	4 m	7.8	4 m	8.0	4 m
29 30	6 53	6.4	5 28	6.5	3 56	6.7	2 14	6.9	0 24	7.1	58 23	7.3	56 10	7.5	53 45	7.8	51 7	8.1	48 12	8.4	45 0
30 0	3 42	6.4	2 12	6.5	0 35	6.7	58 48	6.9	56 51	7.1	54 43	7.3	52 24	7.6	49 51	7.8	47 5	8.1	44 1	8.4	41 0
30 30	0 30	6.4	58 56	6.6	57 13	6.8	55 20	6.9	53 18	7.2	51 3	7.4	48 37	7.6	45 56	7.9	43 1	8.2	39 48	8.5	36 0
31 0	57 18	6.4	55 38	6.6	53 50	6.8	51 52	7.0	49 43	7.2	47 22	7.4	44 48	7.6	42 0	7.9	38 56	8.2	35 34	8.6	32 0
31 30	54 5	6.5	52 20	6.6	50 27	6.8	48 23	7.0	46 7	7.2	43 40	7.5	40 59	7.7	38 3	8.0	34 49	8.3	31 17	8.7	28 0
32 0	50 51	6.5	49 2	6.7	47 3	6.8	44 53	7.1	42 31	7.3	39 56	7.5	37 7	7.8	34 2	8.0	30 40	8.4	26 57	8.7	24 0
32 30	47 37	6.5	45 42	6.7	43 38	6.9	41 21	7.1	38 53	7.3	36 11	7.5	33 14	7.8	30 1	8.1	26 29	8.5	22 35	8.8	20 0
33 0	44 22	6.5	42 22	6.7	40 12	6.9	37 49	7.1	35 14	7.3	32 25	7.6	29 20	7.8	25 57	8.1	22 15	8.6	18 11	8.9	16 0

DECLINATION 16 N

Lat. N.		40		41		42		43		44		45		46		47		48		49		50			
Act.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h
36	0 44 26	5.3	43 31	5.4	42 30	5.5	41 22	5.6	40 7	5.7	38 46	5.9	37 16	6.0	35 38	6.1	33 51	6.3	31 54	6.4	29 46	6.6			
36	30 41 47	5.3	40 49	5.4	39 45	5.5	38 34	5.6	37 16	5.7	35 50	5.9	34 17	6.0	32 34	6.1	30 42	6.3	28 41	6.5	26 28	6.7			
37	0 39 8	5.3	38 7	5.4	37 0	5.5	35 45	5.6	34 24	5.8	32 54	5.9	31 17	6.0	29 30	6.2	27 34	6.3	25 26	6.5	23 8	6.7			
37	30 36 29	5.3	35 25	5.4	34 14	5.5	32 57	5.7	31 31	5.8	29 58	5.9	28 16	6.0	26 25	6.2	24 24	6.4	22 11	6.5	19 47	6.7			
38	0 33 49	5.3	32 42	5.4	31 28	5.5	30 7	5.7	28 39	5.8	27 1	5.9	25 15	6.1	23 19	6.2	21 13	6.4	18 55	6.6	16 25	6.8			
38	30 31 9	5.3	29 59	5.4	28 42	5.6	27 18	5.7	25 45	5.8	24 4	5.9	22 13	6.1	20 13	6.2	18 2	6.4	15 38	6.6	13 2	6.8			
39	0 28 29	5.4	27 19	5.5	25 55	5.6	24 27	5.7	22 51	5.8	21 6	6.0	19 11	6.1	17 6	6.3	14 49	6.4	12 20	6.6	9 38	6.9			
39	36 25 48	5.4	24 32	5.5	23 8	5.6	21 37	5.7	19 57	5.9	18 7	6.0	16 8	6.1	13 58	6.3	11 36	6.5	9 1	6.7	6 12	6.9			
40	0 23 7	5.4	21 48	5.5	20 21	5.6	18 46	5.7	17 1	5.9	15 8	6.0	13 4	6.2	10 48	6.3	8 21	6.5	5 40	6.7	2 45	7.0			

DECLINATION 16 N

Lat. N.	50	51	52	53	54	55	56	57	58	59
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	4h m ^s	4h m ^s	4h m ^s	4h m ^s	4h m ^s	4h m ^s	4h m ^s	4h m ^s	4h m ^s	3h m ^s
29	0 14 51 6.3	13 43 6.5	12 28 6.6	11 5 6.8	9 35 7.0	7 55 7.2	6 6 7.4	4 5 7.6	1 53 7.9	59 28 8.2
29 30	11 41 6.3	10 29 6.5	9 9 6.7	7 41 6.8	6 5 7.0	4 19 7.2	2 23 7.4	0 16 7.7	57 56 8.0	55 22 8.2
30	0 8 31 6.3	7 14 6.5	5 49 6.7	4 16 6.8	2 34 7.0	0 42 7.2	38 40 7.5	56 25 7.7	53 57 8.0	51 15 8.3
30 30	5 21 6.4	3 59 6.5	2 29 6.7	0 51 6.9	59 3 7.1	57 5 7.3	54 55 7.5	52 33 7.8	49 57 8.0	47 6 8.4
31	0 2 10 6.4	0 43 6.6	59 8 6.7	57 24 6.9	55 31 7.1	53 25 7.3	51 9 7.5	48 40 7.8	45 56 8.1	42 55 8.4
31 30	58 58 6.4	57 26 6.6	55 47 6.7	53 57 6.9	51 57 7.1	49 46 7.3	47 23 7.6	44 46 7.9	41 53 8.2	38 43 8.5
32	0 55 40 6.4	54 11 6.6	52 25 6.8	50 29 6.9	48 23 7.2	46 6 7.4	43 35 7.7	40 49 7.9	37 48 8.2	34 29 8.5
32 30	52 34 6.5	50 53 6.6	49 2 6.8	47 1 7.0	44 48 7.2	42 24 7.4	39 45 7.7	36 52 8.0	33 42 8.3	30 13 8.6
33	0 49 20 6.5	47 34 6.6	45 38 6.8	43 31 7.0	41 12 7.2	38 41 7.5	35 55 7.8	32 53 8.0	29 33 8.3	25 54 8.7
33 30	46 6 6.5	44 15 6.7	42 13 6.8	40 0 7.0	37 35 7.3	34 56 7.5	32 2 7.8	28 52 8.1	25 23 8.4	21 33 8.8
34	0 42 52 6.5	40 55 6.7	38 48 6.9	36 29 7.1	33 56 7.3	31 10 7.6	28 8 7.8	24 49 8.2	21 16 8.5	17 10 8.9
34 30	39 37 6.5	37 35 6.7	35 21 6.9	32 56 7.1	30 17 7.4	27 23 7.6	24 13 7.9	20 44 8.2	16 55 8.6	12 43 9.0
35	0 36 21 6.5	34 13 6.7	31 54 6.9	29 22 7.1	26 36 7.4	23 34 7.6	20 15 7.9	16 37 8.3	12 37 8.7	8 13 9.1

55 0 30.21 6.5 34 13 6.7 31 54 6.9 29.22 7.1 26 39 7.4 23 34 7.6 20 15 7.9 16 37 8.3 12 37 8.7 8 13 9.1

DECLINATION 17 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	3h m s 47 41	5.3	3h m s 46 54	5.4	3h m s 46 2	5.5	3h m s 45 4	5.6	3h m s 44 0	5.7	3h m s 42 48	5.8	3h m s 41 30	5.9	3h m s 40 3	6.1	3h m s 38 28	6.2	3h m s 36 44	6.4	3h m s 34 51	6.5
36 30	45 2	5.5	44 13	5.4	43 18	5.5	42 17	5.6	41 9	5.7	39 54	5.8	38 32	5.9	37 1	6.1	35 22	6.2	33 33	6.4	31 34	6.6
37 0	42 24	5.3	41 32	5.4	40 34	5.5	39 30	5.6	38 19	5.7	37 0	5.8	35 34	6.0	33 59	6.1	32 15	6.3	30 21	6.4	28 17	6.6
37 30	39 45	5.5	38 51	5.4	37 50	5.5	36 42	5.6	35 27	5.7	34 5	5.8	32 35	6.0	30 56	6.1	29 7	6.3	27 9	6.5	24 59	6.6
38 0	37 6	5.3	36 9	5.4	35 5	5.5	33 54	5.6	32 39	5.7	31 10	5.9	29 35	6.0	27 52	6.1	25 59	6.3	23 55	6.5	21 40	6.7
38 30	34 27	5.5	33 27	5.4	32 20	5.5	31 6	5.6	29 44	5.8	28 14	5.9	26 35	6.0	24 48	6.2	22 50	6.3	20 41	6.5	18 20	6.7
39 0	31 48	5.3	30 44	5.4	29 34	5.5	28 17	5.6	26 51	5.8	25 18	5.9	23 35	6.0	21 42	6.2	19 40	6.4	17 25	6.5	14 59	6.7
39 30	29 8	5.5	28 2	5.4	26 48	5.5	25 28	5.7	23 58	5.8	22 21	5.9	20 34	6.1	18 36	6.2	16 29	6.4	14 9	6.6	11 36	6.8
40 0	26 28	5.5	25 10	5.4	24 2	5.5	22 38	5.7	21 5	5.8	19 23	6.0	17 32	6.1	15 30	6.2	13 17	6.4	10 51	6.6	8 13	6.8

DECLINATION 17 N

Lat. N.	50		51		52		53		54		55		56		57		58		59			
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.		
	4h m	s	4h m	s	4h m	s	4h m	s	4h m	s	4h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s
31	0 6 57	6.3	5 43	6.5	4 21	6.7	2 51	6.8	1 12	7.0	59 23	7.3	57 23	7.5	55 11	7.7	52 46	8.0	50 6	8.2		
31	30 3 47	6.4	2 28	6.5	1 1	6.7	59 26	6.9	57 41	7.0	55 45	7.3	53 39	7.5	51 20	7.8	48 47	8.0	45 59	8.3		
32	0 0 36	6.4	59 13	6.5	57 41	6.7	56 0	6.9	54 9	7.0	52 7	7.3	49 54	7.6	47 27	7.8	44 46	8.1	41 49	8.4		
32	30 57 25	6.4	55 57	6.6	54 20	6.7	52 33	6.9	50 36	7.0	48 28	7.3	46 7	7.6	43 33	7.9	40 44	8.2	37 37	8.5		
33	0 54 13	6.4	52 40	6.6	50 58	6.8	49 6	7.0	47 3	7.2	44 48	7.4	42 20	7.6	39 37	7.9	36 39	8.2	33 23	8.5		
33	30 51 1	6.4	49 23	6.6	47 35	6.8	45 37	7.0	43 28	7.2	41 6	7.4	38 31	7.7	35 41	8.0	32 34	8.3	29 8	8.6		
34	0 47 48	6.4	46 5	6.6	44 12	6.8	42 8	7.0	39 53	7.2	37 24	7.5	34 41	7.7	31 42	8.0	28 26	8.3	24 49	8.7		
34	30 44 35	6.5	42 47	6.7	40 48	6.8	38 38	7.0	36 16	7.3	33 40	7.5	30 49	7.8	27 42	8.1	24 16	8.4	20 29	8.8		
35	0 41 21	6.5	39 27	6.7	37 23	6.8	35 8	7.0	32 38	7.3	29 55	7.5	26 56	7.8	23 40	8.1	20 4	8.4	16 6	8.9		

DECLINATION 18 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
ALT.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
	3h		3h		3h		3h		3h		3h		3h		3h		3h		3h		3h	
36	0 50 51	5.2	50 14	5.3	49 31	5.4	48 42	5.5	47 48	5.7	46 47	5.8	45 39	5.9	44 24	6.0	43 1	6.2	41 29	6.3	39 49	6.5
36	30 48 14	5.3	47 33	5.3	46 48	5.4	45 56	5.5	44 58	5.7	43 54	5.8	42 42	5.9	41 23	6.0	39 56	6.2	38 20	6.4	36 34	6.5
37	0 45 36	5.3	44 53	5.4	44 4	5.4	43 9	5.5	42 8	5.7	41 0	5.8	39 45	5.9	38 22	6.1	36 50	6.2	35 9	6.4	33 19	6.5
37	30 42 57	5.3	42 12	5.4	41 21	5.5	40 23	5.6	39 18	5.7	38 7	5.8	36 48	5.9	35 26	6.1	33 44	6.2	31 59	6.4	30 3	6.6
38	0 40 20	5.3	39 31	5.4	38 37	5.5	37 36	5.6	36 28	5.7	35 13	5.8	33 50	6.0	32 18	6.1	30 38	6.3	28 47	6.4	26 47	6.6
38	30 37 41	5.3	36 50	5.4	35 33	5.5	34 48	5.6	33 37	5.7	32 18	5.8	30 51	6.0	29 16	6.1	27 30	6.3	25 35	6.4	23 29	6.7
39	0 35 3	5.3	34 9	5.4	33 8	5.5	32 1	5.6	30 46	5.7	29 23	5.8	27 52	6.0	26 12	6.1	24 23	6.3	22 22	6.5	20 11	6.7
39	30 32 24	5.3	31 27	5.4	30 23	5.5	29 13	5.6	27 54	5.7	26 28	5.9	24 53	6.0	23 8	6.1	21 14	6.3	19 8	6.5	16 51	6.7
40	0 29 45	5.3	28 45	5.4	27 38	5.5	26 24	5.6	25 2	5.7	23 32	5.9	21 53	6.0	20 4	6.1	18 4	6.3	15 54	6.5	13 30	6.7

DECLINATION 18 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	4h m ^s 17 58	6.3	4h m ^s 17 4	6.4	4h m ^s 16 5	6.6	4h m ^s 14 58	6.7	4h m ^s 13 44	6.9	4h m ^s 12 23	7.2	4h m ^s 10 51	7.3	4h m ^s 9 10	7.6	4h m ^s 7 19	7.8	4h m ^s 5 16	8.1
30 30	14 49	6.3	13 52	6.5	12 47	6.6	11 36	6.8	10 16	6.9	8 48	7.2	7 11	7.4	5 23	7.6	3 24	7.8	1 13	8.1
31 0	11 40	6.3	10 38	6.5	9 29	6.6	8 12	6.8	6 48	7.0	5 13	7.2	3 30	7.4	1 35	7.6	59 29	7.9	57 9	8.1
31 30	8 31	6.3	7 25	6.5	6 11	6.6	4 49	6.8	3 18	7.0	1 38	7.2	59 48	7.4	57 47	7.7	55 33	7.9	53 5	8.2
32 0	5 22	6.3	4 11	6.5	2 52	6.7	1 25	6.8	59 48	7.0	58 2	7.2	56 5	7.5	53 57	7.7	51 35	8.0	48 58	8.3
32 30	2 12	6.4	0 56	6.5	59 32	6.7	58 0	6.9	56 18	7.1	54 25	7.2	52 21	7.5	50 6	7.8	47 36	8.0	44 50	8.3
33 0	59 1	6.4	57 41	6.5	56 12	6.7	54 34	6.9	52 46	7.1	50 48	7.3	48 37	7.5	46 13	7.8	43 35	8.1	40 41	8.4
33 30	55 51	6.4	54 25	6.5	52 51	6.7	50 18	6.9	49 14	7.1	47 9	7.3	44 51	7.6	42 20	7.8	39 33	8.1	36 30	8.4
34 0	52 39	6.4	51 9	6.5	49 30	6.7	47 41	6.9	45 41	7.1	43 29	7.4	41 4	7.6	38 25	7.9	35 30	8.2	32 17	8.5
34 30	49 28	6.4	47 53	6.6	46 8	6.7	44 13	7.0	42 7	7.2	39 48	7.4	37 16	7.7	34 29	7.9	31 24	8.2	28 1	8.7
35 0	46 15	6.4	44 35	6.6	42 45	6.8	40 44	7.0	38 32	7.2	36 6	7.4	33 26	7.7	30 31	8.0	27 17	8.3	23 41	8.7

DECLINATION 19 N

Lat. N	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
°	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s
36 0	53 59	5.2	53 30	5.3	52 56	5.4	52 16	5.5	51 31	5.6	50 4	5.7	49 43	5.9	48 39	6.0	47 27	6.1	46 8	6.3	44 40	6.4
36 30	51 21	5.2	50 50	5.3	50 13	5.4	49 31	5.5	48 43	5.6	47 48	5.7	46 47	5.9	45 39	6.0	44 24	6.1	43 0	6.3	41 28	6.4
37 0	48 44	5.2	48 10	5.3	47 30	5.4	46 45	5.5	45 54	5.6	44 56	5.7	43 52	5.9	42 40	6.0	41 20	6.1	39 52	6.3	38 14	6.5
37 30	46 7	5.3	45 30	5.4	44 47	5.4	43 59	5.5	43 5	5.7	42 4	5.8	40 55	5.9	39 40	6.0	38 16	6.2	36 43	6.3	35 1	6.5
38 0	43 29	5.3	42 49	5.4	42 4	5.4	41 13	5.5	40 15	5.7	39 11	5.8	37 59	5.9	36 39	6.0	35 11	6.2	33 33	6.3	31 46	6.5
38 30	40 51	5.3	40 9	5.4	39 21	5.5	38 27	5.6	37 26	5.7	36 17	5.8	35 2	5.9	33 38	6.1	32 5	6.2	30 23	6.4	28 31	6.5
39 0	38 13	5.3	37 28	5.4	36 37	5.5	35 40	5.6	34 35	5.7	33 24	5.8	32 4	5.9	30 36	6.1	28 59	6.2	27 12	6.4	25 14	6.6
39 30	35 35	5.3	34 47	5.4	33 53	5.5	32 53	5.6	31 45	5.7	30 30	5.8	29 6	5.9	27 34	6.1	25 52	6.2	24 0	6.4	21 37	6.6
40 0	32 57	5.3	32 6	5.4	31 9	5.5	30 5	5.6	28 54	5.7	27 35	5.8	26 8	5.9	24 31	6.1	22 45	6.2	20 48	6.4	18 39	6.6

DECLINATION 19 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
40 30	30 18	5.3	29 24	5.4	28 24	5.5	27 17	5.6	26 2	5.7	24 40	5.8	23 8	5.8	21 28	6.1	19 37	6.3	17 34	6.5	15 21	6.6
41 0	27 39	5.3	26 43	5.4	25 40	5.5	24 30	5.6	23 11	5.7	21 45	5.9	20 9	6.0	18 24	6.2	16 28	6.3	14 20	6.5	12 1	6.7
41 30	25 0	5.3	24 1	5.4	22 55	5.5	21 41	5.6	20 19	5.7	18 49	5.9	17 9	6.0	15 19	6.2	13 18	6.4	11 5	6.5	8 40	6.7
42 0	22 21	5.3	21 19	5.4	20 10	5.5	18 52	5.6	17 27	5.8	15 52	5.9	14 8	6.1	12 13	6.2	10 7	6.4	7 49	6.6	5 17	6.7
42 30	19 42	5.3	18 37	5.4	17 24	5.5	16 3	5.7	14 34	5.8	12 55	5.9	11 6	6.1	9 7	6.2	6 56	6.4	4 32	6.6	1 54	6.8
43 0	17 2	5.3	15 54	5.4	14 38	5.6	13 13	5.7	11 40	5.8	9 57	5.9	8 4	6.1	6 0	6.3	3 43	6.5	1 13	6.7	58 29	6.8
43 30	14 22	5.4	13 11	5.5	11 51	5.6	10 23	5.7	8 46	5.8	6 59	6.0	5 1	6.1	2 51	6.3	0 29	6.5	57 53	6.7	55 2	6.9
44 0	11 41	5.4	10 27	5.5	9 4	5.6	7 32	5.7	5 51	5.9	4 0	6.0	1 57	6.1	59 42	6.3	57 15	6.5	54 33	6.7	51 35	6.9

DECLINATION 19 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	22 36	6.3	21 54	6.4	21 7	6.6	20 13	6.7	19 13	6.9	18 5	7.1	16 49	7.3	15 34	7.5	13 50	7.8	12 5	8.0
30 30	19 28	6.3	18 42	6.4	17 50	6.6	16 51	6.7	15 46	6.9	14 32	7.1	13 10	7.3	11 39	7.5	9 57	7.8	8 5	8.0
31 0	16 20	6.3	15 30	6.4	14 33	6.6	13 30	6.7	12 18	6.9	10 59	7.1	9 31	7.3	7 53	7.5	6 4	7.8	4 4	8.1
31 30	13 12	6.3	12 17	6.4	11 16	6.6	10 7	6.8	8 51	7.0	7 26	7.2	5 51	7.4	4 7	7.6	2 10	7.8	0 2	8.1
32 0	10 3	6.3	9 4	6.4	7 58	6.6	6 44	6.8	5 22	7.0	3 51	7.2	2 10	7.4	0 19	7.6	58 15	7.9	55 59	8.2
32 30	6 54	6.3	5 51	6.5	4 40	6.6	3 21	6.8	1 53	7.0	0 16	7.2	58 29	7.4	56 31	7.7	54 19	7.9	51 54	8.2
33 0	3 45	6.3	2 37	6.5	1 21	6.6	59 57	6.8	58 24	7.0	56 41	7.2	54 47	7.5	52 41	7.7	50 22	8.0	47 48	8.2
33 30	0 35	6.3	59 23	6.5	58 2	6.7	56 32	6.8	54 53	7.0	53 4	7.2	51 3	7.5	48 50	7.7	46 23	8.0	43 41	8.3
34 0	57 25	6.3	56 8	6.5	54 42	6.7	53 7	6.9	51 22	7.1	49 27	7.3	47 19	7.5	44 58	7.8	42 23	8.0	39 32	8.4
34 30	54 15	6.4	52 52	6.5	51 22	6.7	49 41	6.9	47 50	7.1	45 48	7.3	43 34	7.6	41 5	7.8	38 22	8.1	35 21	8.4
35 0	51 4	6.4	49 37	6.5	48 1	6.7	46 15	6.9	44 18	7.1	42 9	7.3	39 47	7.6	37 11	7.8	34 19	8.1	31 9	8.5

DECLINATION 20 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50				
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.			
40	30	36	31	36	32	41	33	42	34	36	35	33	42	30	36	28	52	27	18	25	35	23	41		
40	30	33	31	32	30	55	30	55	29	51	30	55	28	39	25	50	24	12	22	24	20	24	6.6		
41	0	30	29	8	28	8	28	8	5.6	27	0	5.7	25	45	22	48	21	5	6.3	19	12	6.4	17	7	
41	30	28	26	24	25	21	25	21	5.6	24	10	5.7	22	50	19	45	17	57	6.3	15	59	6.5	13	49	
42	0	25	23	40	22	33	22	33	5.6	21	18	5.7	19	35	16	41	14	49	6.3	12	45	6.5	10	29	
42	30	22	20	55	19	45	19	45	5.6	18	27	5.7	17	15	23	13	37	11	40	6	1	31	6.5	7	9
43	0	20	18	10	16	56	16	56	5.6	15	35	5.8	14	4	5.9	10	32	8	30	6.4	6	15	6.5	3	47
43	30	17	15	25	14	8	14	8	5.7	12	42	5.8	11	7	5.9	7	26	5	19	6.4	2	59	6.6	0	24
44	0	14	12	39	11	18	11	18	5.7	9	49	5.8	8	10	5.9	4	20	2	7	6.4	59	41	6.6	57	0

DECLINATION 20 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	4h m ^s 27 11	6.2	4h m ^s 26 40	6.4	4h m ^s 26 5	6.5	4h m ^s 25 24	6.7	4h m ^s 24 37	6.9	4h m ^s 23 43	7.0	4h m ^s 22 42	7.3	4h m ^s 21 33	7.5	4h m ^s 20 15	7.7	4h m ^s 18 48	7.9
30 30	4 6.2	23 29	6.4	22 49	6.5	22 3	6.7	21 11	6.9	20 12	7.1	19 4	7.3	17 49	7.5	16 25	7.7	14 50	8.0	
31 0	20 56	6.2	20 18	6.4	19 33	6.5	18 42	6.7	17 45	6.9	16 40	7.1	15 27	7.3	14 5	7.5	12 34	7.7	10 51	8.0
31 30	17 49	6.3	17 5	6.4	16 17	6.6	15 21	6.7	14 18	6.9	13 8	7.1	11 48	7.3	10 20	7.5	8 42	7.8	6 52	8.0
32 0	14 41	6.3	13 53	6.4	13 0	6.6	11 59	6.7	10 51	6.9	9 35	7.1	8 9	7.3	6 34	7.5	4 49	7.8	2 51	8.0
32 30	11 33	6.3	10 41	6.4	9 43	6.6	8 37	6.8	7 24	7.0	6 1	7.1	4 30	7.3	2 48	7.6	0 55	7.8	58 50	8.1
33 0	8 24	6.3	7 28	6.4	6 25	6.6	5 14	6.8	3 55	7.0	2 27	7.1	0 50	7.4	59 1	7.6	57 1	7.9	54 47	8.1
33 30	5 10	6.3	4 15	6.5	3 7	6.6	1 51	6.8	0 27	7.0	58 53	7.2	57 8	7.4	55 13	7.6	53 5	7.9	50 43	8.2
34 0	2 6	6.3	1 1	6.5	59 49	6.6	58 28	6.8	56 58	7.0	55 17	7.2	53 26	7.4	51 24	7.6	49 8	7.9	46 38	8.2

DECLINATION 21 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
40 0	39 8	5.3	38 35	5.3	37 57	5.4	37 13	5.5	36 23	5.7	35 25	5.8	34 20	5.9	33 7	6.0	31 46	6.2	30 15	6.3	28 35	6.5
40 30	36 30	5.3	35 55	5.3	35 14	5.4	34 27	5.5	33 33	5.7	32 32	5.8	31 24	5.9	30 7	6.0	28 41	6.2	27 6	6.3	25 20	6.5
41 0	33 53	5.3	33 15	5.3	32 31	5.4	31 41	5.5	30 44	5.7	29 39	5.8	28 27	5.9	27 6	6.0	25 36	6.2	23 56	6.4	22 5	6.5
41 30	31 15	5.3	30 35	5.4	29 48	5.4	28 55	5.6	27 54	5.7	26 46	5.8	25 30	5.9	24 5	6.1	22 30	6.2	20 45	6.4	18 49	6.6
42 0	28 37	5.3	27 54	5.4	27 5	5.5	26 8	5.6	25 4	5.7	23 52	5.8	22 32	5.9	21 3	6.1	19 24	6.3	17 34	6.4	15 32	6.6
42 30	25 59	5.3	25 13	5.4	24 21	5.5	23 21	5.6	22 14	5.7	20 58	5.8	19 34	6.0	18 0	6.1	16 16	6.3	14 22	6.4	12 15	6.6
43 0	23 21	5.3	22 32	5.4	21 37	5.5	20 34	5.6	19 23	5.7	18 4	5.8	16 35	6.0	14 57	6.1	13 9	6.3	11 9	6.5	8 56	6.7
43 30	20 43	5.3	19 51	5.4	18 53	5.5	17 46	5.6	16 32	5.7	15 9	5.9	13 36	6.0	11 53	6.1	10 0	6.3	7 55	6.5	5 36	6.7
44 0	18 4	5.3	17 10	5.4	16 8	5.5	14 58	5.6	13 40	5.7	12 13	5.9	10 36	6.0	8 49	6.1	6 51	6.3	4 40	6.5	2 15	6.7

DECLINATION 21 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
30 0	31 43	6.2	31 25	6.4	31 1	6.5	30 32	6.7	29 58	6.8	29 18	7.0	28 31	7.2	27 38	7.4	26 36	7.6	25 26	7.9
30 30	28 36	6.2	28 13	6.4	27 45	6.5	27 12	6.7	26 33	6.8	25 47	7.0	24 55	7.2	23 55	7.4	22 47	7.7	21 30	7.9
31 0	25 29	6.2	25 2	6.4	24 30	6.5	23 52	6.7	23 7	6.8	22 17	7.1	21 18	7.2	20 12	7.4	18 57	7.7	17 33	7.9
31 30	22 22	6.2	21 51	6.4	21 14	6.5	20 31	6.7	19 42	6.9	18 45	7.1	17 41	7.2	16 29	7.5	15 7	7.7	13 36	8.0
32 0	19 15	6.3	18 39	6.4	17 58	6.5	17 10	6.7	16 16	6.9	15 14	7.1	14 4	7.3	12 45	7.5	11 16	7.7	9 37	8.0
32 30	16 7	6.3	15 28	6.4	14 42	6.6	13 49	6.7	12 49	6.9	11 42	7.1	10 26	7.3	9 0	7.5	7 25	7.8	5 38	8.0
33 0	13 0	6.3	12 16	6.4	11 25	6.6	10 28	6.7	9 22	6.9	8 9	7.1	6 47	7.3	5 15	7.5	3 32	7.8	1 37	8.0
33 30	9 52	6.3	9 3	6.4	8 8	6.6	7 6	6.8	5 55	6.9	4 36	7.1	3 8	7.3	1 29	7.6	59 39	7.8	57 36	8.1
34 0	6 44	6.3	5 51	6.4	4 51	6.6	3 43	6.8	2 27	6.9	1 2	7.1	59 28	7.4	57 42	7.6	55 45	7.9	53 34	8.1

DECLINATION 21 N

Lat. N.	50		51		52		53		54		55		56		57		58		59		
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	
36 0	54	8	52	57	51	37	50	9	48	30	46	41	44	39	42	25	39	56	37	11	
36 30	50	58	49	42	6.5	48	43	6.9	44	59	7.1	43	3	40	55	7.5	38	56	33	2	
37 0	47	48	46	27	6.5	44	57	6.7	41	27	7.1	39	25	37	10	7.6	34	54	28	51	
37 30	44	37	43	11	6.5	41	36	6.7	37	55	7.1	35	45	33	23	7.6	30	50	24	37	
38 0	41	26	39	55	6.6	38	15	6.7	34	21	7.2	32	5	29	35	7.6	26	49	23	45	
38 30	38	14	36	38	6.6	34	53	6.8	30	46	7.2	28	23	25	46	7.7	22	51	19	38	
39 0	35	1	33	21	6.6	31	30	6.8	27	11	7.2	24	40	21	55	7.8	18	51	15	29	
39 30	31	48	30	2	6.6	28	6	6.8	23	34	7.3	20	56	18	2	7.8	14	50	11	18	
40 0	28	35	26	43	6.6	24	41	6.8	19	56	7.3	17	11	14	8	7.8	10	47	7	4	

DECLINATION 22 N

Lat. N.	40	41	42	43	44	45	46	47	48	49	50
Alt.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.	H.A. D.
°	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s	3h m s
40	0 42 7 5.2	41 44 5.3	41 15 5.4	40 40 5.6	40 0 5.6	39 13 5.7	38 18 5.8	37 17 6.0	36 7 6.1	34 49 6.3	33 22 6.4
40	30 39 30 5.2	39 4 5.3	38 33 5.4	37 11 5.6	37 11 5.6	36 21 5.7	35 23 5.9	34 18 6.0	33 4 6.1	31 41 6.3	30 10 6.4
41	0 36 53 5.2	36 25 5.3	35 50 5.4	34 23 5.6	34 23 5.6	33 29 5.7	32 27 5.9	31 18 6.0	30 0 6.1	28 33 6.3	26 56 6.5
41	30 34 16 5.2	33 45 5.3	33 8 5.4	31 34 5.6	31 34 5.6	30 37 5.8	29 31 5.9	28 18 6.0	26 56 6.2	25 24 6.3	23 42 6.5
42	0 31 38 5.2	31 5 5.3	30 25 5.4	28 45 5.6	28 45 5.6	27 44 5.8	26 35 5.9	25 18 6.0	23 51 6.2	22 15 6.3	20 28 6.5
42	30 29 1 5.2	28 25 5.4	27 42 5.4	25 55 5.6	25 55 5.6	24 51 5.8	23 38 5.9	22 17 6.0	20 46 6.2	19 5 6.4	17 12 6.5
43	0 26 23 5.2	25 44 5.4	24 59 5.5	23 6 5.7	23 6 5.7	21 58 5.8	20 41 5.9	19 16 6.0	17 40 6.2	15 54 6.4	13 56 6.6
43	30 23 46 5.3	23 4 5.4	22 15 5.5	20 16 5.7	20 16 5.7	19 4 5.8	17 44 6.0	16 14 6.1	14 33 6.2	12 42 6.4	10 39 6.6
44	0 21 8 5.3	20 23 5.4	19 31 5.5	17 25 5.7	17 25 5.7	16 10 5.8	14 45 6.0	13 11 6.1	11 26 6.2	9 30 6.4	7 21 6.6

DECLINATION 22 N

Lat. N	50		51		52		53		54		55		56		57		58		59			
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.		
	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s	3h m	s
36 0	58 44	6.3	57 46	6.4	56 40	6.6	55 26	6.8	54 1	7.0	52 27	7.2	50 42	7.4	48 46	7.6	46 36	7.9	44 12	8.2		
36 30	55 36	6.3	54 33	6.5	53 21	6.6	52 1	6.8	50 32	7.0	48 52	7.2	47 0	7.4	44 57	7.7	42 39	7.9	40 6	8.2		
37 0	52 27	6.3	51 19	6.5	50 3	6.7	48 37	6.8	47 2	7.0	45 16	7.2	43 17	7.5	41 6	7.7	38 41	8.0	35 59	8.3		
37 30	49 17	6.3	48 4	6.5	46 43	6.7	45 12	6.8	43 31	7.0	41 39	7.3	39 33	7.5	37 15	7.8	34 41	8.0	31 50	8.3		
38 0	46 7	6.4	44 50	6.5	43 23	6.7	41 47	6.9	40 0	7.1	38 1	7.3	35 48	7.5	33 22	7.8	30 40	8.1	27 40	8.4		
38 30	42 56	6.4	41 35	6.6	40 3	6.7	38 21	6.9	36 28	7.1	34 22	7.3	32 2	7.6	29 28	7.9	26 37	8.2	23 27	8.5		
39 0	39 46	6.4	38 18	6.6	36 42	6.7	34 54	6.9	32 54	7.1	30 42	7.3	28 15	7.6	25 32	7.9	22 32	8.2	19 13	8.6		
39 30	36 34	6.4	35 2	6.6	33 20	6.8	31 26	7.0	29 20	7.2	27 1	7.4	24 26	7.7	21 35	8.0	18 26	8.3	14 56	8.7		
40 0	33 22	6.4	31 45	6.6	29 57	6.8	27 57	7.0	25 45	7.2	23 18	7.4	20 36	7.7	17 36	8.0	14 17	8.4	10 36	8.8		

DECLINATION 23 N

Lat. N.	40			41			42			43			44			45			46			47			48			49			50						
	H.A.	D.	H.A.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.								
40	0	45	3	5.2	44	29	5.4	44	4	5.5	43	33	5.6	42	12	5.8	41	22	6.0	40	24	6.1	39	18	6.2	38	4	6.4	37	22	6.1	36	12	6.2	34	53	6.4
40	30	42	26	5.2	42	9	5.3	41	47	5.4	41	19	5.5	40	45	5.6	40	5	5.7	39	18	5.8	38	23	6.0	37	22	6.1	36	12	6.2	34	53	6.4			
41	0	39	49	5.2	39	30	5.3	39	5	5.4	38	34	5.5	37	57	5.6	37	14	5.7	36	23	5.8	35	25	6.0	34	19	6.1	33	5	6.3	31	41	6.4			
41	30	37	13	5.2	36	50	5.3	36	23	5.4	35	49	5.5	35	9	5.6	34	22	5.7	33	28	5.8	32	26	6.0	31	16	6.1	29	57	6.3	28	29	6.4			
42	0	34	36	5.2	34	11	5.3	33	41	5.4	33	4	5.5	32	21	5.6	31	30	5.7	30	33	5.9	29	27	6.0	28	13	6.1	26	49	6.3	25	16	6.4			
42	30	31	58	5.2	31	31	5.3	30	58	5.4	30	18	5.5	29	32	5.6	28	38	5.7	27	37	5.9	26	27	6.0	25	9	6.1	23	41	6.3	22	3	6.5			
43	0	29	21	5.2	28	52	5.3	28	16	5.4	27	33	5.5	26	43	5.6	25	46	5.7	24	41	5.9	23	27	6.0	22	5	6.2	20	32	6.3	18	49	6.5			
43	30	26	44	5.2	26	12	5.3	25	33	5.4	24	47	5.5	23	54	5.6	22	53	5.7	21	44	5.9	20	27	6.0	19	0	6.2	17	22	6.3	15	34	6.5			
44	0	24	7	5.2	23	32	5.3	22	5	5.4	22	1	5.5	21	5	5.6	20	0	5.7	18	48	5.9	17	26	6.0	15	54	6.2	14	12	6.3	12	18	6.5			

DECLINATION 23 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	4h m ^s 3 17	6.3	4h m ^s 2 31	6.4	4h m ^s 1 37	6.6	4h m ^s 0 36	6.7	3h m ^s 59 26	6.9	3h m ^s 58 8	7.1	3h m ^s 56 39	7.3	3h m ^s 55 0	7.6	3h m ^s 53 9	7.8	3h m ^s 51 4	8.1
36 30	0 9	6.3	3 59 18	6.4	3 58 20	6.6	3 57 14	6.8	55 59	7.0	54 34	7.1	52 59	7.4	51 13	7.6	49 14	7.8	47 1	8.1
37 0	57 1	6.3	56 5	6.4	55 2	6.6	53 51	6.8	52 30	7.0	51 0	7.2	49 18	7.4	47 25	7.6	45 19	7.9	42 57	8.2
37 30	53 52	6.3	52 52	6.4	51 44	6.6	50 28	6.8	49 1	7.0	47 25	7.2	45 37	7.4	43 36	7.7	41 22	7.9	38 52	8.2
38 0	50 43	6.3	49 39	6.5	48 26	6.6	47 4	6.8	45 32	7.0	43 49	7.2	41 54	7.4	39 46	7.7	37 24	8.0	34 46	8.3
38 30	47 34	6.3	46 25	6.5	45 7	6.7	43 39	6.8	42 2	7.0	40 12	7.2	38 11	7.5	35 55	7.7	33 25	8.0	30 37	8.3
39 0	44 24	6.3	43 10	6.5	41 47	6.7	40 14	6.9	38 31	7.1	36 35	7.3	34 26	7.5	32 3	7.8	29 24	8.1	26 27	8.4
39 30	41 14	6.3	39 55	6.5	38 27	6.7	36 48	6.9	34 59	7.1	32 56	7.3	30 41	7.6	28 10	7.9	25 22	8.1	22 15	8.4
40 0	38 4	6.3	36 40	6.5	35 7	6.7	33 22	6.9	31 26	7.1	29 17	7.3	26 54	7.6	24 14	7.9	21 18	8.2	18 1	8.5

DECLINATION 24 N

Lat. N.	40		41		42		43		44		45		46		47		48		49		50			
	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.		
40 0	3h 47 55	m s 5.2	3h 47 50	m s 5.3	3h 47 39	m s 5.4	3h 47 23	m s 5.5	3h 47 2	m s 5.6	3h 46 35	m s 5.7	3h 46 1	m s 5.8	3h 45 22	m s 5.9	3h 44 35	m s 6.0	3h 43 41	m s 6.1	3h 42 40	m s 6.2	3h 41 40	m s 6.3
40 30	45 19	5.2	45 10	5.3	44 57	5.4	44 39	5.5	44 14	5.6	43 44	5.7	43 8	5.8	42 24	5.9	41 34	6.0	40 36	6.1	39 30	6.2	38 30	6.3
41 0	42 42	5.2	42 31	5.3	42 16	5.4	41 54	5.5	41 27	5.6	40 54	5.7	40 14	5.8	39 27	5.9	38 33	6.0	37 30	6.1	36 20	6.2	35 20	6.3
41 30	40 5	5.2	39 52	5.3	39 34	5.4	39 10	5.5	38 39	5.6	38 3	5.7	37 19	5.8	36 29	5.9	35 31	6.0	34 24	6.1	33 9	6.2	32 9	6.3
42 0	37 29	5.2	37 13	5.3	36 52	5.4	36 25	5.5	35 52	5.6	35 12	5.7	34 25	5.8	33 31	6.0	32 29	6.1	31 18	6.2	29 58	6.3	28 58	6.4
42 30	34 52	5.2	34 34	5.3	34 10	5.4	33 40	5.5	33 4	5.6	32 21	5.7	31 30	5.8	30 32	6.0	29 26	6.1	28 11	6.2	26 46	6.3	25 46	6.4
43 0	32 15	5.2	31 54	5.3	31 28	5.4	30 55	5.5	30 16	5.6	29 29	5.7	28 35	5.8	27 33	6.0	26 23	6.1	25 3	6.2	23 34	6.3	22 34	6.4
43 30	29 38	5.2	29 15	5.3	28 46	5.4	28 10	5.5	27 27	5.6	26 38	5.7	25 40	5.9	24 34	6.0	23 20	6.1	21 55	6.2	20 21	6.3	19 21	6.4
44 0	27 1	5.2	26 35	5.3	26 3	5.4	25 25	5.5	24 39	5.6	23 46	5.7	22 44	5.9	21 35	6.0	20 16	6.1	18 47	6.2	17 7	6.3	16 7	6.4

DECLINATION 24 N

Lat. N.	50		51		52		53		54		55		56		57		58		59	
Alt.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.	H.A.	D.
36 0	4h m ^s 7 46	6.2	4h m ^s 7 12	6.4	4h m ^s 6 31	6.6	4h m ^s 5 42	6.7	4h m ^s 4 47	6.9	4h m ^s 3 43	7.1	4h m ^s 2 30	7.3	4h m ^s 1 7	7.5	3h m ^s 59 34	7.7	3h m ^s 57 49	8.0
36 30	4 39	6.3	4 0	6.4	3 14	6.6	2 21	6.7	1 20	6.9	6 11	7.1	58 51	7.3	57 22	7.5	55 42	7.8	53 49	8.1
37 0	1 31	6.3	0 48	6.4	59 58	6.6	59 0	6.7	57 53	6.9	56 38	7.1	55 12	7.3	53 36	7.5	51 48	7.8	49 47	8.1
37 30	58 23	6.3	57 36	6.4	50 41	6.6	55 38	6.8	54 26	6.9	53 5	7.1	51 33	7.4	49 50	7.6	47 54	7.8	45 45	8.1
38 0	55 15	6.3	54 24	6.4	53 23	6.6	52 15	6.8	50 58	7.0	49 31	7.2	47 52	7.4	46 2	7.6	43 59	7.9	41 42	8.2
38 30	52 7	6.3	51 10	6.4	50 6	6.6	48 52	6.8	47 29	7.0	45 56	7.2	44 11	7.4	43 14	7.6	40 3	7.9	37 37	8.2
39 0	48 58	6.3	47 57	6.5	46 48	6.6	45 29	6.8	44 0	7.0	42 21	7.2	40 29	7.4	38 25	7.7	36 6	8.0	33 31	8.3
39 30	45 49	6.3	44 43	6.5	43 29	6.6	42 5	6.8	40 30	7.0	38 44	7.2	36 46	7.5	34 34	7.7	32 7	8.0	29 23	8.3
40 0	42 40	6.3	41 29	6.5	40 10	6.6	38 40	6.8	37 0	7.0	35 7	7.2	33 2	7.5	30 42	7.7	28 7	8.0	25 14	8.3

BESSEL'S REFRACTIONS.

Alt.	Ref'n.	Alt.	Ref'n
24.....	2 8.9	35.....	1 22.3
25.....	2 3.2	36.....	1 19.3
26.....	1 57.8	37.....	1 16.5
27.....	1 52.8	38.....	1 13.8
28.....	1 48.2	39.....	1 11.2
29.....	1 43.8	40.....	1 8.7
30.....	1 39.7	41.....	1 6.3
31.....	1 35.8	42.....	1 4.0
32.....	1 32.1	43.....	1 1.8
33.....	1 28.7	44.....	0 59.7
34.....	1 25.4		

The Parallax may be taken as 7" throughout.

ERRATA.

- Page 5, line 16, for 25.3×5.4 read 25.3×4.5
- “ 11, Lat. 58, Alt. $\overset{\circ}{27} \overset{\prime}{30}$ for $\overset{m}{21} \overset{s}{58}$ read $\overset{m}{21} \overset{s}{15}$
- “ 12, “ 41, “ $33 \ 30$ “ $6 \ 3$ “ $6 \ 30$
- “ 14, “ 50, “ $30 \ 30$ “ $59 \ 49$ “ $59 \ 39$
- “ 15, “ 50, “ $27 \ 30$ “ $21 \ 40$ “ $21 \ 48$
- “ 16, “ 40, “ $32 \ \text{to} \ 34$ for $\overset{6.7}{6.7}$ read $\overset{5.7}{5.7}$
 $\overset{6.8}{6.8}$ $\overset{5.8}{5.8}$
- “ 26, “ 50, “ $26 \ \overset{\prime}{30}$ for $\overset{m}{54} \ \overset{s}{16}$ read $\overset{m}{56} \ \overset{s}{16}$
- “ 30, “ 53, “ $28 \ 30$ “ $46 \ 30$ “ $46 \ 36$
- “ 35, “ 45, “ 40 “ $6 \ 13$ “ $6 \ 15$
- “ 37, “ 40, “ $36 \ 30$ “ $38 \ 8$ “ $38 \ 28$
- “ 42, “ 54, “ $31 \ 30$ to $\overset{\prime}{32} \ \overset{\prime}{30}$ for 7.0 read 7.1
- “ 43, “ 42, “ $38 \ 30$ for $\overset{m}{35} \ \overset{s}{33}$ read $\overset{m}{35} \ \overset{s}{53}$
- “ 45, “ 44, “ $36 \ 30$ “ $40 \ 43$ “ $48 \ 43$

