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GRIDS AND GRID REFERENCES

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GRIDS AND GRID REFERENCES

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SECTION I

GENERAL

1. Purpose and Scope

a. This manual describes the basic principles of the U.S. Army Military Grid Reference and the British Grid Reference Systems.

b. It describes the standard methods for determining references used by the Army. The same methods are prescribed for use by two or more Services of the Department of Defense in joint operations carried out on gridded maps at scales of 1 : 1,000,000 and larger.

c. It describes military grids as they appear at various scales on maps of the Army and explains the notes and diagrams which supplement the grids. Descriptions and explanations are based on the following scale breakdown:

(1) 1 : 100,000 scale and larger—standard scale is 1 : 50,000.

(2) Scales smaller than 1 : 100,000 and larger than 1 : 1,000,000—standard scale is 1 : 250,000.

(3) 1 : 1,000,000 scale.

d. It contains the identifications of the Grid Zone Designations and the 100,000-meter squares of the Universal Transverse Mercator grid and the Universal Polar Stereographic grid.

e. It contains the identifications of the grid squares of the various British grids.

f. It contains additional data necessary for the preparation of grid drawings and the use of the reference systems.

g. Specific dimensions, size and style of type, and placement of marginal data relating to grids and grid formats are contained on Army Map Service (AMS) style sheets for various scales. A listing of current style sheets is given in paragraph 4*b* of appendix I of this manual. The style sheets themselves comprise appendix I of AMS Technical Manual (TM) S–1, or they may be ordered separately from the Army Map Service.

h. Explanations of the mathematical theory of grids are not within the scope of this manual and are omitted. Such information, and other related mapping data, may be obtained from sources listed in appendix I.

i. The average map user need not normally be concerned with the technical details discussed in this manual. The grid reference box, which appears as part of the marginal data of each map bearing a grid, contains sufficient instructions for the user to compose a correct grid reference from the map.

2. Major Grids

a. Between 84° north and 80° south, except in areas for which British grids are prescribed, maps at scales of 1 : 1,000,000 and larger are printed with the Universal Transverse Mercator (UTM) grid.

b. Beyond the 84° north and 80° south parallels, maps at scales of 1 : 1,000,000 and larger are printed with the Universal Polar Stereographic (UPS) grid.

c. In a few areas of the world, British grids are still shown on maps at scales of 1 : 1,000,000 and larger. However, the British grid systems are being phased out. The objective is to convert the mapping of all areas of the world to UTM and UPS grids.

d. Normally, the only lines of reference on maps at scales smaller than 1 : 1,000,000 are the lines of latitude and longitude.

3. Multiple Major Grids

The use of UTM, UPS, and British grids presents complex conditions in junction areas, i.e.: *grid zone junctions within a grid system; grid junctions between various grid systems; and junctions between spheroids.* Despite this complexity, these conditions lend themselves to a uniform graphical treatment of the grids with differences only in grid color, labels and values. The treatment of grids under various junction conditions at various map scales is prescribed in later sections of this manual. To avoid confusion and lengthy

explanations in each of these sections, separate *zones* of a single grid system are treated as separate *grids*.

4. Overlapping Grids

a. Maps at scales of 1:100,000 and larger, falling within approximately 25 miles of a grid junction, show the adjacent (overlapping) grid by ticks and values around the neatline.

b. Overlapping grids are used primarily for the extension of fire control and survey operations. Grid references are expressed in terms of the major grid for an area.

5. Extended Grids

An extended grid is a form of overlapping grid, except that it is used for partial coverage of a map area. This treatment is for maps containing portions of major grids (grid zone junctions, grid junctions, and spheroid junctions). The major grids are extended into adjacent areas of a map and shown by appropriate ticks and values at the neatlines.

6. Reference Systems

a. The U.S. Army Military Grid Reference System is the official system of referencing when using maps printed with either the UTM or the UPS grids. The system is described in section III.

b. The British Grid Reference System is the official system of referencing when using maps printed with a British grid. The system is described in section IV.

c. References for points taken from ungridded maps are expressed by geographic coordinates. The system is described in section V.

SECTION II

SPHEROIDS, PROJECTIONS, AND MILITARY GRIDS

7. General

a. The earth is not a sphere, but a *spheroid* (an ellipsoid of revolution), flattened at the poles and bulging at the Equator. The various determinations of the shape of the spheroid normally are differentiated by their degree of flattening.

b. A map *projection* is the systematic drawing of lines representing the meridians and parallels (the graticule) on a flat surface. Different projections have unique characteristics and serve differing purposes. They are depicted by projecting the graticule of the spheroid onto a plane; the intersections of the graticule are computed in terms of the spheroid.

c. *Grids* are applied to military maps to provide a uniform system for referencing and making measurements. There is a definite relationship between the grid and the graticule, so that for each grid position a corresponding geographic position can be determined.

8. Graticule

a. The graticule is a network of lines representing the parallels and meridians that form a map projection. Military maps use the *sexagesimal system* of angular measurement for designating the values of the graticule—the division of a full circle into 360° (degrees). A degree is divided into 60 minutes, and each minute into 60 seconds. Parallels are numbered from 0° at the Equator to 90° at the poles. Meridians are numbered east and west from 0° at the prime meridian to a common 180° meridian.

b. The prime meridian for U.S. military mapping is Greenwich, England. Other prime medidians upon which foreign maps may be based are given in FM 21-26.

c. Some foreign mapping may be based upon the *centesimal system*—the division of a full circle into 400 grads. A grad is divided into 100 centesimal minutes, and each centesimal minute into 100 centesimal seconds.

9. Spheroids

a. Several spheroids are used in U.S. military mapping. Each spheroid is defined by two parameters: its *semimajor axis* and either its *semiminor axis* or the *flattening*. Figure 1 defines these terms and lists the dimensions of the spheroids.

b. Plate I identifies and defines the extent of currently effective spheroids.

10. Projections

a. The projections used as the framework of military maps have a common characteristic in that they are all conformal. Conformality indicates that small areas retain their true shape; angles closely approximate their true values; and, at any point, the scale is the same in all directions.

b. Certain projections are prescribed for U.S. military mapping:

(1) Maps at scales larger than 1:500,000 of areas between 80° south and 84° north are based on the Transverse Mercator Projection.

(2) Maps at 1:1,000,000 scale between 80° south and 84° north are based on the Lambert Conformal Conic Projection.

(3) Maps at 1:1,000,000 scale and larger of the polar regions (south of 80° south and north of 84° north) are based on the Polar Stereographic Projection.

(4) General maps at scales smaller than 1:1,000,000 are based on projections individually selected to conform with the intended use of the map. Because of their limited use, such projections are not described in this manual.

(5) Maps in British areas of responsibility may be based on the Transverse Mercator Projection, the Lambert Conical Orthomorphic Projection (Lambert Conformal Conic Projection), Cassini-Soldner Projection, Laborde Projection, and the Rectified Skew Orthomorphic Projection.

The application of these projections is specified in the pages following plate III.

c. The following paragraphs contain descriptions of the theories of some of the prescribed projections; in practice, however, the projections are reduced to a plane surface by use of mathematical formulas. (See app. I for references to mathematical tables.) Figures 2, 3, 5, and 6 are provided as an aid in the comprehension of these theories.

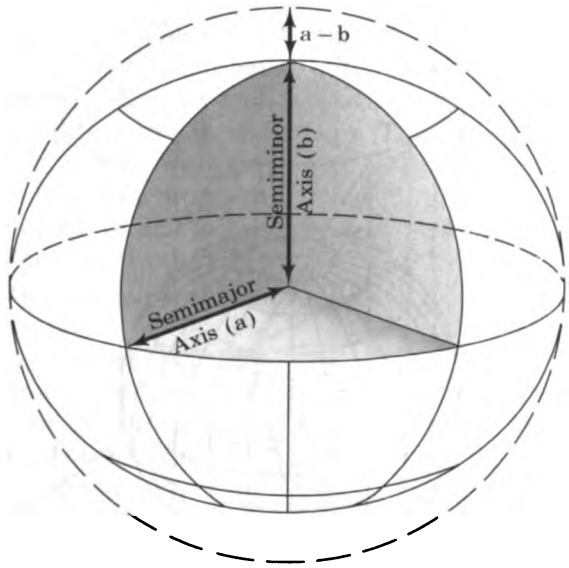
d. Mercator Projection. Although the Mercator Projection is not prescribed for military maps, it is briefly described because it provides a basis for understanding the *Transverse* Mercator Projection. This projection can be visualized as a spheroid projected onto a cylinder with tangency established at the equator and with the polar axis of the spheroid in coincidence with the cylinder axis as shown in figure 2. The origins of the projection lines are about three-quarters of the way back along the diameter. When the cylinder is opened and flattened, a distortion appears in the polar regions inasmuch as the line representing the equator is the true distance and each parallel is represented by a line as long as the equator. The poles are infinitely distant from the Equator and are not shown on the projection. Distortion becomes more pronounced as the distance north and south of the Equator increases.

e. Transverse Mercator Projection. The Mercator Projection is transversed by rotating the axis of the cylinder until the spheroid is tangent to the cylinder along a meridian. By projecting the surface of the spheroid onto the cylinder, as shown in figure 3, in the same manner as for the Mercator Projection, the Transverse Mercator Projection is developed on the surface of the cylinder, which is then opened and flattened.

(1) Distortion—A hemisphere appears distorted at the outer edges when projected on a cylinder. The two shaded areas of figure 3 show the varying distortion of two equivalent geographic areas on the same projection. Note that both areas extend 15° in longitude within the 15° to 30° north latitude band. The area bounded by the 60° to 75° meridians is greatly magnified in comparison to the area bounded by the 0° to 15° meridians. When a meridian is tangent to the cylinder of projection, *there is no distortion along that meridian.* Distances along the tangent meridians are true distances, and all distances within 3° of the meridians are relatively accurate. Therefore, to minimize distortion, the Transverse Mercator Projection, for military purposes, uses 60 longitudinal zones, each zone 6° wide. For example: a zone centered on 3° (central meridian) is bounded by the 0° and 6° meridians, and a zone centered on 9° is bounded by the 6° and 12° meridians.

(2) Secant condition—The cylinder of projection is modified by reducing its elliptical dimensions and making it secant to the spheroid, intersecting the spheroid along lines parallel to the central meridian of a zone (fig. 4). This condition establishes, in one 6° zone, two lines of secancy 180,000 meters east and west of the central meridian. These lines of secancy, in effect, allow a more congruous relationship between spheroid and map distances than that of the central meridian tangency. Since the central meridian of all zones is given a false easting value of 500,000 meters east (mE), the secant lines have coordinates of 320,000 mE and 680,000 mE respectively. Figure 4 also gives a schematic representation of the scale distortion near the Equator in any 6° zone. Note that the scale of the projection at the lines of secancy is exact.

(3) Scale factor—For most military operations, map and ground distances are assumed to be equivalent. However, in certain geodetic and artillery operations, where long distances are involved and accuracy of results is essential, it is necessary to correct for the difference between distances on the map and distances on the ground (spheroid). This is done by the use of scale factors from prepared tables. For the Transverse Mercator Projection, the scale factor is 1.00000 (unity) at the lines of tangency, decreasing inwardly to 0.99960 at the central meridian, and increasing outwardly to about 1.00010 near the zone boundaries.



Spheroid	a (meters)	b (meters)	1/f ±
International	6,378,388		297
Clarke 1866	6,378,206.4	6,356,583.8	
Clarke 1880	6,378,249.145		293.465
Everest	6,377,276.345	6,356,075.415	
Bessel	6,377,397.155		299.1528128
Australian National	6,378,160		298.25
Airy	6,377,563.396	6,356,256.910	
Fischer	6,378,155		298.3
Malayan	6,377,304.063		300.8017

$\pm f = \frac{a - b}{a}$ = flattening

Figure 1. Defining Parameters of Spheroids

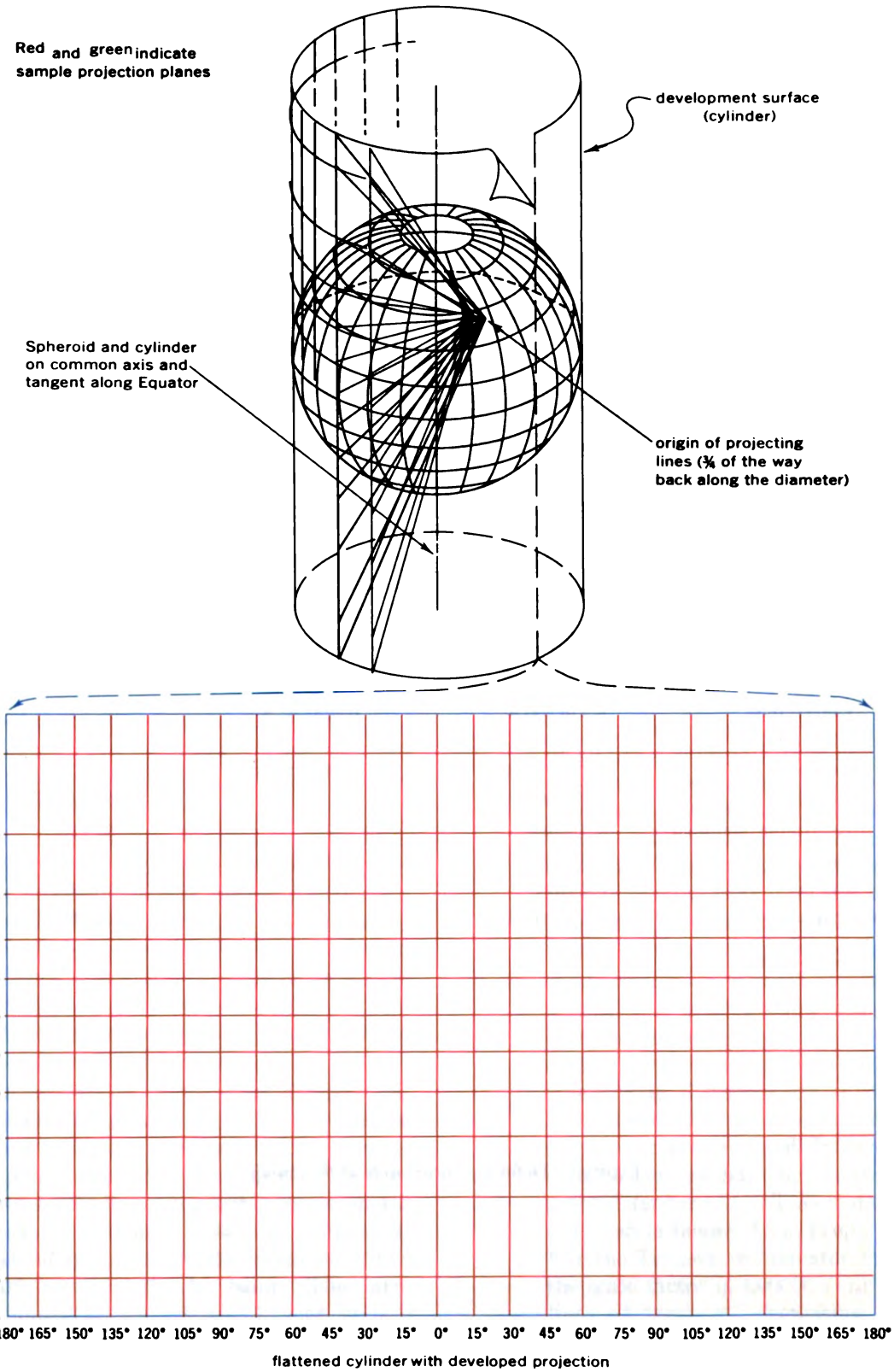


Figure 2. Mercator Projection

f. Polar Stereographic Projection. The Polar Stereographic Projection, a conformal azimuthal projection, is similar in both the northern and southern polar regions. The projection is developed on a plane tangent at a pole with the projection lines originating from the opposite pole. The plane is perpendicular to the minor axis, as shown in figure 5. For use with the UPS grid, a scale factor of 0.994 is applied at the origin (pole) to lower the plane of projection to intersect the sphere at approximately 81°07′ latitude. This arbitrary geometry is applied to reduce the maximum scale distortion of the tangent projection. As shown in figure 5, the scale factor increases from 0.994 to 1.000 in the vicinity of 81°07′, reaches 1.0016 at 80°00′, and attains its maximum value of 1.00239 at 79°30′. The scale factor is constant along any given parallel.

g. Lambert Conformal Conic Projection. This projection can be visualized as the projection of the spheroid onto a cone whose axis coincides with the polar axis of the spheroid as in figure 6. Usually, the cone is secant to the spheroid, intersecting along two parallels of latitude which are on the same side of the Equator. These two parallels are called "standard parallels." Meridians appear as straight lines radiating from a point beyond the mapped areas. Parallels appear as arcs of concentric circles which are centered at the point from which the meridians radiate. None of the parallels appear in exactly the projected positions; they are mathematically adjusted to produce the property of conformality. This adjustment is slight if the standard parallels are sufficiently close together.

h. The characteristics of prescribed projections are tabulated in figure 7. Refer to DA TM 5-240 for plotting of projections.

11. Military Grids

Military grids consist of two sets of equally spaced parallel straight lines intersecting at right angles and forming a regular series of squares. The north-south lines are called "eastings" and the east-west lines "northings." Each grid line is one of an even-interval selection of measurement units (e.g., meters or yards). The interval is selected in accordance with the map scale. The intervals shown on military map scales are: 1,000 units for 1 : 12,500, 1 : 25,000, 1 : 50,000, and 1 : 100,000; 10,000 units for 1 : 250,000, and 1 : 500,000; and 100,000 units for 1 : 1,000,000.

a. The grids prescribed for military maps are—

(1) Universal Transverse Mercator (UTM) grid for areas between 80° South and 84° North.

(2) Universal Polar Stereographic (UPS) grid for the polar regions south of 80° south and north of 84° north.

(3) British grids. British grids are prescribed for certain parts of the world as shown in plate III. These grids are being progressively replaced by the UTM grid, the intent being to eventually cover all military mapping of the world with a universal grid system.

b. Specifications for the Universal Grid Systems:

(1) UTM grid:

(*a*) *Projection*—Transverse Mercator in zones 6° wide.

(*b*) *Spheroid:*

1. International
2. Bessel
3. Clarke 1866
4. Clarke 1880
5. Everest
6. Australian National

(*c*) *Longitude of Origin*—Central meridian of each zone (3°, 9°, 15°, 21°, 27°, 33°, 39°, 45°, 51°, 57°, 63°, 69°, 75°, 81°, 87°, 93°, 99°, 105°, 111°, 117°, 123°, 129°, 135°, 141°, 147°, 153°, 159°, 165°, 171°, and 177° E and W).

(*d*) *Latitude of Origin*—Equator (0° N-S).

(*e*) *Unit*—Meter.

(*f*) *False Easting*—500,000 meters.

(*g*) *False Northing*—0 meters for Northern Hemisphere; 10,000,000 meters for Southern Hemisphere.

(*h*) *Scale Factor on Central Meridian*—0.9996.

(*i*) *Zone Numbering and Lettering*—See section III, and plates II-2 through II-31.

(*j*) *Limits of System*—From 80° S to 84° N.

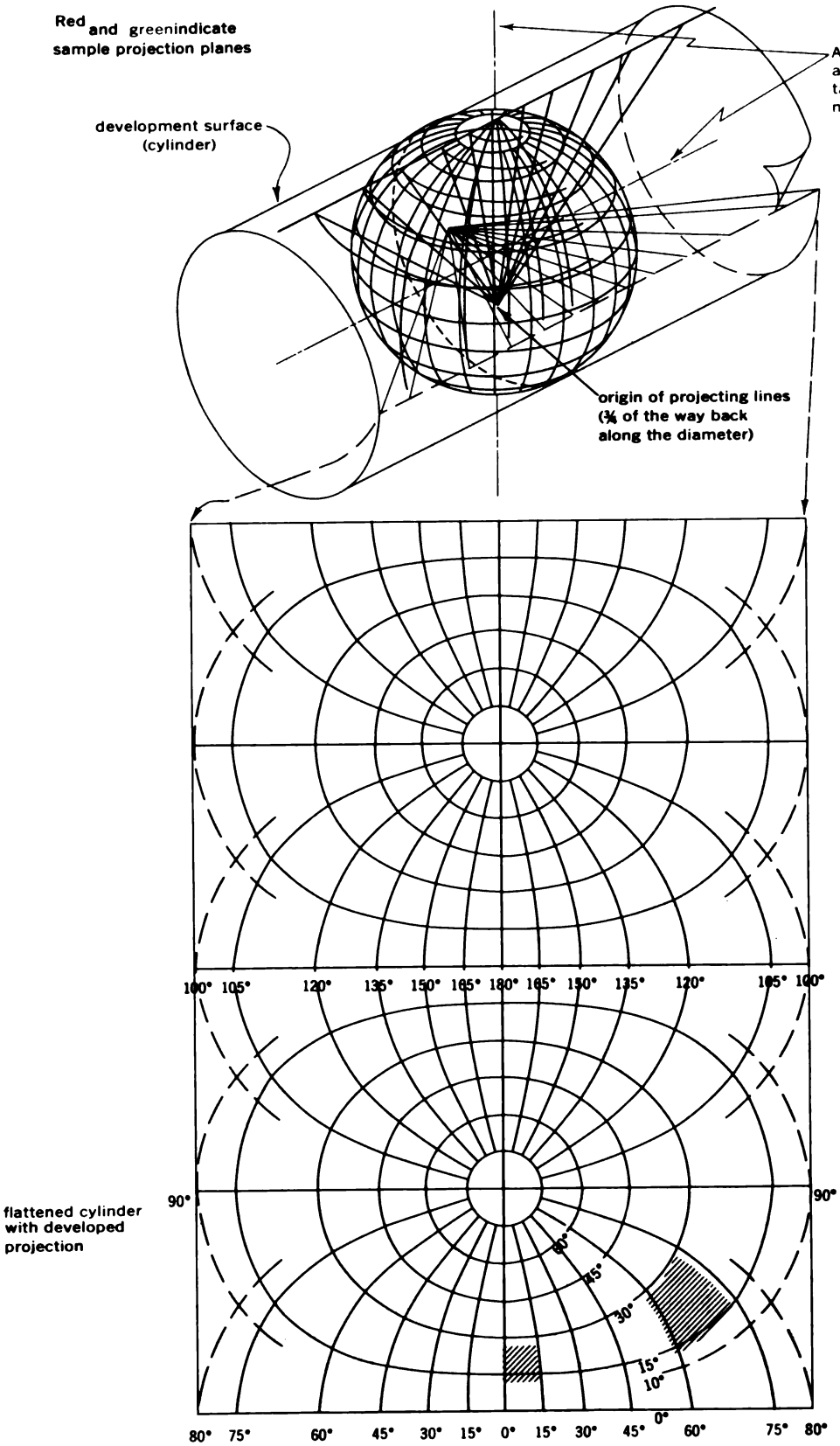
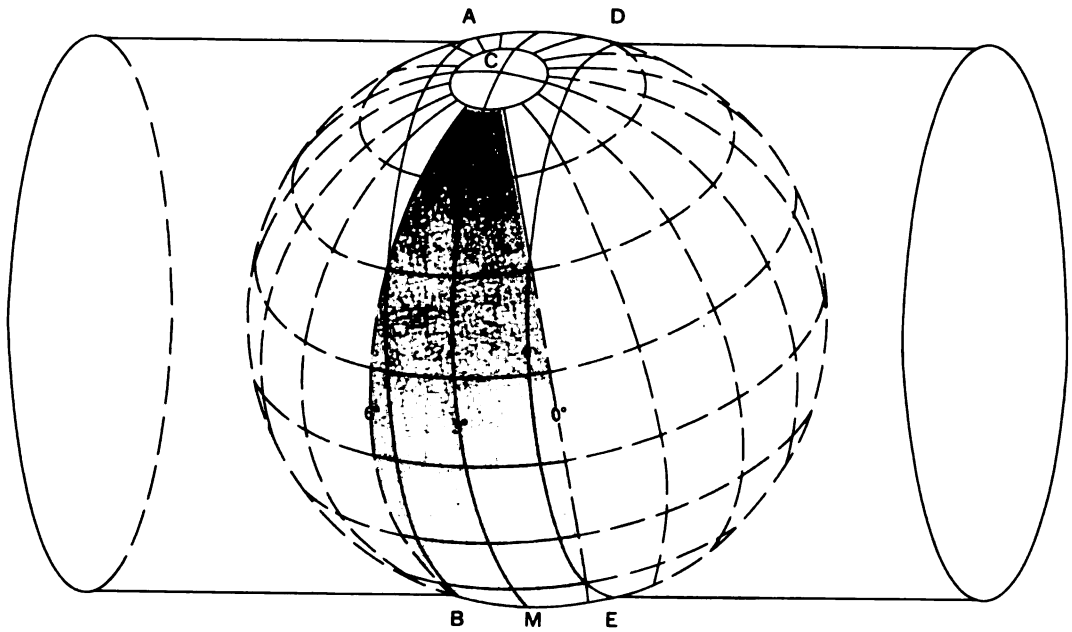
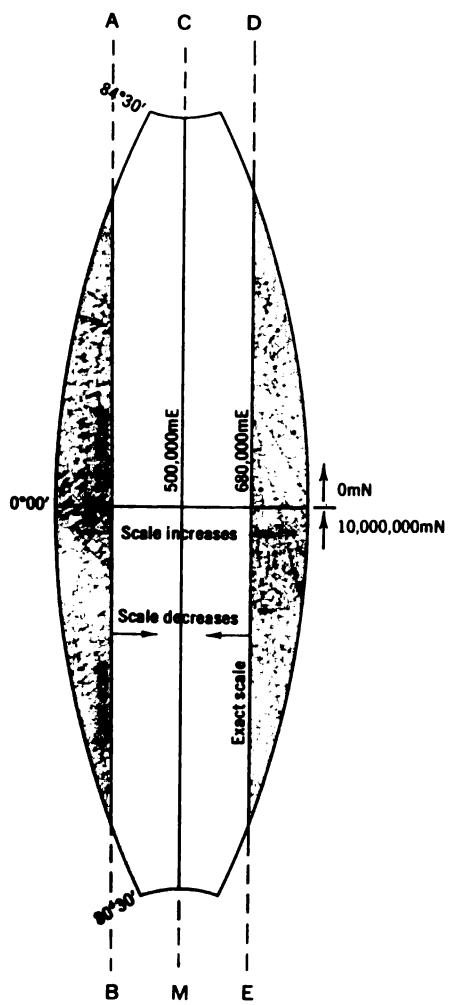


Figure 3. Transverse Mercator Projection.



CM—Central meridian
AB, DE—Lines of secancy formed by intersections of cylinder and spheroid



(Size and shape of zones are exaggerated for illustration purposes)

Figure 4. Secant condition of Transverse Mercator Projection; typical 6-degree projection zone.

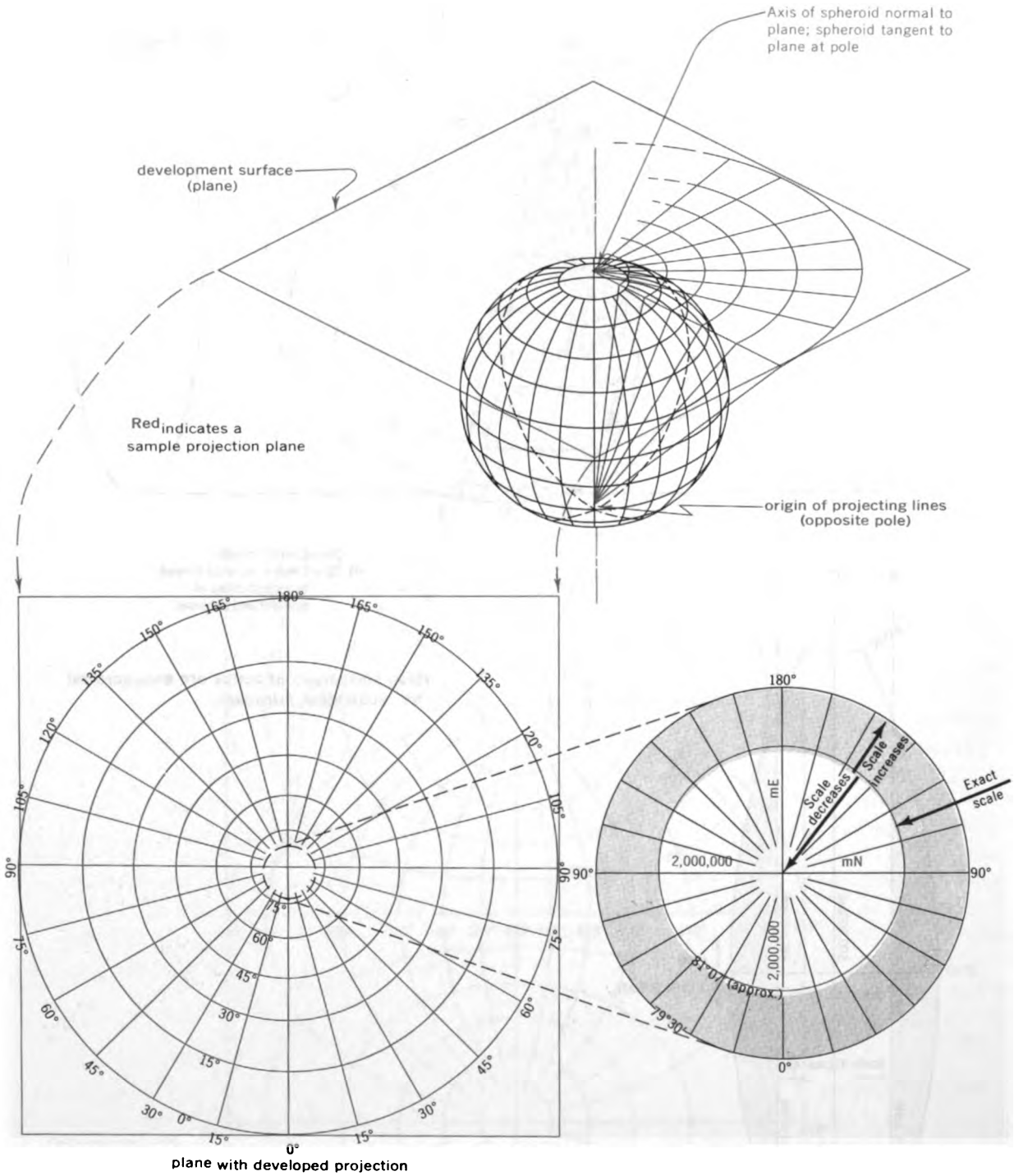


Figure 5. Polar Stereographic Projection.

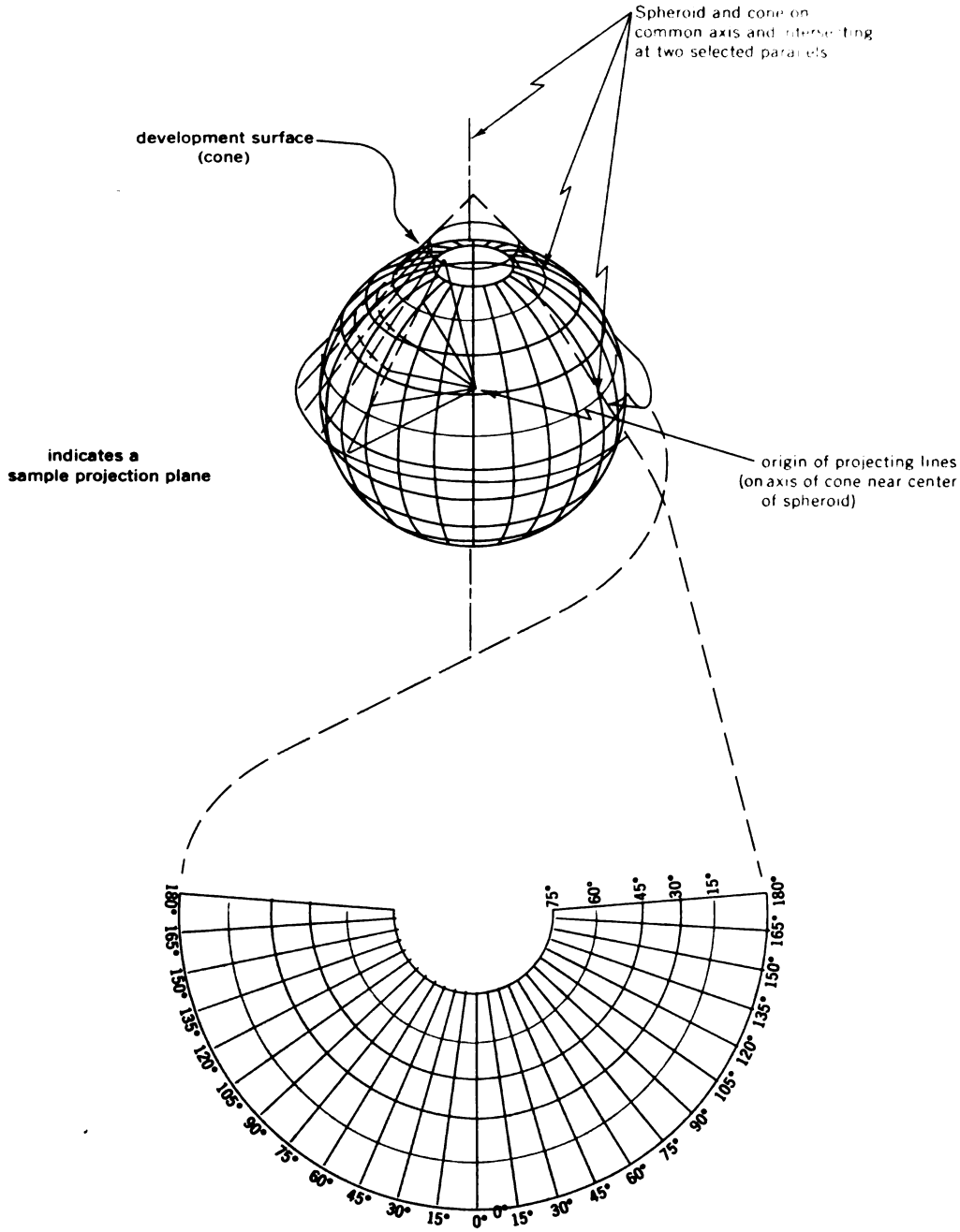


Figure 6. Lambert Conformal Conic Projection

Characteristics	Transverse Mercator	Polar Stereographic	Lambert Conformal Conic
origin of projecting lines	point on diameter approximately ¾ of the way to the opposite side of spheroid	opposite pole	axis of cone near center of spheroid
development surface	cylinder	plane	cone
tangency (unity scale factor)	central meridian	pole	parallel of origin
secancy	two meridians of unity scale factor	concentric circle of unity scale factor	two standard parallels
parallels	curved lines unequally spaced	concentric circles unequally spaced	arcs of concentric circles nearly equally spaced
meridians	central meridian is a straight line; all others are curved lines	straight lines radiating from the pole	straight lines converging on the projected polar axis
intersections of parallels and meridians	90°	90°	90°
scale distortion	increases away from central meridian (unity scale factor)	increases away from pole (unity scale factor)	increases away from standard parallel (unity scale factor)
rhumb line	curved line	curved line	curved line
great circle	curved line (except central meridian and equator)	approximates a straight line	approximates a straight line

Figure 7. Characteristics of projections.

(*k*) *Limits of Zones*—The zones are bounded by meridians, the longitudes of which are multiples of 6° west and east of Greenwich.

(*l*) *Overlap*—On large-scale maps and trig lists, the data for each zone or spheroid overlaps the adjacent zones and spheroids a minimum of 25 miles. The UTM Grid extends to 80°30′ S and 84°30′ N, providing a 30-minute overlap with the UPS grid.

(*m*) *Secant Lines* (unity scale factor)—320,000m and 680,000m eastings of each zone.

(2) UPS grid:

(*a*) *Projection*—Polar Stereographic.

(*b*) *Spheroid*—International.

(*c*) *Longitude of Origin*—0°–180° E-W.

(*d*) *Latitude of Origin*—90° N and 90° S.

(*e*) *Unit*—Meter.

(*f*) *False Easting*—2,000,000 meters.

(*g*) *False Northing*—2,000,000 meters.

(*h*) *Scale Factor at Origin*—0.994.

(*i*) *Zone Numbering and Lettering*—See section III, and plates II-1 and II-32.

(*j*) *Limits of System:*

1. North Zone—Polar area north of 84° N.

2. South Zone—Polar area south of 80° S.

(*k*) *Overlap*—The UPS Grid extends to 83°30′ N and 79°30′ S, providing a 30-minute overlap with the UTM grid.

(*l*) *Approximation of Secant Line* (Unity scale factor)—81°06′52″ parallel.

c. British grids:

(1) Specifications for the various British grids are given in the pages following plate III.

(2) A general description of the grids and numbering systems is given in section IV.

d. Tables for constructing UTM grids are contained in TM's 5-241-3/1 through 5-241-7, 5-241-11 through 5-241-16, and 5-241-30, and 5-241-31. Tables for constructing UPS grids and a technical description are contained in TM 5-241-9.

SECTION III

THE U.S. ARMY MILITARY GRID REFERENCE SYSTEM

12. General Description

a. The U.S. Army Military Grid Reference System is designed for use with the UTM and UPS grids.

b. For convenience, the world is divided into large, regularly shaped geographic areas, each of which is given a unique identification, called the *Grid Zone Designation* (fig. 8). These areas are subdivided into 100,000-meter squares, based on the grid covering the area. Each square is identified by two letters called the *100,000-meter square identification.* This identification is unique within the area covered by the Grid Zone Designation. Plates II–1 through II–32, beginning on page 87, show the 100,000-meter square identifications for the entire globe. Numerical references within the 100,000-meter square are given to the desired accuracy in terms of the easting (E) and northing (N) grid coordinates for the point.

c. Ordinarily, a reference keyed to a gridded map of any scale, is made by giving the 100,000-meter square identification together with the numerical reference. The Grid Zone Designation usually is prefixed to the identification when references are made in more than one grid zone.

13. The Grid Zone Designation

a. Between 84° north and 80° south, the globe is divided into standard areas 6° east-west by 8° north-south. Departures from these standard sizes are located north of 56° N (fig. 8): these departures are illustrated in detail on the appropriate 100,000-meter square identification plates. The columns are identified by the Universal Transverse Mercator (UTM) zone numbers; i.e., starting at the 180° meridian and proceeding easterly, the columns are numbered *1* through *60* consecutively. The rows are identified by letters; starting at 80° south and proceeding northerly to 84° north, the rows are lettered alphabetically *C* through *X* with the letters *I* and *O* omitted. The grid zone designation is determined by reading *right-up*, first the column designation and then the row designation, as *3N* in figure 8.

b. The North Polar and the South Polar areas are divided into halves by the 0°–180° meridians. The halves containing the west longitudes are given the grid zone designations *Y* and *A* respectively; the halves containing the east longitudes are given the grid zone designations *Z* and *B*, respectively. Numbers are not used in conjunction with the letters. The divisions and grid zone designations of the polar areas are illustrated in figure 8.

14. 100,000-Meter Square Identifications

a. Between 84° north and 80° south, a grid zone area is divided into 100,000-meter squares based on the UTM grid for the zone. These 100,000-meter squares are identified by the combination of two alphabetical letters derived through a sequential lettering system (fig. 9). Starting at the 180° meridian and proceeding easterly along the Equator for 18°, the 100,000-meter columns, including partial columns along grid junctions, are lettered alphabetically *A* through *Z* (with *I* and *O* omitted). This alphabet is repeated at 18° intervals. The 100,000-meter rows are lettered alphabetically *A* through *V* (*I* and *O* omitted) reading from south to north, with this alphabet being repeated every 2,000,000 meters. Normally, every odd-numbered UTM zone has the alphabet of the 100,000-meter row letters beginning at the Equator; the even-numbered UTM zones normally have the alphabet of the 100,000-meter row letters beginning at the northing grid line 500,000 meters south of the Equator. This staggering lengthens the distance between 100,000-meter squares of the same identification. Below the Equator, the 100,000-meter row letters also read alphabetically from south to north, tying into the letters above in the same zone. These principles are illustrated in figure 9 and plates II–19 and II–25. The identification of any 100,000-meter square is determined by reading *right-up:* first the column letter and then the row letter, as *WJ* in figure 9.

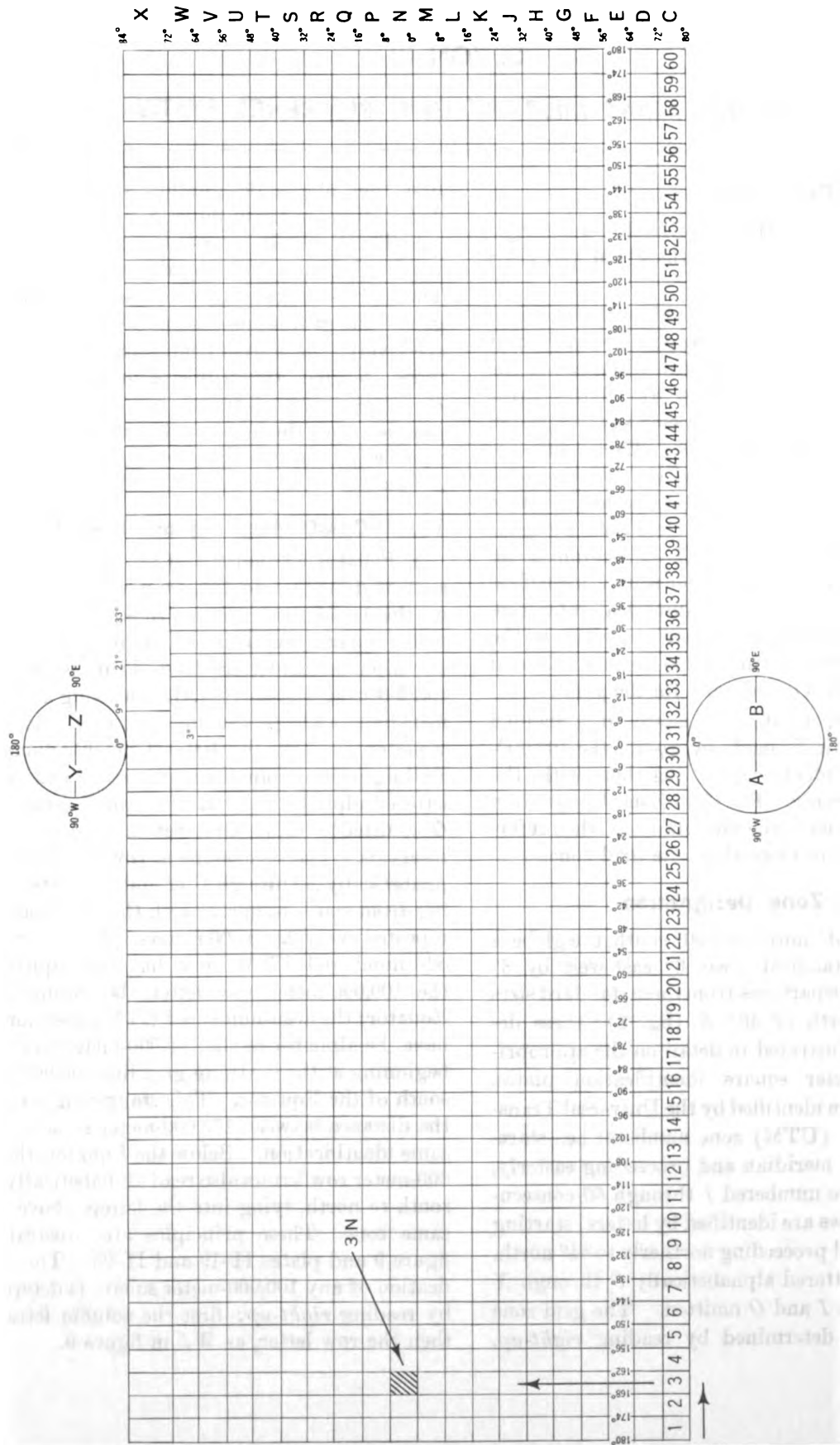


Figure 8. Grid zone designations of the Military Grid Reference System.

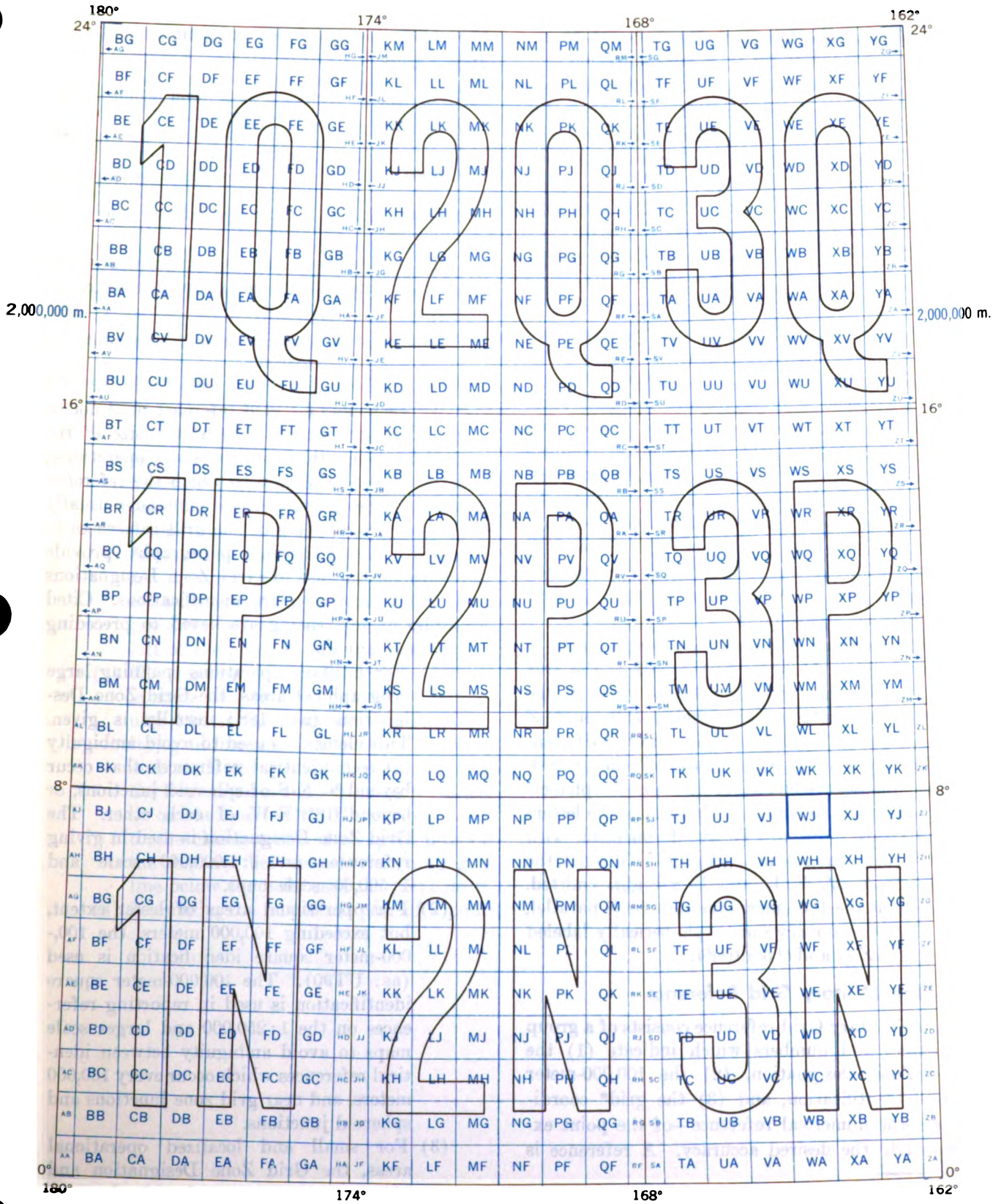


FIGURE 9. Basic plan of the 100,000-meter square identifications of the U. S. Army Military Grid Reference System, between 84° N. and 80° S.

(1) Under this system a 100,000-meter square identification normally will not be repeated within 18° in any direction.

(2) To prevent ambiguity of identifications along spheroid junctions, changes in the order of the row letters are necessary. The row alphabet is advanced 10 letters. Thus, the maximum distance within which 100,000-meter square identifications are not repeated is decreased.

b. In the North Polar Area the 0°–180° meridians coincide with an even 100,000-meter vertical grid line and the 90°–90° meridians coincide with an even 100,000-meter horizontal grid line (plate II-1). In the half of the area identified by the Grid Zone Designation *Y*, the 100,000-meter columns are labeled *R* through *Z* alphabetically from left to right; in the half identified by the Grid Zone Designation *Z*, the 100,000-meter columns are labeled *A* through *J* alphabetically from left to right; in the latter case the *I* is omitted. To avoid confusion with 100,000-meter squares in adjoining UTM zones, the letters *D*, *E*, *V*, and *W* are omitted. Starting at the 0° meridian and 84° N parallel the 100,000-meter rows are alphabetically labeled *A* through *P* (*I* and *O* omitted).

c. In the South Polar Area, a similar plan is followed (plate II-32). In the half of the area identified by the Grid Zone Designation *A*, the 100,000-meter columns are labeled *J* through *Z* alphabetically from left to right; in the half identified by the Grid Zone Designation *B*, the 100,000-meter columns are labeled *A* through *R* alphabetically from left to right. In both cases the letters *I* and *O* are omitted. To avoid confusion with 100,000-meter squares in adjoining UTM zones, the letters *D*, *E*, *M*, *N*, *V*, and *W* are also omitted. Starting at the 180° meridian and 80° S parallel, the 100,000-meter rows are alphabetically labeled *A* through *Z* (*I* and *O* omitted).

15. The Military Grid Reference

a. A Military Grid reference consists of a group of letters and numbers which indicate (1) the Grid Zone Designation, (2) the 100,000-meter square identification, and (3) the grid* coordinates—the numerical reference—of the point expressed to the desired accuracy. A reference is written as a continuous number without spaces, parentheses, dashes, or decimal points.

Examples:

18SUT..... (Locating a point within a 100,000-meter square.)
18SUT90..... (Locating a point within a 10,000-meter square.)
18SUT9109..... (Locating a point within 1,000 meters.)
18SUT916091..... (Locating a point within 100 meters.)

b. To satisfy special needs, a reference can be given to the nearest 10 meters and the nearest 1 meter as—

18SUT91620914..... (Locating a point within 10 meters.)
18SUT9162309143..... (Locating a point within 1 meter.)

c. All elements of a grid reference need not be used. Their use depends upon: the size of the area of activities; the type of military operations; and the scale of the map to which the reference is keyed. The military area commander usually designates the elements of the grid references to be used. The following paragraphs provide guidance for the use of Grid Zone Designations and 100,000-meter square identifications. Cited examples of referencing are keyed to preceding paragraphs *a* and *b*.

(1) For military operations spanning large geographical areas, the Grid Zone Designation (as: 18S) usually is given. This element is used to avoid ambiguity between identical references that occur beyond 9° N-S of spheroid junctions, or beyond 18° E-W of each other. The Grid Zone Designation is used in giving references on 1:1,000,000 scale and 1:500,000 scale maps.

(2) For operational areas of lesser extent, but exceeding 100,000 meters, the 100,000-meter square identification is used (as: UT90). The 100,000-meter square identification is used in reporting references on the 1:250,000 and larger scale maps to avoid ambiguity between identical references which occur every 100,000 meters, and near grid zone junctions and spheroid junctions.

(3) For small and localized operational areas, the Grid Zone Designation and 100,000-meter square identification are

*Also referred to as *rectangular* coordinates.

not used, unless reporting falls within the parameters explained in preceding paragraphs. In the instance of local reporting, only the numerical part of the grid reference is used (as: 916091). This condition applies to 1:100,000 scale maps and larger.

(4) U.S. Army maps at scales 1:1,000,000 and larger provide a grid reference box with the elements and instructions for making a complete grid reference.

d. The determination of the numerical part of the grid reference follows standard military practice of reading right (eastings) and up (northings). It is important to note that eastings and northings are given the same number of digits.

(1) In reading the easting coordinate, the map user locates the first easting (vertical) grid line to the left of the point of reference and reads the large figure (or figures)—*the principal digits*—labeling the line either in the top or bottom margin or on the line itself. Any small figures shown as part of a grid number are ignored. He then estimates to the closest tenth of the grid interval the distance between the easting grid line to the left of the point and the point itself.

(2) The reading of the northing coordinate is made in a similar manner. The map user locates the first northing (horizontal) grid line below the point of reference and reads the principal digits labeling the line either in the left or right margin or on the line itself. He then estimates to the closest tenth of the grid interval the distance between the northing grid line below the point and the point itself.

(3) Normally, the numerical part of a point reference taken from a 1,000-meter grid (on maps at scales of 1:100,000 and larger) is a *six-digit* number; for example: *916091*. Reading from left to right, the *91* represents the 10,000 and 1,000 digits of the first easting grid line to the left of the point; the *6* represents the estimated tenths (nearest 100 meters) from the easting line to the point; the *09* represents the 10,000 and 1,000 digits of the first northing grid line below the point; and the *1* represents the estimated tenths (nearest 100 meters) from the northing grid line to the point. See figure 10.

(4) The numerical part of a reference taken from a 10,000-meter grid (on maps smaller than 1:100,000 scale and larger than 1:1,000,000 scale) is a *four-digit* number; for example: *9109*. Reading from left to right, the *9* represents the 10,000 digit of the first easting grid line to the left of the point; the *1* represents the estimated tenths (nearest 1,000 meters) from the easting grid line to the point; the *0* represents the 10,000 digit of the first northing grid line below the point; and the *9* represents the estimated tenths (nearest 1,000 meters) from the northing grid line to the point. See figure 11.

(5) The numerical part of a reference taken from a 100,000-meter grid (on maps of 1:1,000,000 scale) is a *two-digit* number; for example: *90*. Reading from left to right, the *9* represents the 10,000 digit of the first easting (or grid tick) to the left of the point; the *0* represents the 10,000 digit of the first northing grid line (or grid tick) below the point.

THE MILITARY GRID REFERENCE SYSTEM

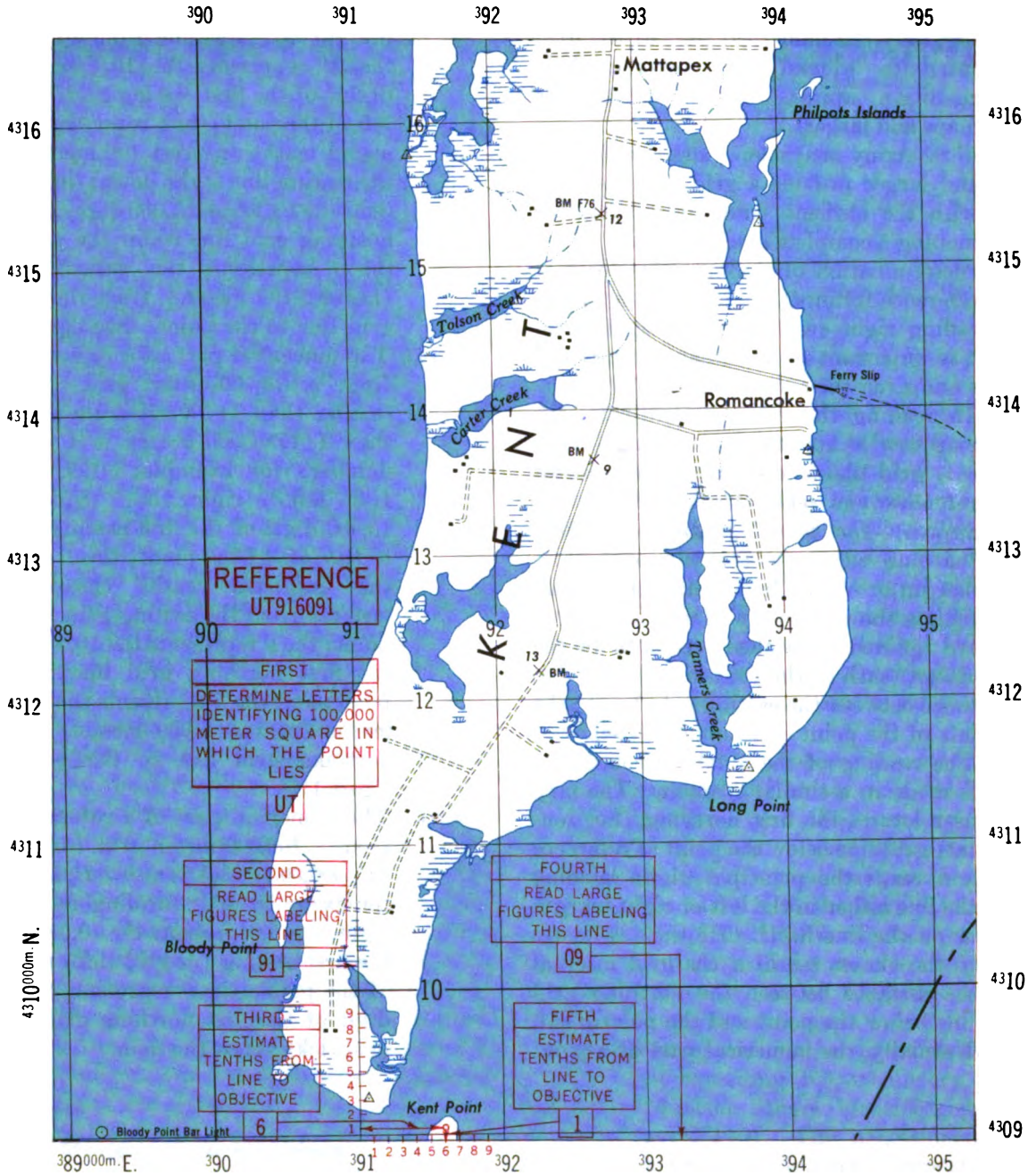


Figure 10. Method of reading a U. S. Army Military Grid Reference from a large scale map.

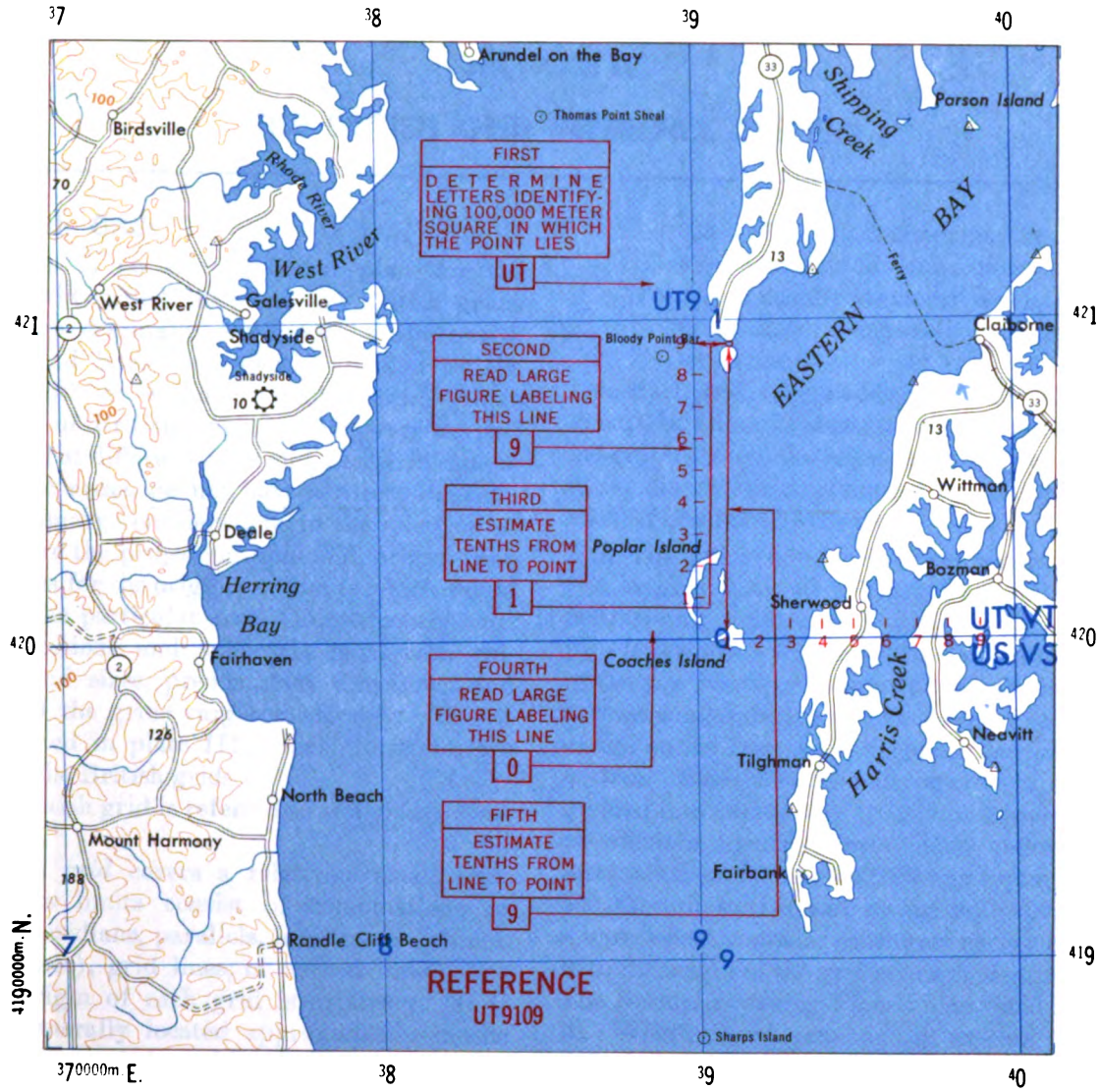


Figure 11. Method of reading a U. S. Army Military Grid Reference from a 1:250,000 scale map.

SECTION IV

THE BRITISH GRID REFERENCE SYSTEM

16. British Grids

a. There is no related global plan for the various grids which make up the British grids. Some were originally developed by the native country and later conveniently adopted by the British with or without modifications. Others are solely of British origin. They were devised or adopted at different times and, except in certain geographic areas, do not have a direct relationship. Primary considerations in the selection of a grid were the projection, spheroid, origin, false coordinates for the origin, and limits which would best suit the particular area. Consequently, various projections and spheroids have been employed; and sizes, predominant directions, and outlines of the grids vary considerably. This is demonstrated in plate III, which illustrates the layout of the British grids.

b. A British grid is referred to as a *grid*, a *zone*, or a *belt.*

(1) A *grid* covers a relatively small area. Its limits consist of combinations of meridians, parallels, loxodromes (rhumb lines), grid lines, or curved lines. The origin of each grid is arbitrary. It is generally located approximately in the center of the grid and bears no relation to the origins of other grids or to those of adjacent zones or belts.

(2) A *zone* usually is wide in longitude and comparatively narrow in latitude. It covers an area of interest without respect to international boundaries. Its limits, which are regular in some few cases but irregular in most, consist of either parallels and meridians or combinations of meridians, parallels, loxodromes, or grid lines. Each zone has its own origin which, with some few exceptions, falls within the limits of the zone. There is no relation between the origins of the zones, although, in a regional geographic area, those of adjacent zones may be on a common meridian or on a common parallel.

(3) A *belt* usually is extensive in latitude, but is always comparatively narrow in longitude.

c. Each grid, zone, and belt has a name. Where groups of adjacent zones or belts cover a regional geographic area, the same name may be used for each; distinction is preserved by adding either a number or a letter to the name.

d. The unit of measure is either meters or yards.

e. A grid, zone, or belt usually is divided into 500,000-unit squares with each square identified by a letter of the alphabet. In a square comprised of twenty-five 500,000-unit squares, the letters are arranged alphabetically (the letter *I* is omitted except on the Irish grid) from *left to right, top to bottom.* Each 500,000-unit square is similarly divided into twenty-five 100,000-unit squares, each of which is identified by a letter following the same plan as for the 500,000-unit squares. The 500,000-unit square and its integral 100,000-unit square whose common southwest corner coincides with the origin of the grid are each identified as *V*. The Normal Lettering Plan is illustrated in figure 12. Where a grid, zone, or belt exceeds 2,500,000 units in any direction, the basic lettering plan is repeated for the additional squares.

f. Only about one-half of the British grids, zones, and belts adhere to the Normal Lettering Plan. The remainder have been modified by variations, omissions, and substitutions. The principal reasons for these modifications are to extend the distances between squares of similar identifications which fall in the same or in adjacent grids, zones, and belts, or to eliminate such duplication.

(1) In certain cases, while both 500,000 and 100,000 letters are used.

(*a*) The 500,000 letters do not follow the normal plan, but the 100,000 letters do.

(*b*) The 500,000 letters follow the normal plan, but the 100,000 letters do not.

THE BRITISH GRID REFERENCE SYSTEM

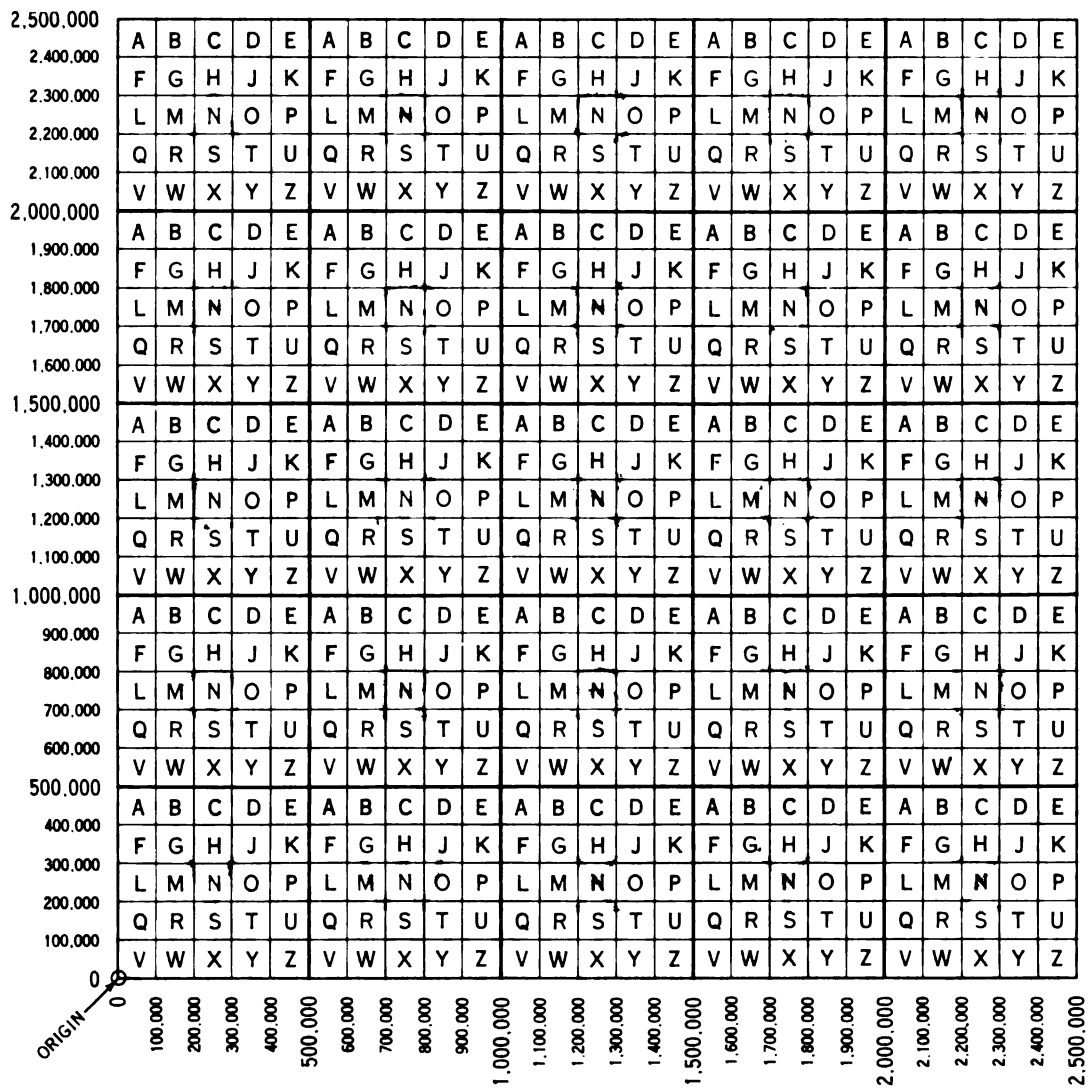


Figure 12. Normal Lettering Plan of the 500,000-and 100,000-unit squares of the British grid systems.

(*c*) Neither the 500,000 nor the 100,000 letters follow the normal plan.

(2) In certain small grids and zones, the 500,000 letters are omitted and only the 100,000 letters are used.

(3) The two New Zealand Belts employ a unique system. The Northern Belt is identified as *N*. The Southern Belt is identified as *S*. Within each belt the 100,000-yard squares are identified by two-digit numbers representing the 100,000 digits of the easting and the northing grid lines which intersect at the southwest corner of each square.

g. Pertinent facts for each grid, zone, and belt are contained in the pages which follow plate III. Among the items described are projection, spheroid, unit of measure, origin, false coordinates of origin, scale factor, limits, identifications of grid squares, composition of principal digits, grid reference box to be used, and variations in the grid reference system.

17. British Grids on Maps

a. Maps at scales of 1:100,000 and larger are gridded at 1,000-unit intervals; those at scales smaller than 1:100,000 are gridded at 10,000-unit intervals, except 1:1,000,000 scale maps which are gridded at 100,000-unit intervals.

b. Each grid line is labeled with its value in the margin and on the line itself. In the margins, the grid value for each line is shown in two sizes of type. The larger figures—the principal digits—are the only figures to be used in determining a grid reference. On the face of the map, the grid lines are labeled at convenient intervals with principal digits only. These grid-labeling practices are applicable also to the UTM and UPS grids.

(1) The number of principal digits labeling the grid lines is dependent upon the particular grid and the interval of the grid lines.

(2) With grids whose 100,000-unit squares *are* identified—either by letters or numbers—the grid lines of maps gridded at 10,000- or 100,000-unit intervals are labeled with *one* principal digit only. This represents the 10,000 digit of the grid value. On maps in the same area whose grid lines appear at 1,000-unit intervals the lines are labeled with *two* principal digits. These represent the 10,000 and 1,000 digits of the grid value.

(3) The lines of all grids (except the Ceylon Belts) whose 100,000-unit squares *are not* identified are labeled with *two* principal digits when the interval is 10,000 or 100,000 units and with *three* principal digits when the interval is 1,000 units. At the 10,000- or 100,000-unit interval, the numbers represent the 100,000 and 10,000 digits of the grid value. At the 1,000-unit interval, the numbers represent the 100,000, 10,000, and 1,000 digits of the grid value.

(4) With the Ceylon Belts, *two* principal digits are used, *regardless* of the interval of the grid lines. On maps gridded at 10,000- or 100,000-yard intervals, the numbers represent the 100,000 and 10,000 digits of the grid value. On maps gridded at 1,000-yard intervals, the numbers represent the 10,000 and 1,000 digits of the grid value.

c. The 100,000- and 500,000-unit square identifications are shown in several ways, depending upon the scale of the map.

(1) On maps of British origin which are gridded at 10,000-unit intervals, a miniature representation of the 100,000-unit grid lines is surprinted in the index to adjoining sheets. Within each square is added the 100,000-unit square identification. If the 500,000-unit squares are identified, the identification is added in smaller type just before each 100,000-unit square identification, as *sC*. Similar identifications appear on the face of the map. These will be found either in the center or at the corners of each 100,000-unit square. Variations in these practices will often be encountered.

(2) This same plan is followed on maps of British origin which are gridded at 1,000-unit intervals, although in many

cases it will be found that the identifications are omitted from the face of the map.

(3) On U.S. Army maps containing British grids, a miniature representation of the sheet and 100,000-unit grid lines appears in the grid reference box which is part of the marginal data of the sheet. The appropriate 500,000- and 100,000-unit square identifications appear in each square of the miniature. These are written together, with the 500,000-unit square identification appearing in smaller type, as: *sC*. Examples are illustrated in figures 2[7], 37, and 42. Similar identifications appear on the face of maps gridded at 10,000-unit intervals. Examples are illustrated in figures 31 and 40.

d. For a more detailed description of British grid items on maps, see sections VI, VII, and VIII.

18. Referencing

The British employ two basic methods for giving grid references. These are modified in some instances. The first method, which is the more common, is used in conjunction with grids whose 100,000-unit squares are identified by letters. For convenience, this method is referred to in this manual as the *Normal British Grid Reference System*. The second method is used in conjunction with grids whose 100,000-unit squares are not identified. For convenience, this method is referred to as the *Abnormal British Grid Reference System*.

19. The Normal British Grid Reference System

a. The instructions contained in this paragraph apply only to those grids which adhere to the Normal Lettering Plan (para 16*e*).

b. The normal method for giving a reference based on a British grid is similar to that used for the U.S. Army Military Grid Reference System. See figures 10 and 11. A reference consists of a group of letters and numbers which indicate (1) the 500,000-unit square identification, (2) the 100,000-unit square identification, and (3) the grid coordinates—the numerical reference—expressed to a prescribed refinement. It is desirable to leave a space between letters and numbers.

Examples:

CQ 65---------- (Locating a point within 10,000 units.)
CQ 6354---------- (Locating a point within 1,000 units.)
CQ 632543---------- (Locating a point within 100 units.)

c. All elements of a grid reference are not used in every instance. Those omitted depend upon the size of the area of activities and upon the interval of the grid lines.

(1) The 500,000-unit square letter may be omitted if reporting is not beyond a distance of 500,000 units. The letter is retained, however, if reporting is being made outside of the grid. When reporting falls within the 500,000-unit square, the reference examples given in para 19*b* would read:

Q 65---------- (Locating a point within 10,000 units.)
Q 6354---------- (Locating a point within 1,000 units.)
Q 632543---------- (Locating a point within 100 units.)

(2) In references based on a 1,000-unit grid, the grid coordinates are prefixed with the letter of the 100,000-unit square, as Q 632543, to avoid ambiguity. Ambiguity is possible because a numerical reference may be repeated: (1) beyond a reporting distance of 100,000 units; and (2) within 100,000 units of a grid junction.

(3) Similarly, in references based on a 10,000-unit or 100,000-unit grid, the 100,000-unit identification is shown as Q 6354 for 10,000-unit grids, and as Q 65 for 100,000-unit grids.

20. Exceptions to the Normal British Grid Reference System

a. Exceptions for particular grids are specified in the pages which follow plate III.

b. No 500,000-unit square letters are used with the two New Zealand Belts. To avoid ambiguity, references for the North Island Belt are prefixed

with the letter *N* and references for the South Island Belt are prefixed with the letter *S*. Also, in these belts, when the two-digit 100,000-yard square identification is used in a reference, a dash separates it from the numerical reference.

21. The Abnormal British Grid Reference System

a. The Abnormal British Grid Reference System is used when 100,000-unit squares are not identified, as with the Madagascar and French Lambert Grids. The reference usually is expressed in terms of grid coordinates only, and is determined in the same manner as that used with the Normal British Grid Reference System. The number of digits in the references depends upon the grid interval and the grid itself.

b. Except for the Ceylon Belts,* an abnormal reference taken from a map gridded at 100,000-meter intervals consists of *four* digits; at 10,000 meters—*six* digits; and for 1,000-meter intervals *eight* digits.

Examples:

8675----------(Locating a point within 10,000 meters.)
863754----------(Locating a point within 1,000 meters.)
86327543----------(Locating a point within 100 meters.)

c. References based on the Ceylon Belts use *four* digits on maps gridded at 100,000-yard intervals and *six* digits for all other grid intervals.

Examples:

Reference from map gridded at 100,000-yard intervals:
8675----------(Locating a point within 10,000 units.)
Reference from map gridded at 10,000-yard intervals:
863754----------(Locating a point within 1,000 units.)
Reference from map gridded at 1,000-yard intervals:
632543----------(Locating a point within 100 units.)

(1) The Ceylon Belts Grid Reference System has a distinct disadvantage. Ambiguity between references is possible when six-digit reporting covers an area exceeding 100,000 yards square.

(2) The British provide no official method for preserving a distinction between the references. In practice, various devices have been used, such as prefixing the reference with the scale, name, or number of the map from which the reference is taken.

(3) On maps prepared by the U.S. Army, the grid reference box will contain instructions for preserving distinctions. Normally, this will require prefixing the numerical reference with the sheet number of the map from which the reference was taken.

22. Unique Reporting

a. The British Grid Reference System unlike the U.S. Army Military Grid Reference System makes no provisions for worldwide reporting. It may be necessary to identify the general areas in terms of geographic coordinates before giving the grid references for the separate general areas.

*The unit of measure for the Ceylon Belts is *yards*. The unit of measure is *meters* for all other grids which use the Abnormal British Grid Reference System.

SECTION V

GEOGRAPHIC COORDINATE REFERENCES

23. Use

The use of geographic coordinates is a fundamental principle in the establishment of a world-wide system of reference. This widely accepted system is based on the expression of position by latitude (parallels) and longitude (meridians) in terms of arc (degrees, minutes, and seconds) and referred to the intersection of the Equator (north or south) and the Greenwich Meridian (east or west). Figure 13 is representative of the system of parallels and meridians described.

24. The Reference

The composition of a geographic reference is influenced by map scale and desired refinement for plotting and scaling.

Examples of references are—

40°N132°E	(To closest degree of latitude and longitude.)
40°30'N132°15'E	(To closest 15 minutes of latitude and longitude.)
40°31'N132°14'E	(To closest minute of latitude and longitude.)
40°31'15"N132°14'15"E	(To closest 15 seconds of latitude and longitude.)
40°31'12"N132°14'18"E	(To closest second of latitude and longitude.)
40°31'12.5"N132°14'-17.6"E.	(To closest 0.1 second of latitude and longitude.)
40°31'12.55"N132°14'-17.67"E.	(To closest 0.01 second of latitude and longitude.)

25. Geographic Coordinates on Maps

a. U.S. military maps are designed to facilitate determination of the geographic coordinates of a reference.

b. On maps at the scale of 1:1,000,000 the parallels and meridians are shown by full lines at one-degree intervals. In the margin of the map, the lines are labeled in degree values.

c. On maps at the scale of 1:500,000, parallels and meridians are shown by full lines at 30-minute intervals. In the margin of the map, the full degree lines are labeled in degree values, while intermediate lines are labeled in minutes only.

d. On maps at scales of 1:250,000 and larger the intersections of the parallels and meridians are indicated by ticks at prescribed intervals. The following table indicates these intervals and describes the composition of the geographic coordinates as they appear on maps.

Scale	*Tick interval*	*Labeling at corners*	*Labeling of ticks*
1:250,000	15 minutes	Degrees-minutes	Minutes.
1:100,000	10 minutes	Degrees-minutes	Minutes.
1:50,000	5 minutes	Degrees-minutes	Minutes.
1:25,000	2½ minutes	Degrees-minutes-seconds.	Minutes-seconds.

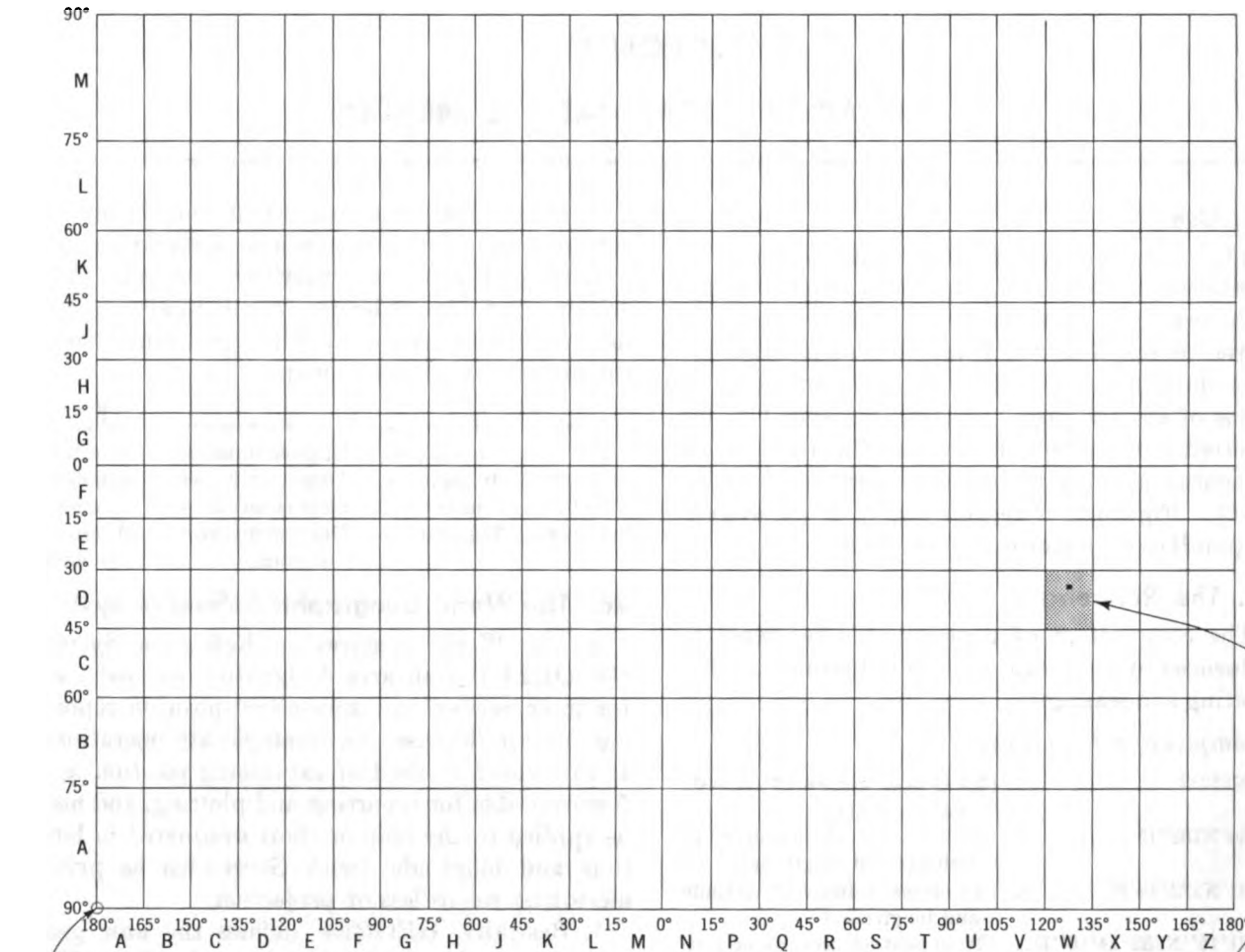
26. The World Geographic Reference System

a. The World Geographic Reference System (GEOREF) is an area-designation method used for inter-Service and inter-allied position reporting for air defense and strategic air operations. It provides a method of expressing position in a form suitable for reporting and plotting, and may be applied to any map or chart graduated in latitude and longitude (with Greenwich as prime meridian) regardless of projection.

b. Basically, GEOREF defines the unit geographic area in which a specific point lies. The Earth is divided into quadrangles of longitude and latitude with a systematic code that gives positive identification to each quadrangle. The point of origin is the 180° meridian at the South Pole. It extends eastward 360° to the 180° meridian. It extends northward 180° to the North Pole. See figure 13. In composing references, the rule to READ RIGHT-UP prevails. The system and identification code includes—

(1) Twenty-four longitudinal zones of 15° each lettered *A* through *Z* (omitting *I* and *O*) eastward from the origin. Twelve bands of latitude, each 15° wide, lettered *A* through *M* (omitting *I*) northward from the origin. This combination divides the Earth's surface into basic 15° quadrangles identified by two letters such as the shaded quadrangle *WD* in figure 13.

GEOREF SYSTEM INDEX



GEOREF BREAKDOWN OF A TYPICAL 15° QUADRANGLE

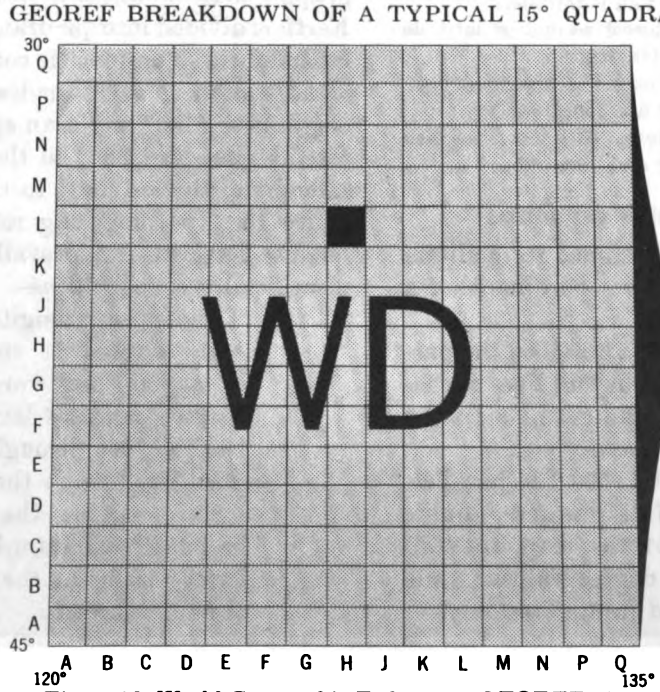


Figure 13. World Geographic Reference (GEOREF) System

(2) Each basic 15° quadrangle is divided into 1° quadrangles defined by north-south zones and east-west bands lettered *A* through *Q*, omitting *I* and *O*. The lettering starts at the southwest corner of the 15° quadrangle regardless of position east or west of zero degrees. Each 1° quadrangle is identified by two additional letters (four in all); e.g. WD*HL*. The lettering system is shown in figure 13.

(3) Each 1° quadrangle is further divided into 60 1-minute units eastward and 60 1-minute units northward. The resulting zones and bands are numbered 0 through 59; the numbers 0 through 9 are written as 00, 01, 02, etc. Thus four letters and four numerals identify each 1′ quadrangle in the world; e.g., WDHL *5307*.

(4) Each of the 1′ quadrangles may be further divided into decimal parts (1/10th and 1/100th) eastward and northward. Thus four letters and six numerals will define a location to 0.1-minute; four letletters and eight numerals will define a location to 0.01-minute.

SECTION VI

GRIDS ON MAPS AT 1:100,000 SCALE AND LARGER

27. General

a. Grid data and grid formats on maps prepared for the U.S. Army at 1:100,000 scale and larger are standard and essentially the same for British grids, Universal Transverse Mercator grids, and Universal Polar Stereographic grids.

b. Grids added on Army reprints of maps of other origins adhere as closely as possible to these standards. There may be minor changes in limits of grid zones and variations in the color of grid lines and grid values. The changes and variations are explained, as necessary, in the margin of the map.

c. Grids on maps not prepared for the U.S. Army may not follow these standards. The variations, however, are usually minor and self-explanatory.

d. The grid data for U.S. Army maps usually include: the major grid, a declination diagram, a grid reference box, and notes identifying the grid.

e. The neighboring—overlapping—grid is shown when a map lies close to a grid junction line. A separate declination diagram and notes identifying the overlapping grid appear in the margin.

f. In certain cases, the map also shows an obsolete—secondary—grid which occurs in its area. The secondary grid is identified by a marginal note.

g. No one map ever shows more than three grids. When a sheet covers an area which includes more than three grids (either major, overlapping, or secondary), those omitted are the ones which are considered of least military importance. Major grids are never omitted. When choice lies between two overlapping grids, the one retained usually is the one which occurs most frequently on the sheets in the general area. Secondary grids are least important.

h. Since 1:50,000 is the standard military scale for this category of maps, descriptions and illustrations are keyed to this scale. The same grid treatment applies, however, to other scales in this group.

i. Specific dimensions, size and style of type, and placement of marginal data relating to grids and grid formats at 1:100,000 scale and larger are contained on Army Map Service Style Sheet AMS 25-50-100. See paragraph 1*g*.

28. The Major Grid

a. The major grid is indicated by full black lines at 1,000-unit intervals. The unit is either yards or meters. Every 10,000-unit grid line is accentuated in weight.

b. Grid numbers appear outside the neatline (limits of map usually established by parallels of latitude and meridians of longitude) on all four sides of the sheet, labeling each grid line. Where a grid line coincides with a neatline of the map, the grid line is omitted, but the neatline is labeled in the margin with the values for the grid line.

c. Except for the values labeling the first grid line in each direction from the southwest corner of the sheet, the last three digits (000) of the values are omitted. The values are shown in two sizes of type, with the larger size being reserved for the principal digits.

(1) *Two* principal digits are used for all grids except the Madagascar and French Lambert grids. These represent the 10,000 and 1,000 digits of the grid value.

(2) *Three* principal digits are used with the Madagascar and French Lambert grids. These represent the 100,000, the 10,000, and 1,000 digits of the grid values.

d. Grid values, expressed in principal digits only, are shown labeling grid lines within the map neatlines; these values are referred to as *ladder* numbers. One column (northing) and one row (easting) of ladder numbers are shown intersecting at the approximate center of the sheet. See figure 14. The numbers are centered between adjacent horizontal (northing) and vertical (easting) grid lines. Numbers identifying the 10,000-

unit grid lines are shown in larger type than those for the 1,000-unit grid lines. In areas of dense culture, a number may be moved along a grid line a maximum of one-fourth of the grid interval, or omitted if it impairs the legibility of the map. Omissions are held to a minimum.

e. The color of the grid values and ladder values is governed by the grid system.

(1) Black is used when the grid is either the Universal Transverse Mercator or the Universal Polar Stereographic.

(2) With British grids, the color varies. It may be black, blue, brown or red. The color to be used with each particular British grid is specified in the pages which follow plate III.

(3) Sheets of British origin follow the same color plan as described in (2) above,* except that purple is also sometimes used. Black has been substituted for purple on U.S. Army maps to eliminate an extra color.

f. A note, printed in the same color as the values for the major grid, appears in the lower margin of the sheet to identify the grid. The note is modeled after one of the following:

BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 49, BESSEL SPHEROID

RED NUMBERED LINES INDICATE THE 1,000 METER MADAGASCAR GRID, INTERNATIONAL SPHEROID

BLACK NUMBERED LINES INDICATE THE 1,000 YARD INDIA ZONE II A GRID, EVEREST SPHEROID

(1) On maps having a land inset for which the grid or grid zone differs from that of the map proper, the appropriate grid note is shown within the inset.

(2) On maps of British origin, it will be found that besides identifying the grid, the note usually describes the projection, spheroid, origin, false coordinates of the origin, and the scale factor of the grid.

g. Figures 14 and 15 illustrate the treatment for the major grid on U.S. Army mapping at 1:100,000 scale and larger.

*Departures from prescribed colors will frequently be encountered on sheets of British origin.

29. Multiple Major Grids

a. In certain instances a sheet contains more than one major grid. See para 3.

(1) With the UTM and UPS grids this may occur—

(*a*) Where original sheet lines are retained as established by a mapping agency of a foreign country.

(*b*) Where a sheet is shifted from the normal position to avoid making additional sheets.

(2) With the British grids, this condition occurs more frequently since, in addition to the above cases grid junctions are sometimes loxodromes or are grid lines not coincident with parallels or meridians.

b. Grid and zone junctions are indicated by accentuated lines, printed in black. Labels identifying the junction appear parallel to and on each side of the junction line. The labels may be shown more than once to facilitate identification. Each label is printed in the color designated for the particular grid system. When a grid or zone junction line is coincident with a neatline, both the junction line and the identifying labels are omitted.

(1) For British grids, the label is modeled after the following:

NORTHWEST AFRICA ZONE GRID

INDIA ZONE IV B GRID

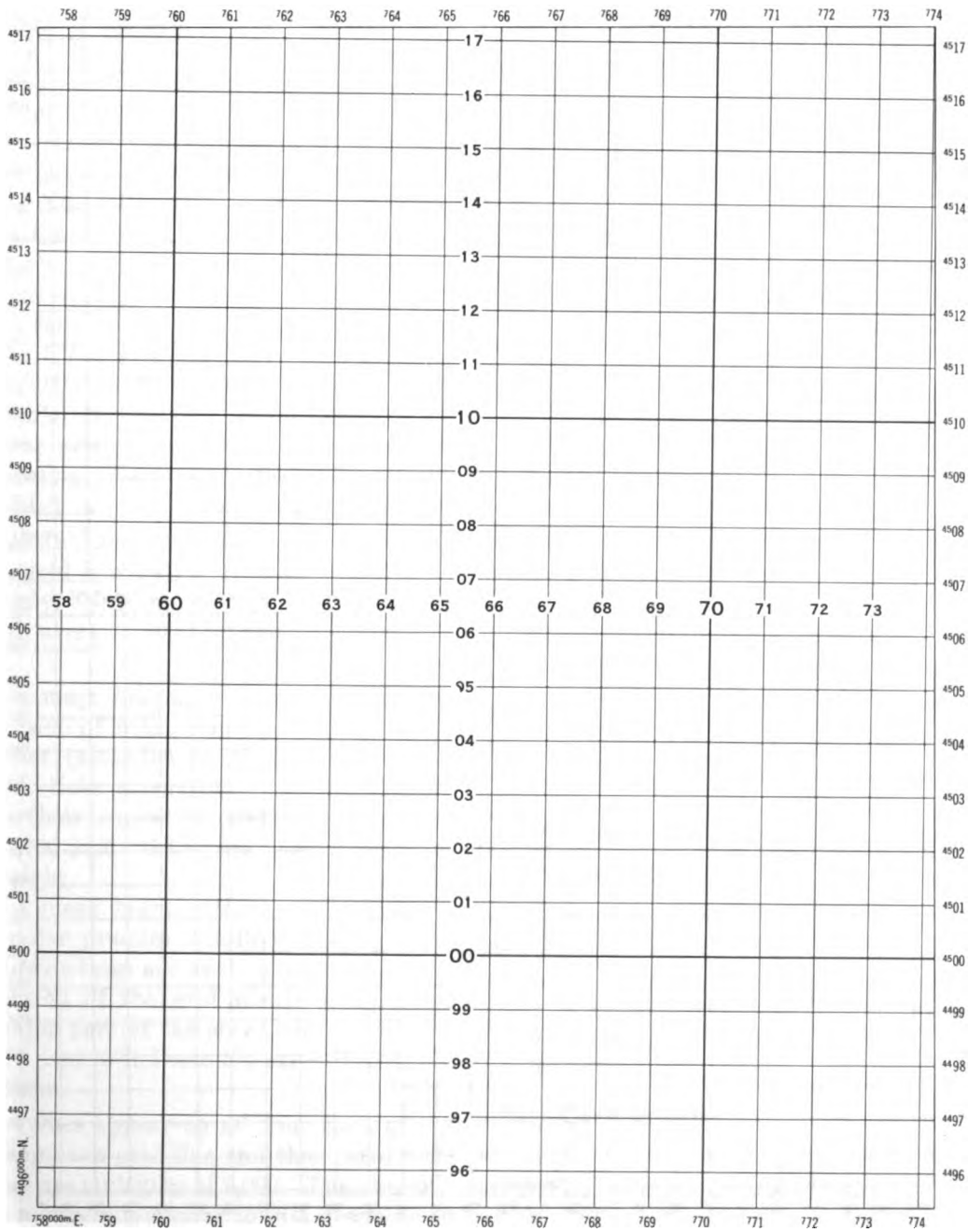
CEYLON BELT GRID

MADAGASCAR GRID

(2) The label for a Universal Transverse Mercator grid junction, or a UPS grid junction, includes the identification of the Grid Zone Designation and is written as—

UTM GRID ZONE DESIGNATION: 47T
UPS GRID ZONE DESIGNATION: B

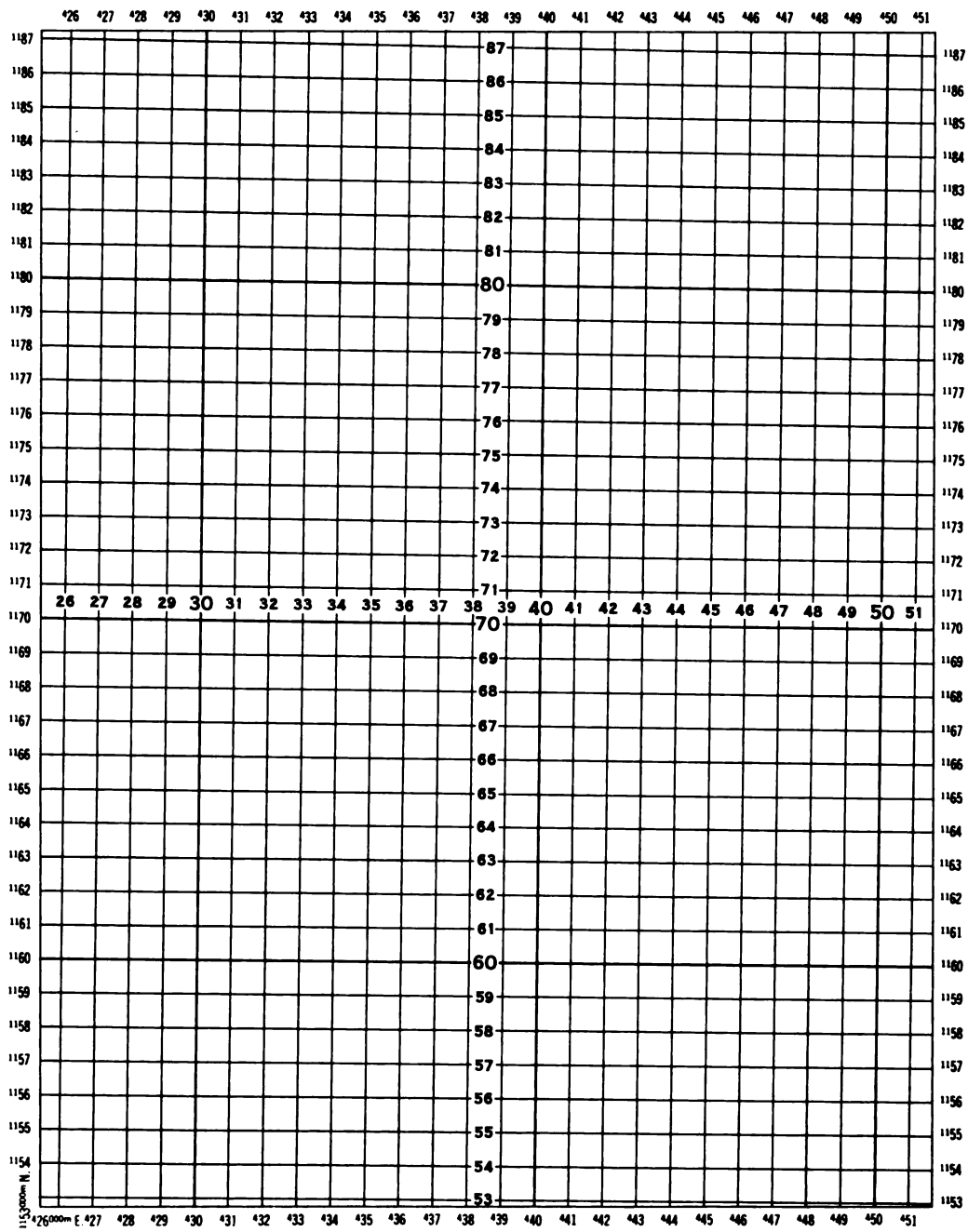
(3) In certain isolated cases, a sheet bearing the UTM grid may straddle a parallel which marks the division between two *grid zone designations.* The dividing line is unaccentuated and is shown in blue—never in the same color as the grid lines—and is labeled on each side by the



BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 49, INTERNATIONAL SPHEROID

Scale 1:50,000 (in miniature)

Figure 14. The major grid as shown on a 1:50,000 scale map



BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, EVEREST SPHEROID

Scale 1:100,000 (in miniature)

Figure 15. The major grid as shown on a 1:100,000 scale map.

appropriate grid zone designation in the color of the grid system. The dividing line is labeled in the map margin with its geographic values. If the dividing line is coincident with a neatline, the dividing line (and labeling related to grid zone designations) is not shown. If the dividing line falls within 0.10 inch (2.5 mm) of the neatline, the dividing line is not shown; it is considered as being coincident with the neatline.

(4) In certain isolated cases, a sheet bearing the UTM grid may straddle a spheroid junction. The treatment in these cases is similar to that previously described for grid and zone junctions. Appropriate labeling, identifying the spheroids, is added on each side of the accentuated spheroid junction line.

c. Each grid is shown by full lines within its own area only, being represented at 1,000-unit intervals with every 10,000-unit line accentuated in weight.

(1) On maps bearing *two* major grids, extension of either grid into the area of the other (extended grid) is shown by *outside* ticks emanating from the neatline in their correct declination. The even 10,000-unit ticks are accentuated in weight.

(2) On maps bearing three major grids, a similar practice is followed, except that *outside* ticks are used to indicate the extension of the grid which occupies the major part of the sheet and *inside* ticks are used to indicate the extensions of the others.

d. Grid values appear on all four sides of the sheet labeling each grid line and those grid ticks whose values are multiples of 5,000. The composition of the numbers is similar to that described in paragraph 28*c*, except that full values appear at each corner, labeling the first grid line in each direction from the corner.

(1) For the UTM and UPS grids, the values for the different grids appear in black and blue. Black is reserved for the grid which covers the greater portion of the sheet. If the grid junction divides the sheet equally, black is used for the grid which occurs most frequently on the sheets in the general area.

(2) For British grids, the values appear in the colors designated for the grid system. Where the designated colors are the same, one or more substitutions are made to emphasize distinction, with the order of preference as follows: black, blue, brown, red.

(3) Black is used for the UTM or UPS when either appears in combination with British grids. In such cases, if the conventional color for a British grid is black, a substitution, is made for the British grid with blue, brown, or red being used.

e. Grid values, expressed in principal digits only, appear on the face of the map labeling each grid line. The design and layout of the columns and rows of ladder numbers adhere to the principles described in paragraph 28*d;* i.e., a column and a row of numbers intersect in the approximate center of the area covered by each grid.

f. Notes identifying each grid appear in the lower margin of the sheet. Each grid note is printed in the same color as that used for the values of the grid it identifies. The notes are modeled after the following:

BLACK NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

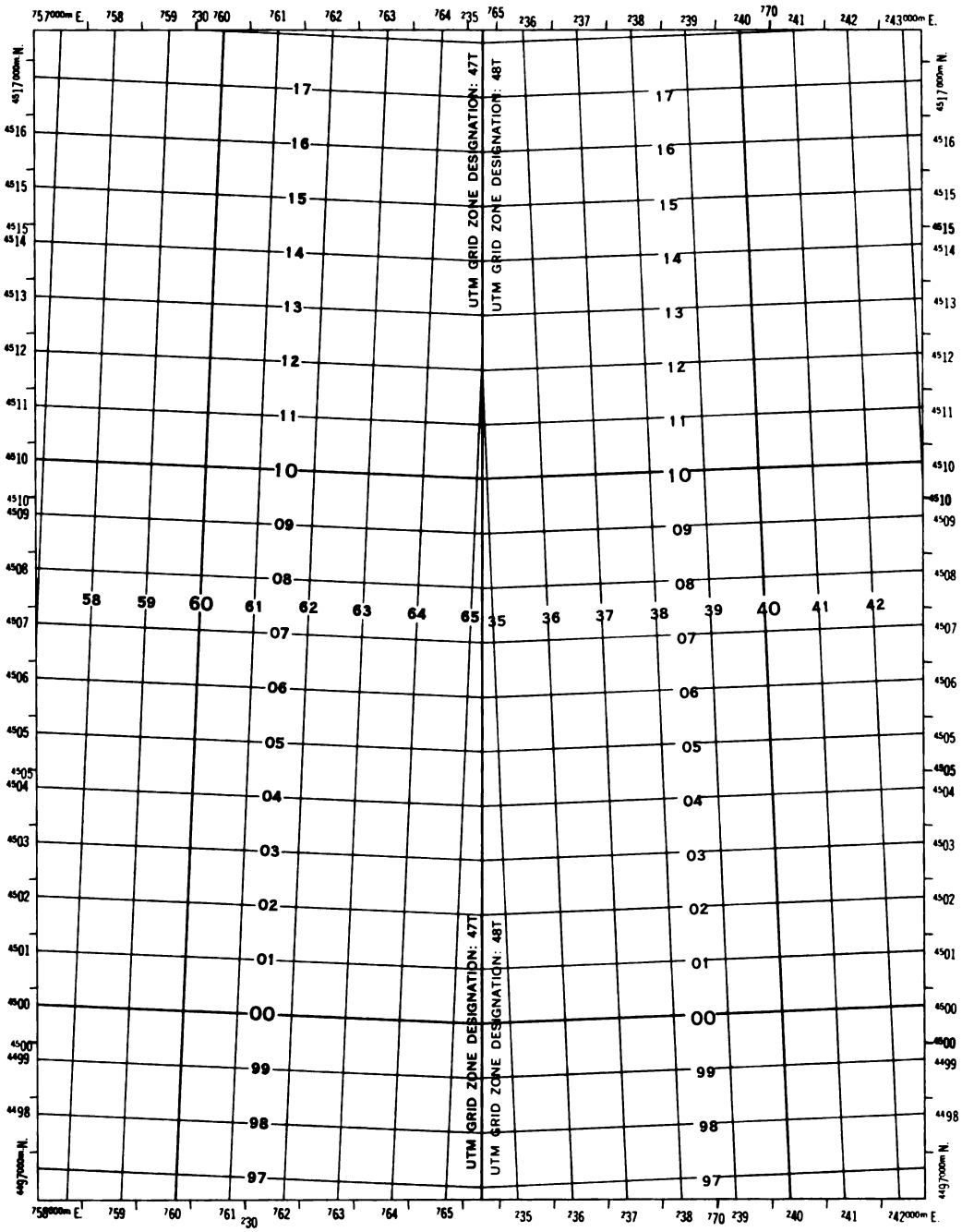
BLUE NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, INTERNATIONAL SPHEROID

g. Figures 16 and 17 illustrate the treatments described for sheets containing more than one major grid.

30. Overlapping Grids

a. If any part of a sheet falls within approximately 25 miles of a grid, zone, or spheroid junction (see fig. 18), the sheet will also bear the grid for the neighboring area. This grid—called the *overlapping grid*—is primarily intended to facilitate military surveying and fire-control operations.

b. The overlapping grid is shown by ticks printed in black, emanating from the neatline in their correct declination and spaced at 1,000-unit intervals. The even 10,000-unit ticks are accentuated in weight. The direction of the ticks from the neatline (*inside* or *outside*) is dependent on the other grids shown on the map.

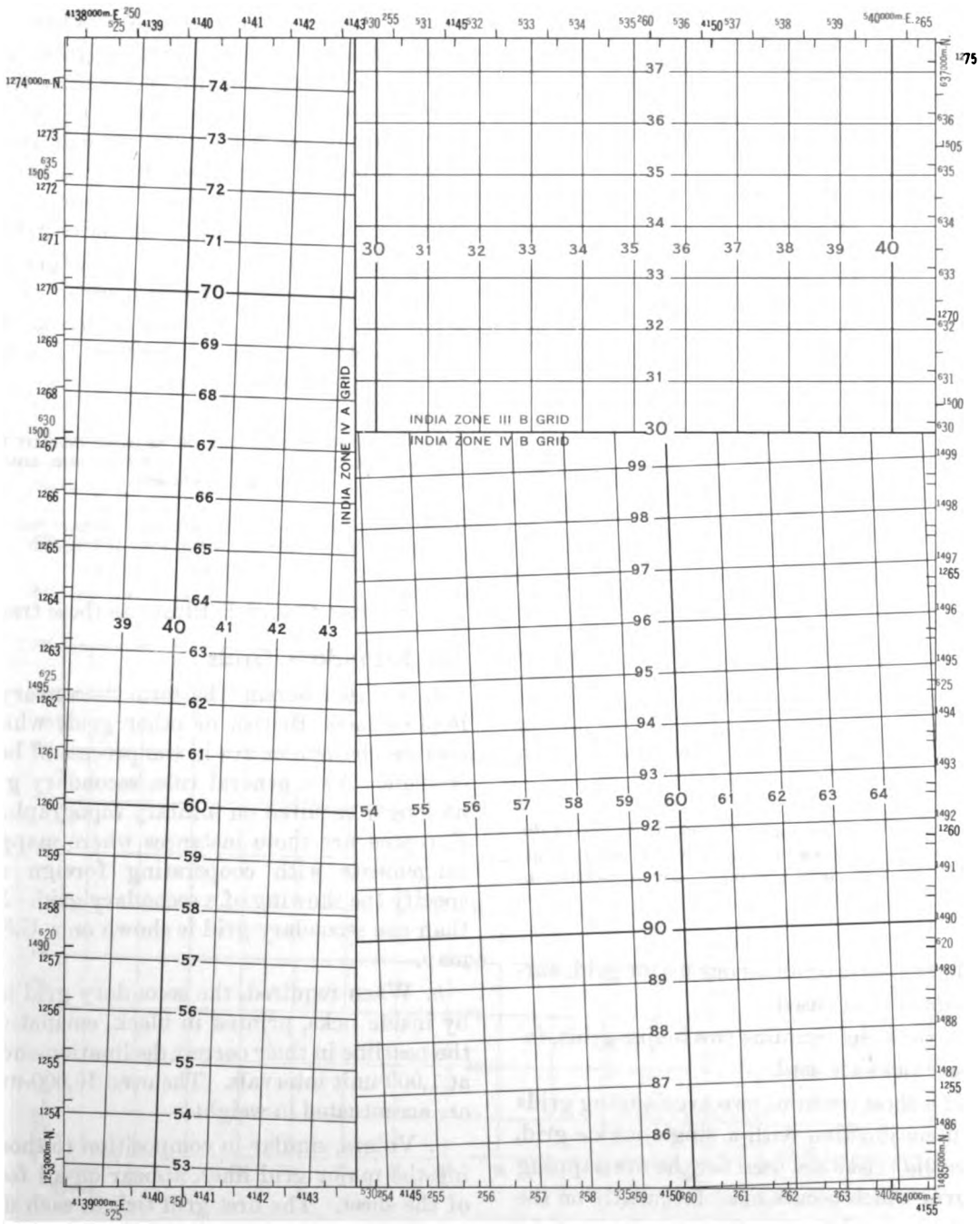


BLACK NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

BLUE NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, INTERNATIONAL SPHEROID

Scale 1:50,000 (in miniature)

Figure 16. Two major grids (in this case, zones of the UTM) separated by a grid junction as shown on a large scale map



BLUE NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER INDIA ZONE IV B GRID, EVEREST SPHEROID

BLACK NUMBERED LINES AND TICKS INSIDE THE NEATLINE INDICATE THE 1,000 METER INDIA ZONE IV A GRID, EVEREST SPHEROID

BROWN NUMBERED LINES AND TICKS INSIDE THE NEATLINE INDICATE THE 1,000 METER INDIA ZONE III B GRID, EVEREST SPHEROID

Scale 1:50,000 (in miniature)

Figure 17. Three major British grids as shown on a large scale map.

0°	21′41″	30°	25′01″	60°	43′16″
1°	21′41″	31°	25′17″	61°	44′37″
2°	21′42″	32°	25′33″	62°	46′04″
3°	21′43″	33°	25′50″	63°	47′38″
4°	21′44″	34°	26′08″	64°	49′20″
5°	21′46″	35°	26′27″	65°	51′10″
6°	21′48″	36°	26′46″	66°	53′10″
7°	21′51″	37°	27′07″	67°	55′20″
8°	21′54″	38°	27′29″	68°	57′43″
9°	21′57″	39°	27′52″	69°	1°00′20″
10°	22′01″	40°	28′16″	70°	1°03′13″
11°	22′05″	41°	28′41″	71°	1°06′24″
12°	22′10″	42°	29′08″	72°	1°09′58″
13°	22′15″	43°	29′36″	73°	1°13′56″
14°	22′21″	44°	30′06″	74°	1°18′26″
15°	22′27″	45°	30′37″	75°	1°23′36″
16°	22′33″	46°	31′10″	76°	1°29′21″
17°	22′40″	47°	31′44″	77°	1°36′05″
18°	22′48″	48°	32′21″	78°	1°43′58″
19°	22′56″	49°	32′59″	79°	1°53′17″
20°	23′04″	50°	33′40″	80°	2°04′28″
21°	23′13″	51°	34′23″	81°	2°18′10″
22°	23′23″	52°	35′09″	82°	2°35′18″
23°	23′33″	53°	35′57″	83°	2°57′21″
24°	23′43″	54°	36′49″	84°	3°26′46″
25°	23′55″	55°	37′43″	85°	4°08′58″
26°	24′07″	56°	38′41″	86°	5°09′49″
27°	24′19″	57°	39′43″	87°	6°52′57″
28°	24′32″	58°	40′49″	88°	10°19′15″
29°	24′46″	59°	42′00″	89°	20°38′19″

THE EQUIVALENT OF 25 MILES IS GIVEN AS 22 MINUTES OF LATITUDE WHEN MEASURED AT ANY POINT ALONG A MERIDIAN.

Figure 18. The above listing expresses, in terms of degrees, minutes, and seconds of longitude, the equivalents of 25 miles when measured along a given parallel of latitude.

(1) If the sheet contains one major grid, *outside* ticks are used.

(2) If the sheet contains two major grids, *inside* ticks are used.

(3) If a sheet contains two overlapping grids in conjunction with a single major grid, *outside* ticks are used for the overlapping grid which occurs most frequently on the sheets in the general area. *Inside* ticks are used for the other.

c. Values, similar in composition to those labeling the major grid lines, appear on all four sides of the sheet. The first grid tick in each direction from the south-west corner of the sheet is labeled with full values. Thereafter, only those grid ticks whose values are multiples of 5,000 are labeled.

d. The color of the overlapping grid values is governed by the grid system. Where the prescribed color for two overlapping grids is the same, the color of the grid which occurs more frequently on the sheets in the general area is retained, and a substitution of black, blue, brown, or red, in that order of preference, is made for the other. A similar substitution is made when the color of an overlapping grid is the same as the major grid.

e. Notes identifying overlapping grids appear in the lower margin of each sheet. These notes are printed in the same color as that used for the values of the grid each identifies. The notes are modeled after the following:

BLUE NUMBERED TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, BESSEL SPHEROID

RED NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1,000 METER INDIA ZONE II A GRID, EVEREST SPHEROID

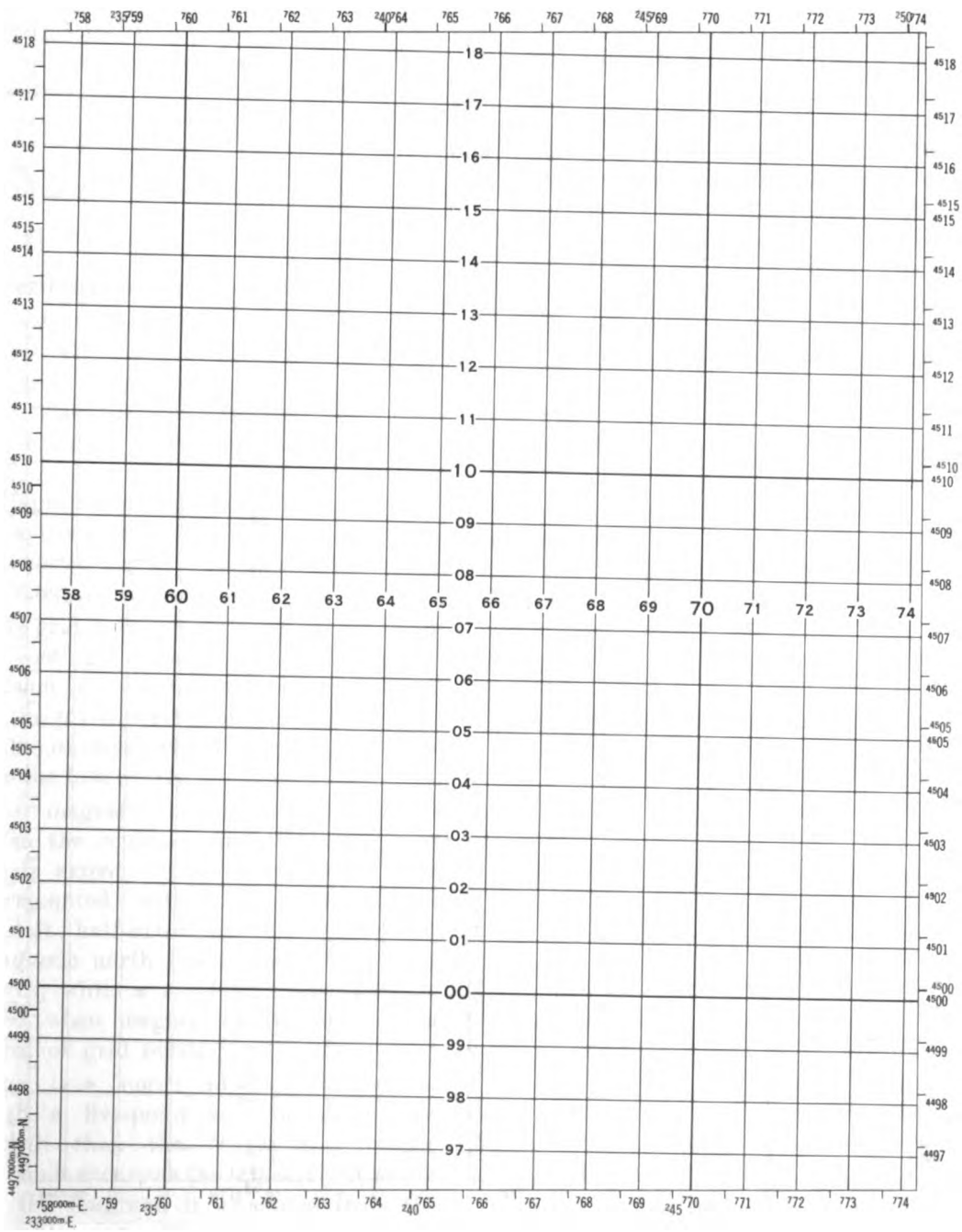
f. Figures 19 and 20 illustrate these treatments.

31. Secondary Grids

a. As used herein, the term "secondary grids" implies those British or other grids which have become obsolete or are in the process of becoming obsolete. As a general rule, secondary grids are no longer required on military topographic maps. Excepted are those instances where mapping arrangements with cooperating foreign agencies specify the showing of a secondary grid. No more than one secondary grid is shown on a U.S. Army map.

b. When required, the secondary grid is shown by inside ticks, printed in black, emanating from the neatline in their correct declination and spaced at 1,000-unit intervals. The even 10,000-unit ticks are accentuated in weight.

c. Values, similar in composition to those labeling the major grid lines, appear on all four sides of the sheet. The first grid tick in each direction from the southwest corner of the sheet is labeled with full values. Thereafter, only those grid ticks whose values are multiples of 5,000 are labeled. If the secondary grid is a British grid, prescribed colors are used unless there is conflict with another grid shown on the map. In that event, substitutions are made in the established order of preference.

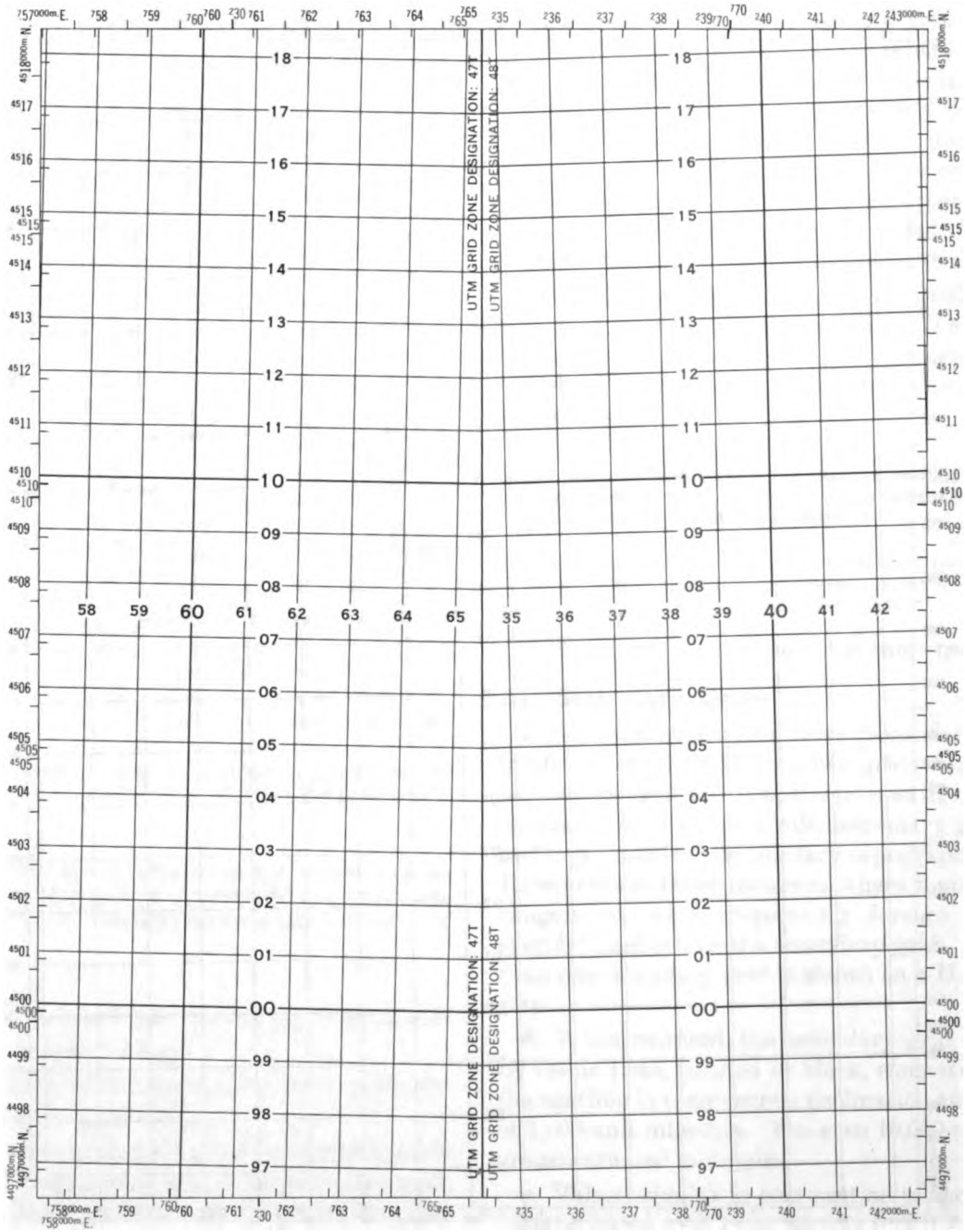


BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

BLUE NUMBERED TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, INTERNATIONAL SPHEROID

Scale 1:50,000 (in miniature)

Figure 19. Major and overlapping grids as shown on a large scale map.



BLACK NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, BESSEL SPHEROID

BLUE NUMBERED LINES AND TICKS OUTSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, BESSEL SPHEROID

BROWN NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

Scale 1:50,000 (in miniature)

Figure 20. Overlapping grid in combination with two major grids separated by a grid junction as shown on a large scale map.

d. A grid note, identifying the secondary grid, appears in the margin of the sheet. This is printed in the same color as that used for the values of the grid it identifies. The note is modeled after the following:

BLUE NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1,000 YARD INDIA ZONE IVB GRID, EVEREST SPHEROID

e. Figure 21 illustrates these treatments.

32. The Declination Diagram (One Grid)

a. A declination diagram appears in the margin of each sheet. The diagram shows the interrelationship of grid north, magnetic north, and true north for the sheet; it also provides information regarding the use of these data. See figures 22 and 23.

b. The diagram contains three prongs which emanate from a central point. The prongs, representing grid north, magnetic north, and true north are appropriately labeled.

(1) The grid north prong is an extension of an easting (vertical) grid line; the extension is a continuous line which stops at the pivot point near the bottom work limits of the sheet. The prong is broken for the letters GN.

(2) The magnetic north prong emanates from the central point to the approximate extent of the letters GN. It is surmounted with a half-arrowhead; a left half-arrowhead is used when magnetic north lies to the left of grid north, while a right half-arrowhead is used when magnetic north lies to the right of grid north.

(3) The true north prong; surmounted with a five-point star, is shorter in length than the other two prongs. When it occurs as the left or right prong of the diagram, it emanates from the central point. When true north occurs as the middle prong, its characteristic star appears at the approximate height of the magnetic north arrowhead; the prong is shown as an interrupted extension from the central point.

(4) Angles between the prongs are approximately represented. The magnetic north and true north prongs are plotted within 30 minutes of their given angular position from grid north, except that the magnetic prong is never shown within three degrees of the grid north prong. In maintaining relative proportions between prongs, the characteristic star of the true north prong must never touch another prong. When there is not angular declination between prongs, a single prong represents the coincidence, and the distinguishing characteristics (star, arrowhead, or letters GN) of each are shown on the composite prong.

c. The *grid-magnetic angle* (G-M Angle) is expressed by a note alongside a dashed arc connecting the grid north and magnetic north prongs. The value of this angle is obtained from the latest isogonic data for a standard epoch; i.e., a year that is divisible by five, such as 1965, 1970, etc. The value of the grid-magnetic angle is given to the nearest one-half degree with mils equivalent to the nearest ten mils. See appendix II for a table of mil equivalents.

(1) The grid-magnetic note is modeled after the following:

1965
GM ANGLE
7½° (130 MILS)

(2) For sheets with 0° grid-magnetic angle the note is shown as follows:

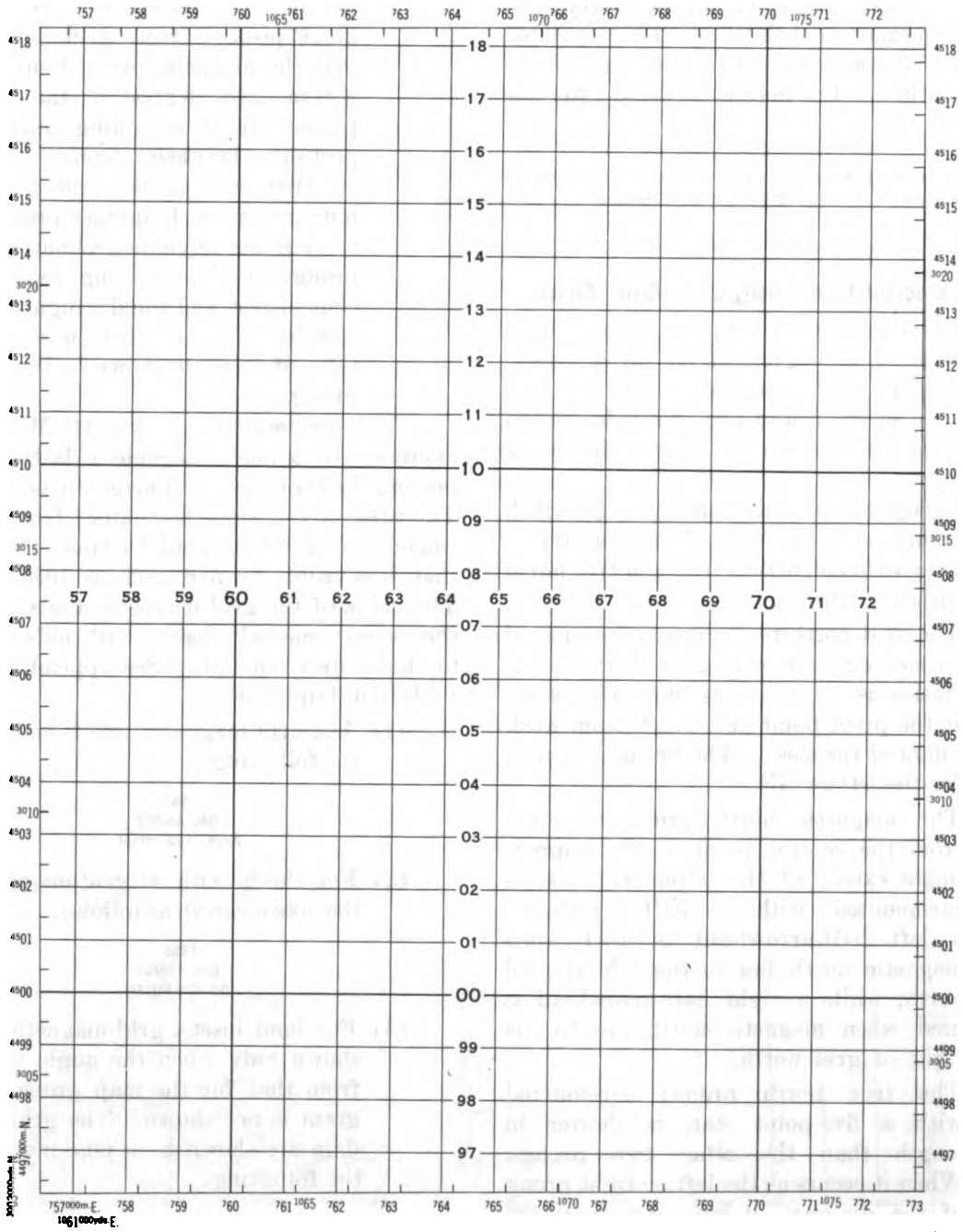
1965
GM ANGLE
0° (00 MILS)

(3) For land insets, grid-magnetic data are shown only when the angle is different from that for the map proper. A diagram is not shown. The grid-magnetic data are shown by a note modeled after the following:

MAGNETIC VARIATION FOR 1965 IS 1½° (30 MILS) WESTERLY OVER THE ENTIRE INSET

d. The *grid convergence* is the angle between grid north and true north. The value of the angle is expressed to the nearest full minute, with the mils equivalent to the nearest full mil.

(1) In the diagram, the grid convergence is indicated by a note alongside a dashed arc which connects the grid north and true north prongs. The convergence angle



BLACK NUMBERED LINES INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

BLUE NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1,000 YARD INDIA ZONE IVB GRID, EVEREST SPHEROID

Scale 1:50,000 (in miniature)

Figure 21. Major and secondary (obsolete) grids as shown on a large scale map.

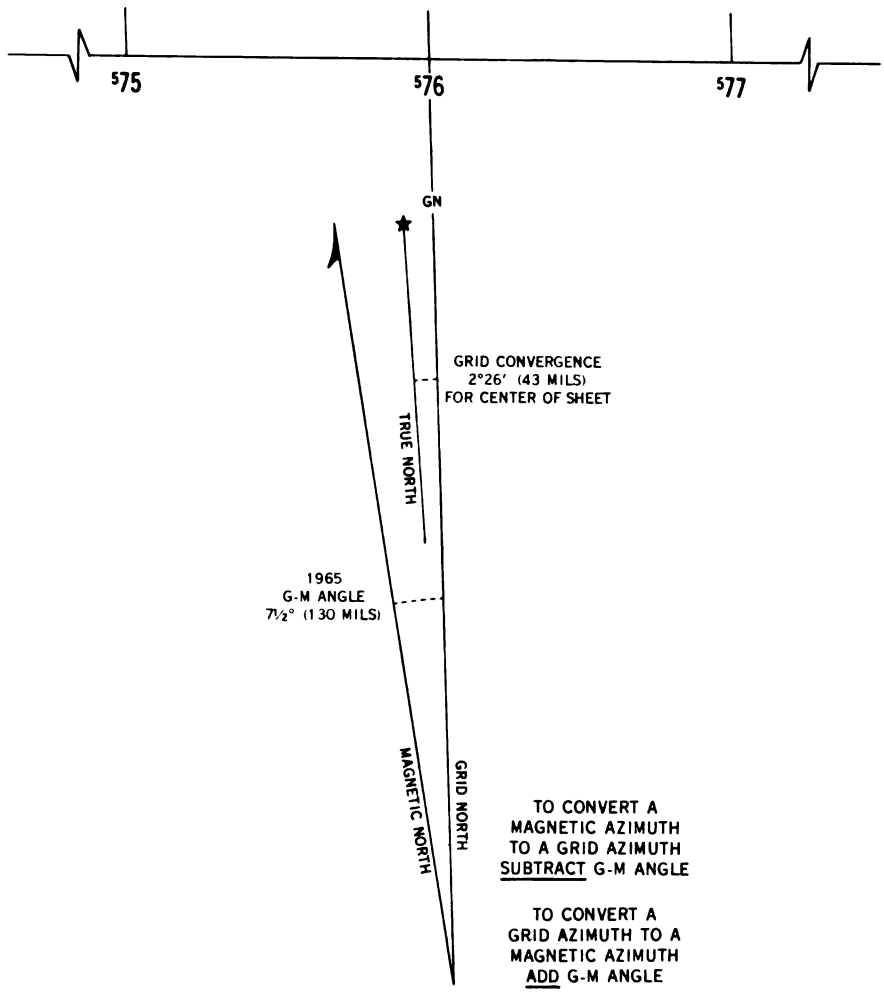


Figure 22. The declination diagram and accompanying notes with true north appearing as the center prong.

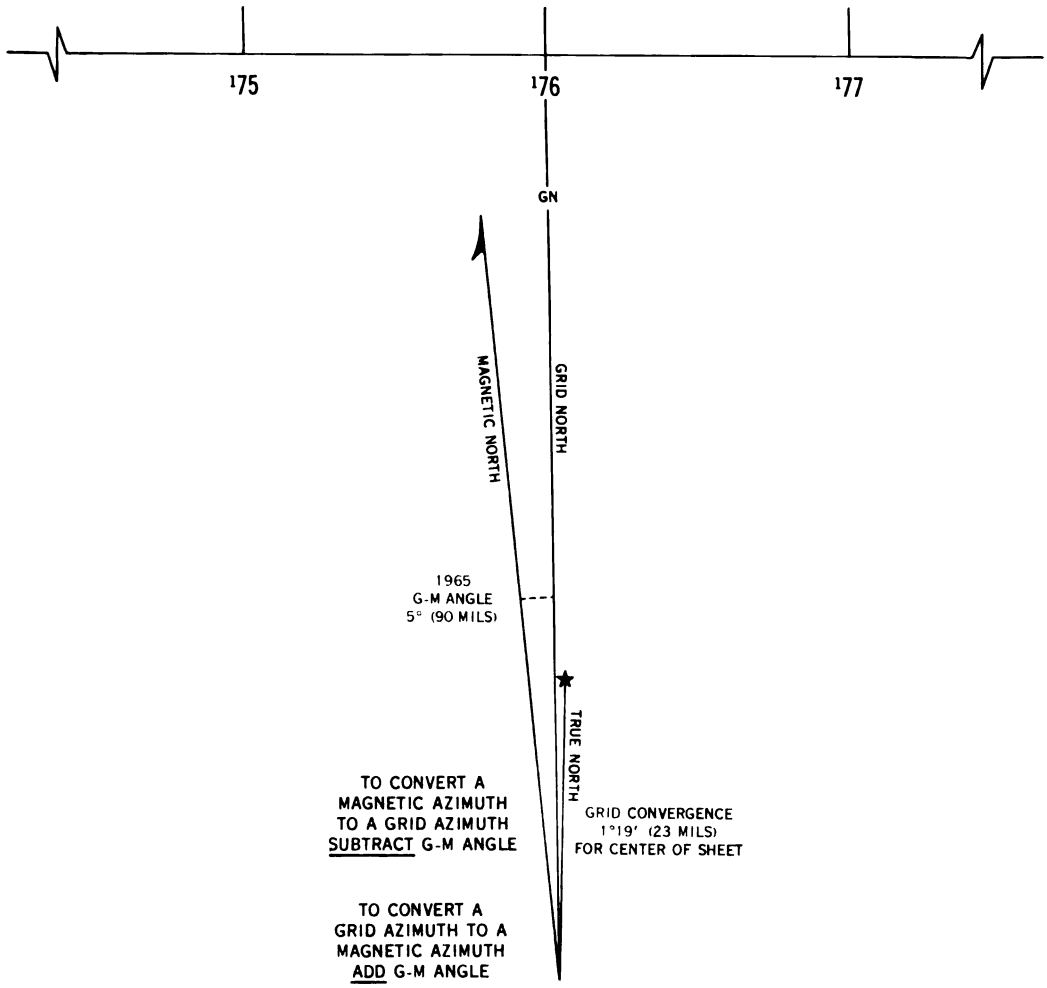


Figure 23. The declination diagram and accompanying notes with true north appearing as an outside prong.

is given for the center of the sheet, and is modeled after the following:

GRID CONVERGENCE
1°19' (23 MILS)
FOR CENTER OF SHEET

(2) In land insets, a diagram is not shown. The grid convergence is shown only when the angle is different from that on the map proper. The convergence angle is given for the center of the inset, and is modeled after the following:

GRID CONVERGENCE FOR THE CENTER OF THE INSET IS 2°36' (40 MILS) WESTERLY

e. Notes appear in conjunction with the diagram explaining the use of the G-M Angle.

(1) When the magnetic north prong of the diagram is east of the grid north prong, the notes read as follows:

TO CONVERT A
MAGNETIC AZIMUTH
TO A GRID AZIMUTH
ADD G-M ANGLE

TO CONVERT A
GRID AZIMUTH TO A
MAGNETIC AZIMUTH
SUBTRACT G-M ANGLE

(2) When the magnetic north prong of the diagram is west of the grid north prong, the notes read as follows:

TO CONVERT A
MAGNETIC AZIMUTH
TO A GRID AZIMUTH
SUBTRACT G-M ANGLE

TO CONVERT A
GRID AZIMUTH TO A
MAGNETIC AZIMUTH
ADD G-M ANGLE

(3) When the magnetic north and grid north prongs are coincident, azimuth conversion notes are omitted.

(4) Azimuth conversion notes are not shown for insets.

f. The diagram and related notes are printed in the same color as the grid values.

33. The Declination Diagram (More Than One Grid)

a. When a sheet bears more than one major grid, or major and overlapping grids, a separate diagram appears for each grid shown on the map. Declination data are not shown for secondary grids. Figure 24 illustrates the declination data shown on a sheet which contains more than one grid.

b. The grid north prong of each diagram is aligned with the easting (vertical) grid lines or grid ticks of the grid to which it pertains. No connection is shown between the grid-north prong and any grid line or grid tick.

c. The composition of each diagram is the same as described in paragraph 32, except—

(1) The diagram is miniaturized, and the three prongs are shown as full lines of the same length.

(2) The minimum plotted angle between any two prongs is three degrees with relative proportions maintained.

(3) Each diagram bears the identification of the grid to which it pertains.

(4) Each diagram and its related notes are printed in the same color as the grid *values* to which they pertain.

34. The Grid Reference Box

a. A grid reference box appears in the margin of each sheet. The box contains instructions and attendant data to enable the user to compose standard grid references. The printing color of the grid reference box is black.

b. The grid system(s) in use on the map dictates the referencing instructions contained in the grid reference box.

(1) For maps having the UTM or UPS grids, AMS Cut No. 140A is used.

(2) For maps having British grids, the appropriate grid reference box and any modifications thereto are specified with each diagram of British grids beginning on page 153.

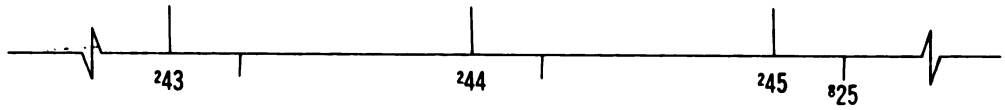
c. The grid reference boxes most commonly used on maps at 1:100,000 scale and larger are shown in figure 25.

d. The *grid reference box* contains instructions for composing a grid reference and provides a step-by-step example referred to a sample point on the map. The selected point is one of the following, listed in order of preference:

(1) A small populated place which is named

(2) A named landmark feature

(3) A horizontal control point



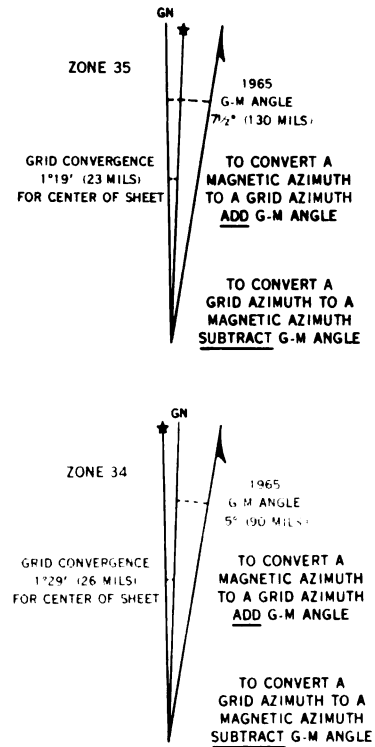
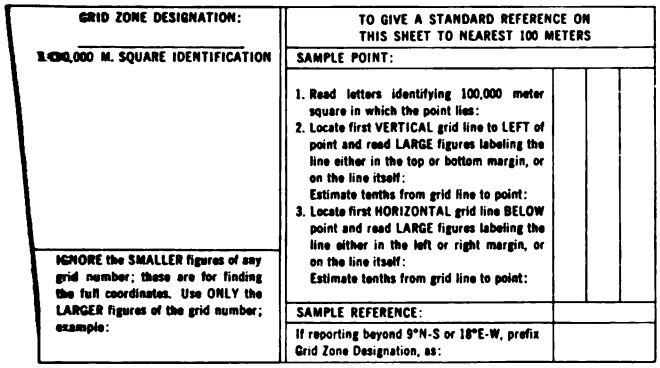
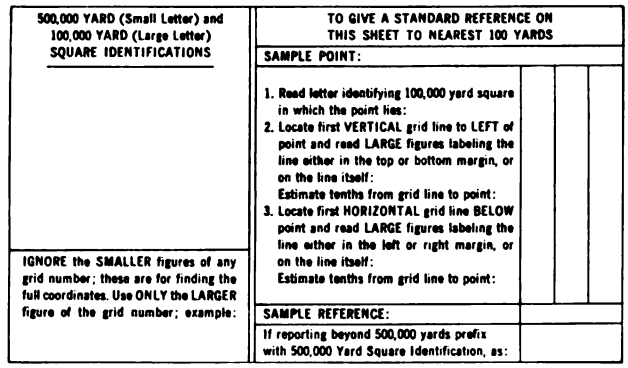


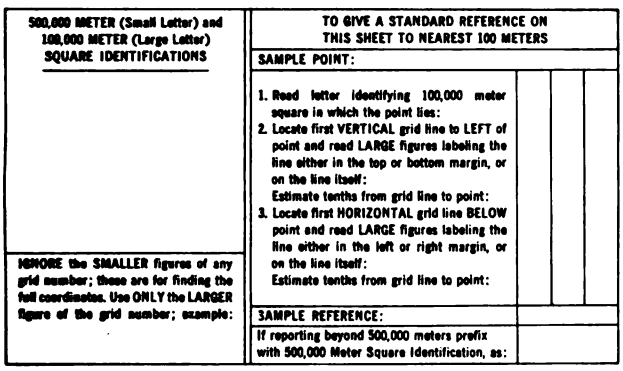
Figure 24. The declination data when a sheet contains an overlapping grid and/or more than one major grid.



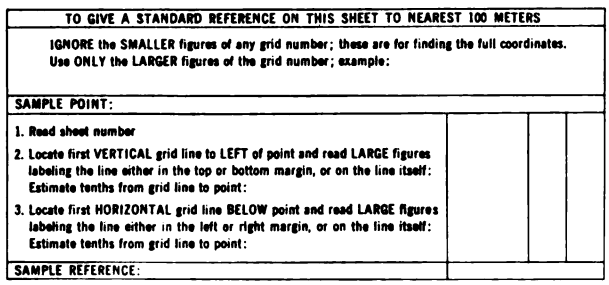
For use with UTM and UPS Grids
(AMS Cut No. 140A)



For use with British Grids which identify
the 500,000 and 100,000 yard squares
(AMS Cut No. 161A)



For use with British Grids which identify
the 500,000 and 100,000 meter squares
(AMS Cut No. 160A)



For use with British Grids which do not
identify the 100,000 unit squares
(AMS Cut No. 16A)

Figure 25. Grid reference boxes most commonly used on maps at scales of 1:100,000 and larger.

(4) A small feature which is named, such as: pond, lake, dam, etc.
(5) A spot elevation
(6) A road, railroad, or stream junction
(7) A projection intersection

e. The grid reference box also contains a miniature representation of the map for defining applicable grid zone designations and grid square identifications.

(1) For the UTM and UPS grids, the miniature representation shows the grid zone designation, the 100,000-meter grid lines and their values in abbreviated form, and the 100,000-meter square identification(s), all printed in black. If the map covers more than one grid zone, the zone designations, and junction lines labeled in degree values, are printed in blue. Figure 26 illustrates the composition of the miniatures under various conditions.

(2) For British grids, the miniature representation shows the 100,000-unit square identifications, and the values of the 100,000-unit grid lines in abbreviated form. These data are printed in the same color as the grid values to which they pertain. If the grid system identifies larger squares, their identifications are shown in smaller type just preceding the 100,000-unit identifications. The 100,000-unit grid lines and grid junction lines are printed in black. If a junction is a grid line, its value is shown in abbreviated form and printed in the same color as the grid values to which it pertains. Loxodromes are not labeled. Figure 27 illustrates the composition of this information under various conditions.

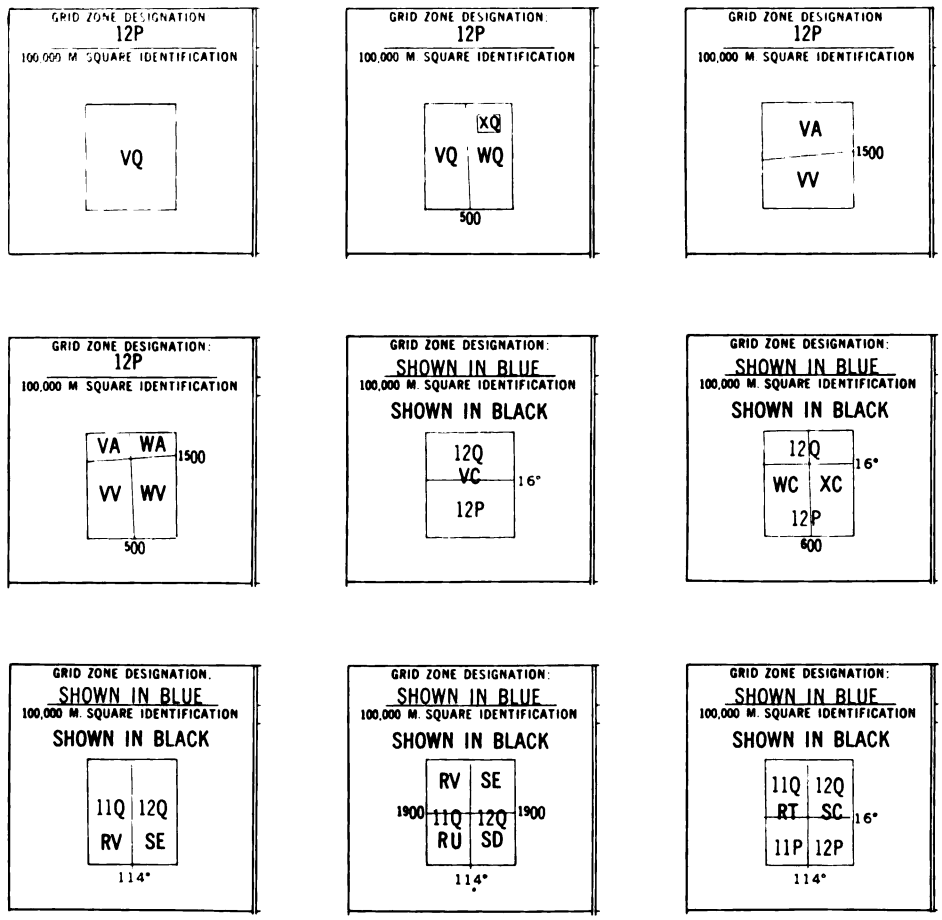


FIGURE 26. Methods of showing grid zone designations and 100,000-meter squares of the UTM in the grid reference boxes of large scale maps.

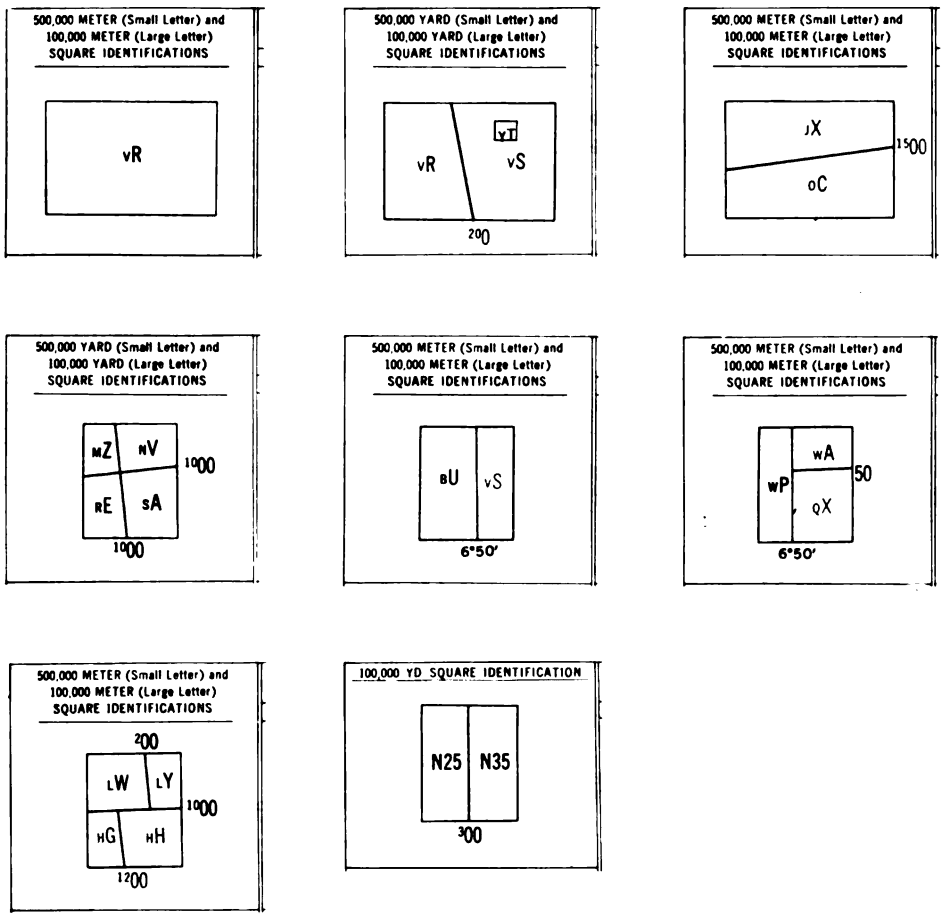


FIGURE 27. Methods of showing 100,000-unit, and larger, square identifications of British grids in the grid reference boxes of large scale maps.

(3) For sheets having a land inset whose 100,000-unit square identification letters differ from those of the map proper, a representation of the inset and its identification letters are included in the grid reference box.

f. When more than one major grid appears on a sheet and the method for giving a reference is the same for all the grids, a common reference box is used.

g. When more than one major grid appears on a sheet and the method for giving a reference varies with the grids, circumstances control the treatment of the grid reference boxes.

(1) A grid reference box is shown in the margin for each grid, except those falling completely in open water areas. Over each box appears a note limiting the use of the box to the grid or grids concerned.

(*a*) When each box describes the method of referencing for one grid only, the note is printed in the same color as the values for its respective grid and is modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

USE THIS BOX FOR GIVING REFERENCES ON THE MADAGASCAR GRID

(*b*) When the same system of referencing is used for two grids (occurring on the same sheet with a third grid which uses a different reference system), the note for the common reference box is printed in black and modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE INDIA ZONE I AND ZONE IIA GRIDS

(2) When all reference boxes cannot be accommodated in the margin, the excess is shown in expanses of open water on the face of the map. When this is not practicable, a note which refers the user to an adjacent sheet is added to a reference box in the margin. This note is positioned below the note described in paragraph *g*(1) above. If only one grid is involved, the note is printed in the same color as the values for that grid. If more than one grid is involved, the note is printed in black. The notes are modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

SEE SHEET 3193 IV FOR GIVING REFERENCES ON THE MADAGASCAR GRID

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

SEE SHEET 3192 I FOR GIVING REFERENCES ON THE INDIA ZONE I AND ZONE IIA GRIDS

SECTION VII

GRIDS ON MAPS AT 1: 250,000 AND 1: 500,000 SCALE

35. General

a. Grid data and grid format for U.S. Army maps at scales of 1:250,000 and 1:500,000 are essentially the same for Universal Transverse Mercator grids, Universal Polar Stereographic grids, and British grids. When possible, sheet lines of maps at these scales are planned to coincide with grid junctions and spheroid junctions.

b. Grids added on Army reprints of maps of other origin adhere as closely as possible to these standards. There may be minor changes in limits of grid zones and variations in the color of grid lines and grid values. The changes and variations are explained, as necessary, in the margin of the map.

c. Grids on maps not prepared for the U.S. Army do not necessarily follow these standards. The variations which exist, however, usually are minor and self-explanatory.

d. The grid data for U.S. Army maps consist of grid lines and values, grid reference boxes, notes identifying the grids, and notes giving the range of magnetic declination over the sheet. Overlapping and extended grids are not shown. In certain cases, secondary grids are shown.

e. Descriptions and illustrations are keyed to 1:250,000 scale, unless otherwise indicated.

f. Specific dimensions, size and style of type, and placement of marginal data relating to grids and grid formats at 1:250,000 scale are shown on Army Map Service Style Sheet AMS 250.

36. The Major Grid

a. The major grid is shown by full lines, printed in blue, at 10,000-unit intervals. The unit is either yards or meters. Every 100,000-unit grid line is accentuated in weight.

b. Grid values appear outside the neatline on all four sides of the sheet, labeling each grid line.

c. Where a grid line coincides with a neatline of the map, the grid line is omitted but the neatline is labeled with the values for the grid line. Except for the values labeling the first grid line in each direction from the southwest corner of the sheet, the last four digits (0000) of the values are omitted. The values are shown in two sizes of type, with the larger size being reserved for the principal digits.

(1) With most grids, *one* principal digit is used. This represents the 10,000 digit of the grid values.

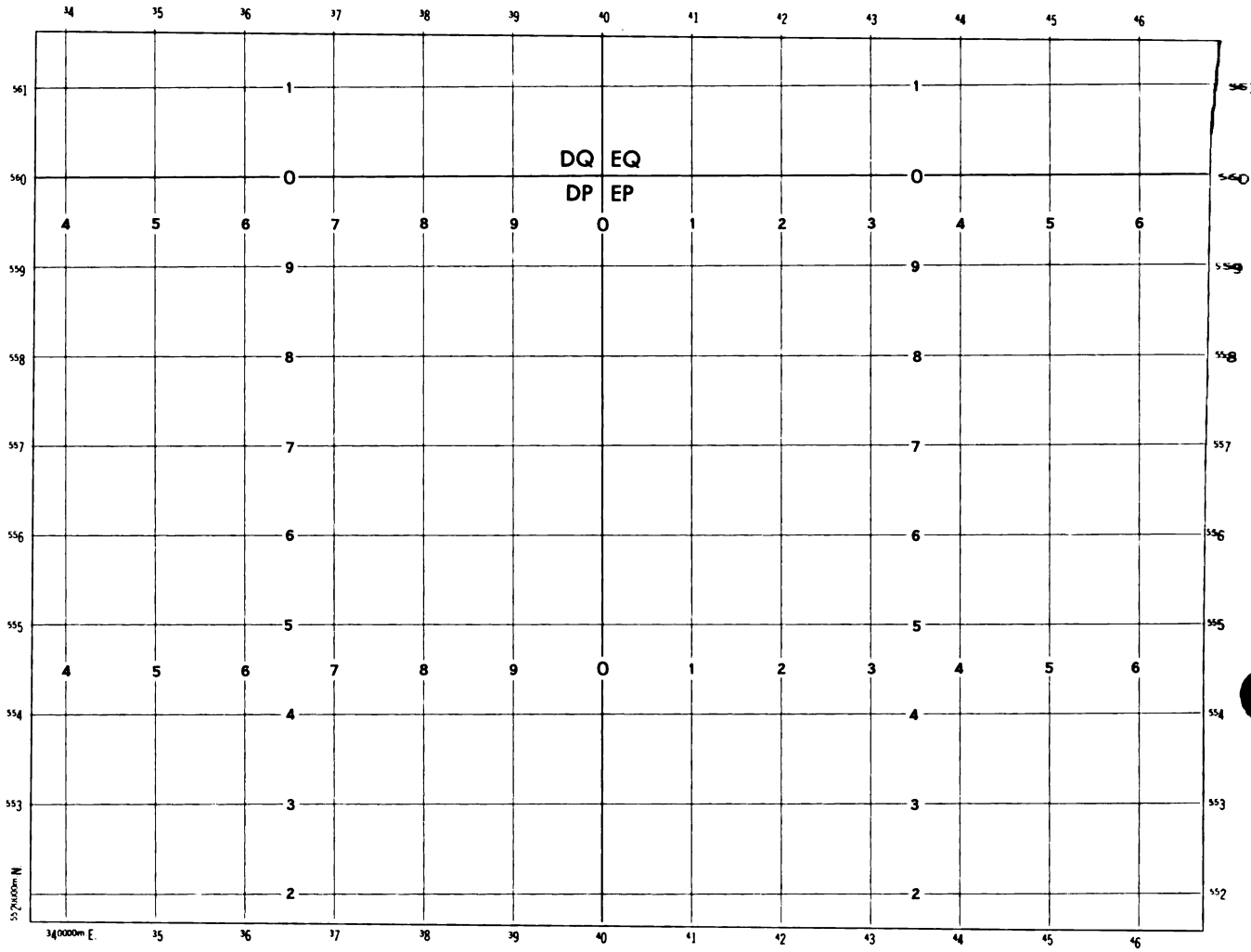
(2) *Two* principal digits are used with the Madagascar and French Lambert grids, and the Ceylon Belt. These represent the 100,000 and 10,000 digits of the grid values.

d. At 1:250,000 scale a grid ladder is shown in the interior of the map. The grid ladder is an established pattern of *columns* and *rows* of grid values, expressed in principal digits only. Positioning of the columns and rows is described below; figure 28 illustrates this treatment.

(1) Two columns of values are shown centered on the northing grid lines. One column is positioned midway between the two easting grid lines nearest to one-fourth of the east-west extent of the sheet, as measured from the center of the west neatline. The other column is positioned similarly from the center of the east neatline.

(2) Two rows of ladder values are centered on the easting grid lines. One row is positioned midway between the two northing grid lines nearest to one-fourth of the north-south extent of the sheet, as measured from the center of the north neatline. The other row is positioned similarly from the center of the south neatline.

(3) In areas of dense detail, a ladder number may be moved along a grid line a maximum of one-fourth of the grid interval, or omitted if it impairs the legibility of the map. Omissions are held to a minimum.



BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 32, INTERNATIONAL SPHEROID

Scale 1:250,000 (in miniature)

Figure 28. Treatment for the major grid in UTM areas as shown on a 1:250,000 map.

(4) At the intersection of two 100,000-unit grid lines the appropriate unit square identification letters are always shown. When this intersection coincides with a neatline, only those identification letters falling *inside* the neatline are shown. Identification letters are similarly shown—inside the neatline—when the intersection of a 100,000-unit line with a grid or spheroid junction line coincides with a neatline.

(5) For British grids which identify 100,000-unit and 500,000-unit squares, the 500,000-unit identification letter appears in smaller size immediately before the 100,000-unit square identification letter.

e. At 1:500,000 scale, the locations of the columns, rows, and 100,000-unit square identification letters differ from those of the 1:250,000 scale.

(1) Ladder values comprising the *rows* are shown centered on easting grid lines midway between the 100,000-unit northing lines and the first lines to the north. Ladder values comprising the *columns* are shown centered on northing lines midway between the 100,000-unit easting lines and the first lines to the east.

(2) The 100,000-unit identifications are shown centered in each 100,000-unit square.

(3) For British grids which also identify larger grid squares—such as the 500,000-unit squares—the additional identifications appear in smaller type immediately before each 100,000-unit square identification.

(4) Figure 29 illustrates the treatment of the major grid at 1:500,000 scale.

f. The color of the grid values and ladder values is governed by the grid system.

(1) Blue is used when the grid system is either the Universal Transverse Mercator or the Universal Polar Stereographic.

(2) With British grids, the color varies—black, purple, blue, brown, or red—as specified in the pages following plate III. Sheets of British origin adhere to these color conventions. On U.S. Army reprints black is substituted for purple to eliminate a color.

g. A grid note printed in the same color as the values for the major grid appears in the lower margin of each sheet to identify the grid. The note is modeled after the following:

BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 40, BESSEL SPHEROID

RED NUMBERED LINES INDICATE THE 10,000 YARD MADAGASCAR GRID, INTERNATIONAL SPHEROID

BLACK NUMBERED LINES INDICATE THE 10,000 METER INDIA ZONE IIA GRID, EVEREST SPHEROID

(1) On sheets having land insets for which the grid or grid zone differs from that of the map proper, the appropriate grid note is shown within the inset.

(2) On maps of British origin, in addition to identifying the grid, interval, and spheroid, the note usually describes the projection, origin, false coordinates of the origin, and the scale factor of the grid.

37. Multiple Major Grids

a. In certain instances a sheet contains more than one major grid. See paragraph 3 for an explanation of "Multiple Major Grids".

(1) With the UTM and UPS grids, this may occur—

(*a*) Where original sheet lines are retained as established by a mapping agency of a foreign country.

(*b*) Where a sheet is shifted from the normal position to avoid making additional sheets.

(*c*) In higher latitudes, where sheets may be wide in longitudinal extent.

(2) With British grids, this condition occurs more frequently since, in addition to the above cases, grid junctions are sometimes loxodromes or are grid lines not coincident with parallels or meridians.

b. Grid and zone junctions are indicated by accentuated lines printed in blue. Labels identifying the grid systems appear on each side of the grid junction line. The labels may appear more than once to facilitate identification. The labels are printed in the same color as those used for the values for the particular grids. Where a grid junction line is coincident with a neatline, both

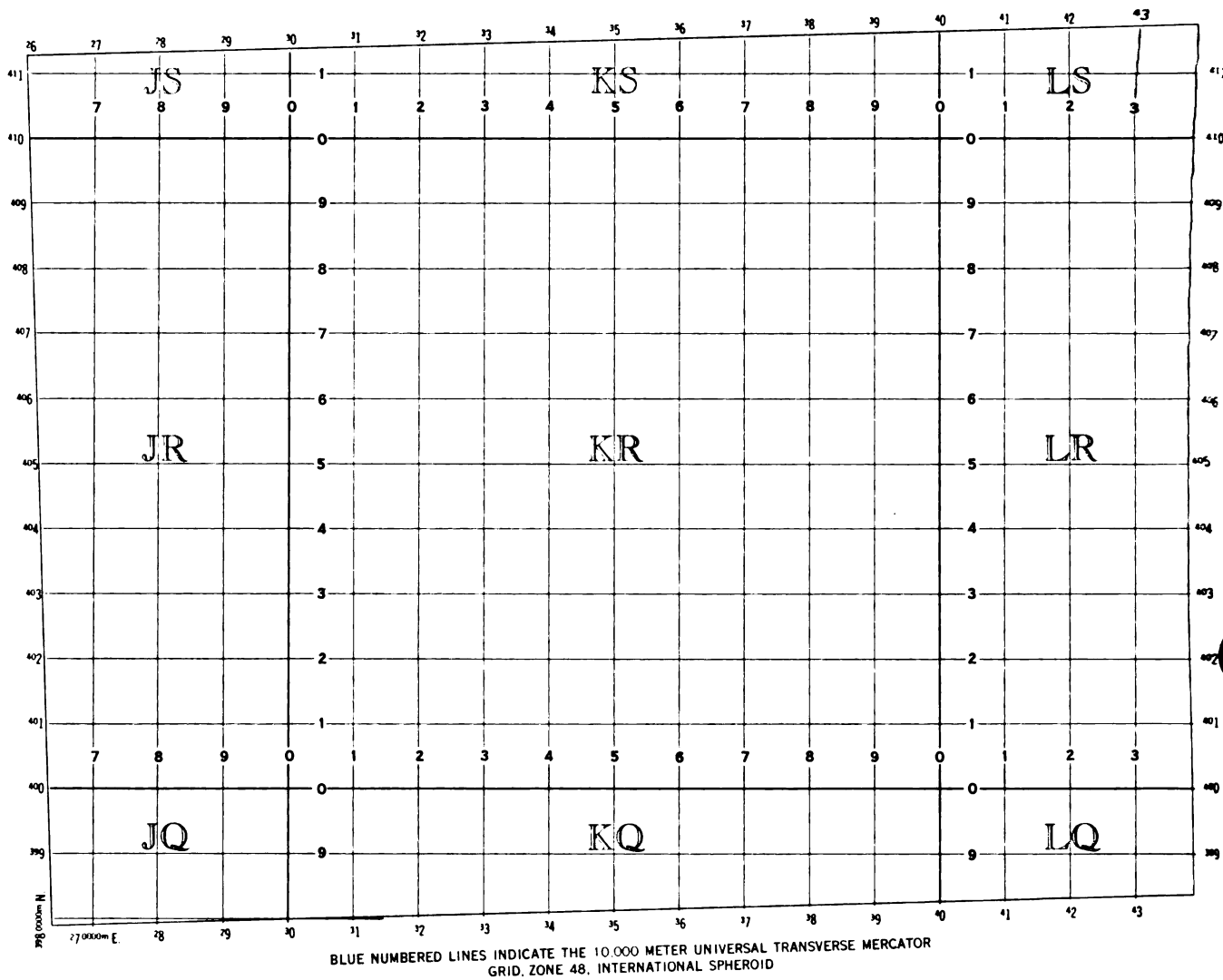


Figure 29. Treatment for the major grid in UTM areas as shown on maps smaller than 1:250,000 scale and larger than 1:1,000,000.

the junction line and the identifying labels are omitted.

(1) For British grids, the labels are modeled after the following:

NORTHWEST AFRICA ZONE GRID

INDIA ZONE IV B GRID

MADAGASCAR GRID

(2) The label for a UTM grid zone or a UPS grid includes the identification of the grid Zone Designation and is written as—

UTM GRID ZONE DESIGNATION: 47T

UPS GRID ZONE DESIGNATION: B

c. Each grid is shown by full lines within its own area, and is represented in the normal manner at 10,000-unit intervals with every 100,000-unit line accentuated in weight. All grid lines are printed in blue.

d. Grid values appear on all four sides of the sheet (outside the neatline) labeling each grid line. The composition of the numbers is similar to that described in paragraphs 36 *b* and *c*, except that full grid values label the first grid line in each direction from each corner of the sheet.

e. On maps at 1:250,000 scale, the grid ladder values are shown as prescribed in paragraph 36 *d*. Departures in labeling are often necessary when two or more major grids are shown. At least one row and one column of identifications are shown within the areal extent of each grid; the normal labeling plan is followed when practical.

f. Where appropriate for the grid, at 1:250,000 scale, identification of 100,000-unit squares and larger unit squares appear on the face of the map at all 100,000-unit grid line intersections as described in paragraph 36 *d*. The unit square identifications appear in the same color as the grid values.

g. The colors of the grid values are the same for any one grid, but vary with different grids.

(1) For zones of the UTM grid, the grid values appear in blue.

(2) For the UTM and UPS grids, the values for the grids appear in blue and brown. Blue is usually reserved for the grid which occurs most frequently on the sheets in the general area.

(3) For British grids, the values appear in the colors specified for the particular grids as described in paragraph 36 *f*(2). Where the prescribed colors are the same for more than one grid, one or more substitutions are made to emphasize distinction. Usually, the conventional color is retained for the grid which occurs most frequently on the sheets in the general area. Substitute colors generally are black, blue, brown, or red, in order of preference.

(4) Blue usually is used for the UTM or UPS grids when either appears in combination with British grids. In this case, if the conventional color of a British grid is blue, a substitution of color for the British grid is made, with black, brown, or red being used, in order of preference.

h. Notes identifying each grid appear in the lower margin of the sheet. These are printed in the same color as that used for the values for the grid each identifies.

(1) When the grids are different zones of the UTM grid, the note is modeled after the following:

BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONES 41 AND 42, BESSEL SPHEROID

(2) When more than one grid is involved, the notes are modeled after the following:

BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 47, INTERNATIONAL SPHEROID

BROWN NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL POLAR STEREOGRAPHIC GRID, NORTH, ZONE Y, INTERNATIONAL SPHEROID

BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 48, INTERNATIONAL SPHEROID

RED NUMBERED LINES INDICATE THE 10,000 YARD MADAGASCAR GRID, EVEREST SPHEROID

i. Figures 30 and 31 illustrate these principles.

j. In certain isolated cases, a sheet falling in a UTM grid area may straddle a spheroid junction. On the map the grids for the two spheroids are treated in the same manner as that used for sheets straddling grid junctions. In addition, type identifying each spheroid is added parallel to the junction line. All items normally are printed in blue. Figure 32 illustrates these principles. A note

printed in the same color as the grid values appears in the lower margin of each sheet to identify the grids, spheroids, and zones. It is modeled after the following:

BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 49, EVEREST SPHEROID, AND ZONE 49, INTERNATIONAL SPHEROID

k. In certain isolated cases, a sheet bearing the UTM grid may straddle a parallel which marks the division between different Grid Zone Designations. The grid and appertaining labeling appear as previously described. A continuous line in black indicates the dividing parallel. The proper Grid Zone Designations, printed in the same color as the grid values, appear on each side of the line. The dividing parallel is omitted when it falls within 0.10 inch (2.5 mm) of the north or south neatlines. Figure 33 illustrates these principles.

38. Overlapping and Extended Grids

Overlapping and Extended grids are not shown on maps at these scales.

39. Secondary Grids

a. As used herein, the term "secondary grids" implies those British or other grids which have become obsolete or are in the process of becoming obsolete. As a general rule, secondary grids are no longer required on military topographic maps. Excepted are those instances where mapping agreements with cooperating foreign agencies specify the showing of a secondary grid.

b. When required, the secondary grid is shown by inside ticks emanating from the neatline in their correct declination, printed in blue, and spaced at 10,000-unit intervals. The 100,000-unit ticks are accentuated in weight.

c. Values, similar in composition to those labeling the major grid lines, appear on all four sides of the sheet. The first grid tick in each direction from the southwest corner of the sheet is labeled with full values. Thereafter, only those grid ticks whose values are multiples of 50,000 are labeled. If the secondary grid is a British grid, prescribed colors are used (para 36*f*(2)), unless there is a conflict with another grid shown on the map. In that event, a substitution is made for the secondary grid. Substitutions, in order of preference, are black, brown, or red.

d. A note appears in the lower margin of each sheet to identify the secondary grid. It is printed in the same color as that used for the values of the grid it identifies and is modeled after the following:

BROWN NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 10,000 YARD INDIA ZONE IV A GRID, EVEREST SPHEROID

e. The principles outlined above are illustrated in figure 34.

f. If a sheet includes areas of more than one secondary grid, only one secondary grid is shown. This is extended over the entire sheet. Usually, the secondary grid shown is that which covers the major portion of the sheet. If the sheet is divided equally by more than one secondary grid, the one shown is that which occurs on most of the sheets in the area.

40. The Grid Reference Box

a. A grid reference box appears in the margin of each sheet. The box contains instructions and attendant data to enable the user to compose standard grid references. The printing color of the grid reference box is blue.

b. The grid system (s) in use on the map dictates the referencing instructions contained in the grid reference box.

(1) For maps having the UTM or UPS Grids, AMS Cut No. 141A is used.

(2) For maps having British grids, the appropriate grid reference box and any modifications thereto are specified with each diagram of British grids beginning on page 153.

c. The grid reference boxes most commonly used on maps having a grid interval of 10,000-units are shown in figure 35.

d. The *grid reference box* contains instructions for composing a grid reference and provides a step-by-step example referred to a sample point on the map. The selected point is one of the following, listed in order of preference:

(1) A small populated place which is named
(2) A named landmark feature
(3) A horizontal control point
(4) A small feature which is named, such as: pond, lake, dam, etc.
(5) A spot elevation
(6) A road, railroad, or stream junction
(7) A projection intersection

e. The grid reference box also contains a miniature representation of the map for defining applicable grid zone designations and grid square identifications.

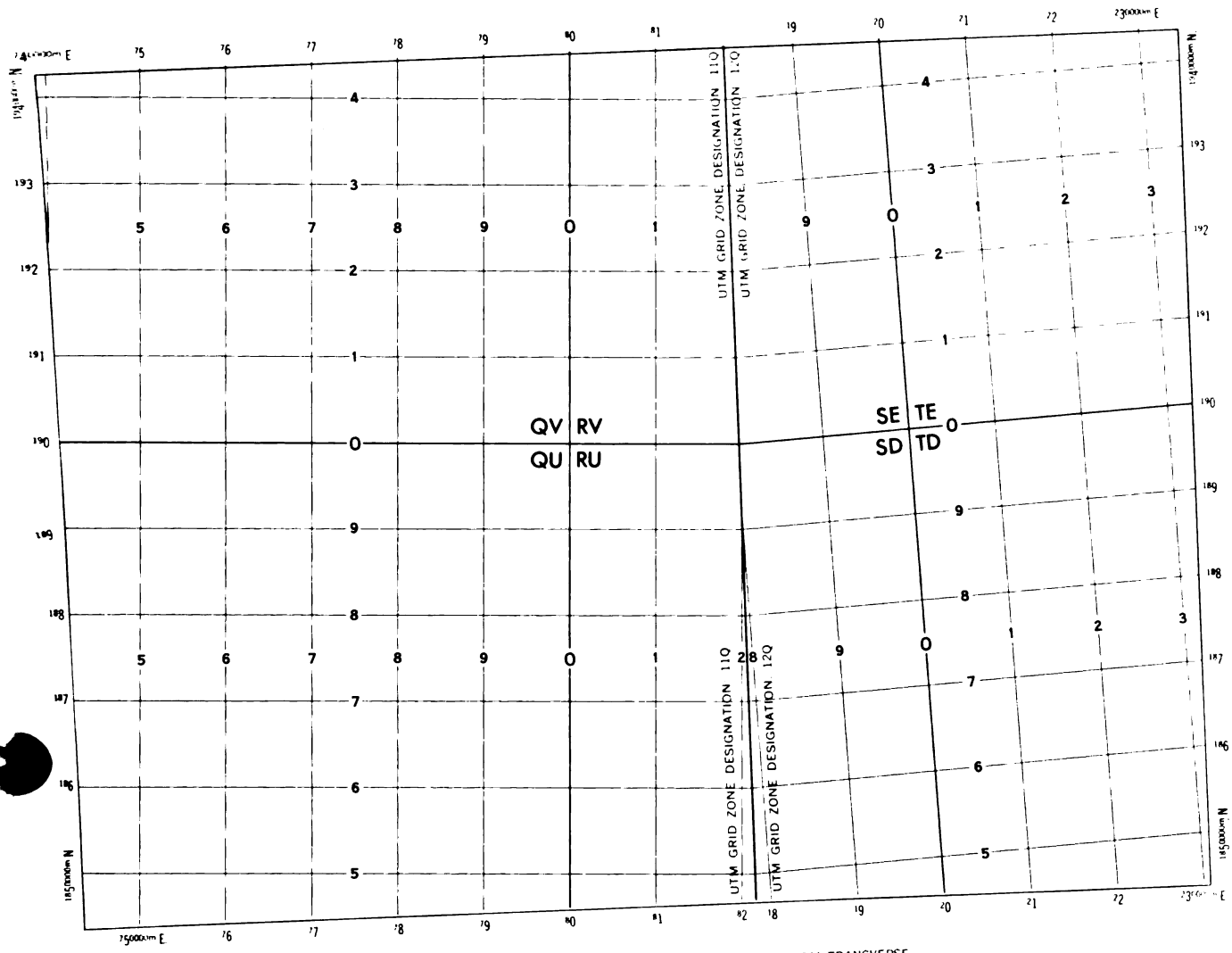
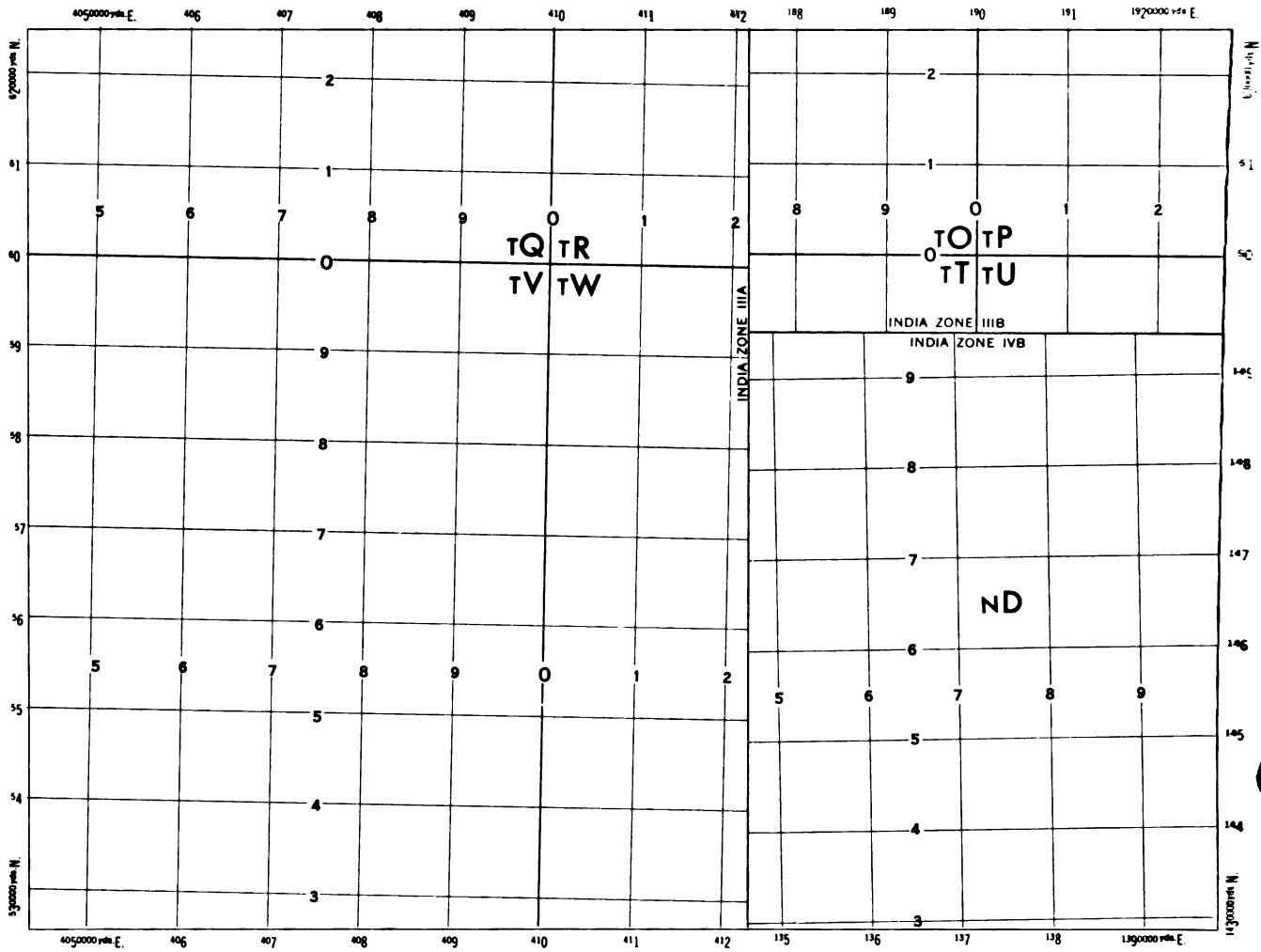


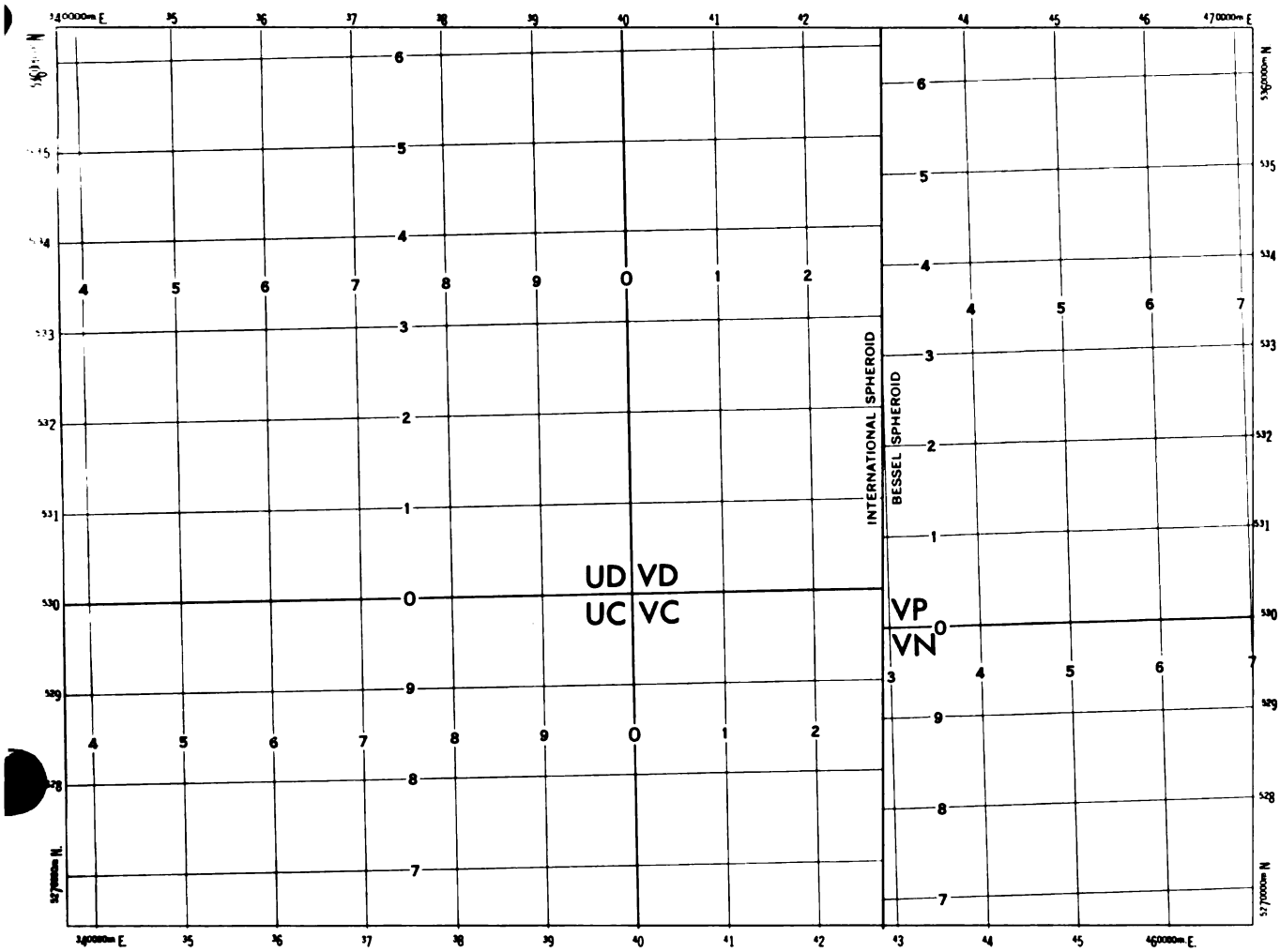
Figure 30. Two major UTM grid zones separated by a grid junction as shown on a 1:250,000 scale map.



BLACK NUMBERED LINES INDICATE THE 10,000 YARD INDIA ZONE IIIA GRID, EVEREST SPHEROID
BLUE NUMBERED LINES INDICATE THE 10,000 YARD INDIA ZONE IVB GRID, EVEREST SPHEROID
BROWN NUMBERED LINES INDICATE THE 10,000 YARD INDIA ZONE IIIB GRID, EVEREST SPHEROID

Scale 1:250,000 (in miniature)

Figure 31. Three major British grids separated by grid junctions as shown on a 1:250,000 scale map.



BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 45, BESSEL SPHEROID; AND ZONE 45, INTERNATIONAL SPHEROID

Scale 1:250,000 (in miniature)

Figure 32. Two major grids (UTM) separated by a spheroid junction as shown on a 1:250,000 scale map.

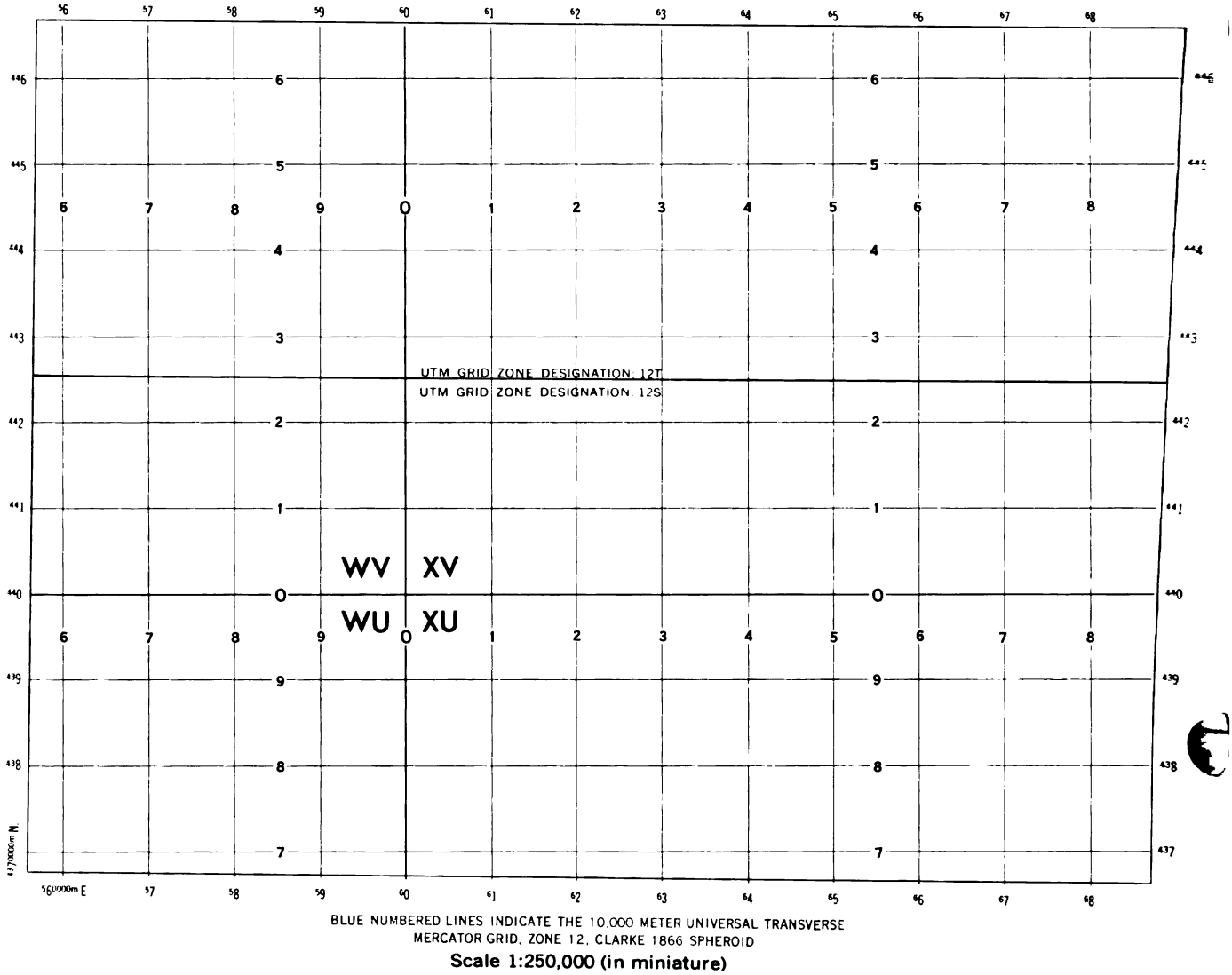
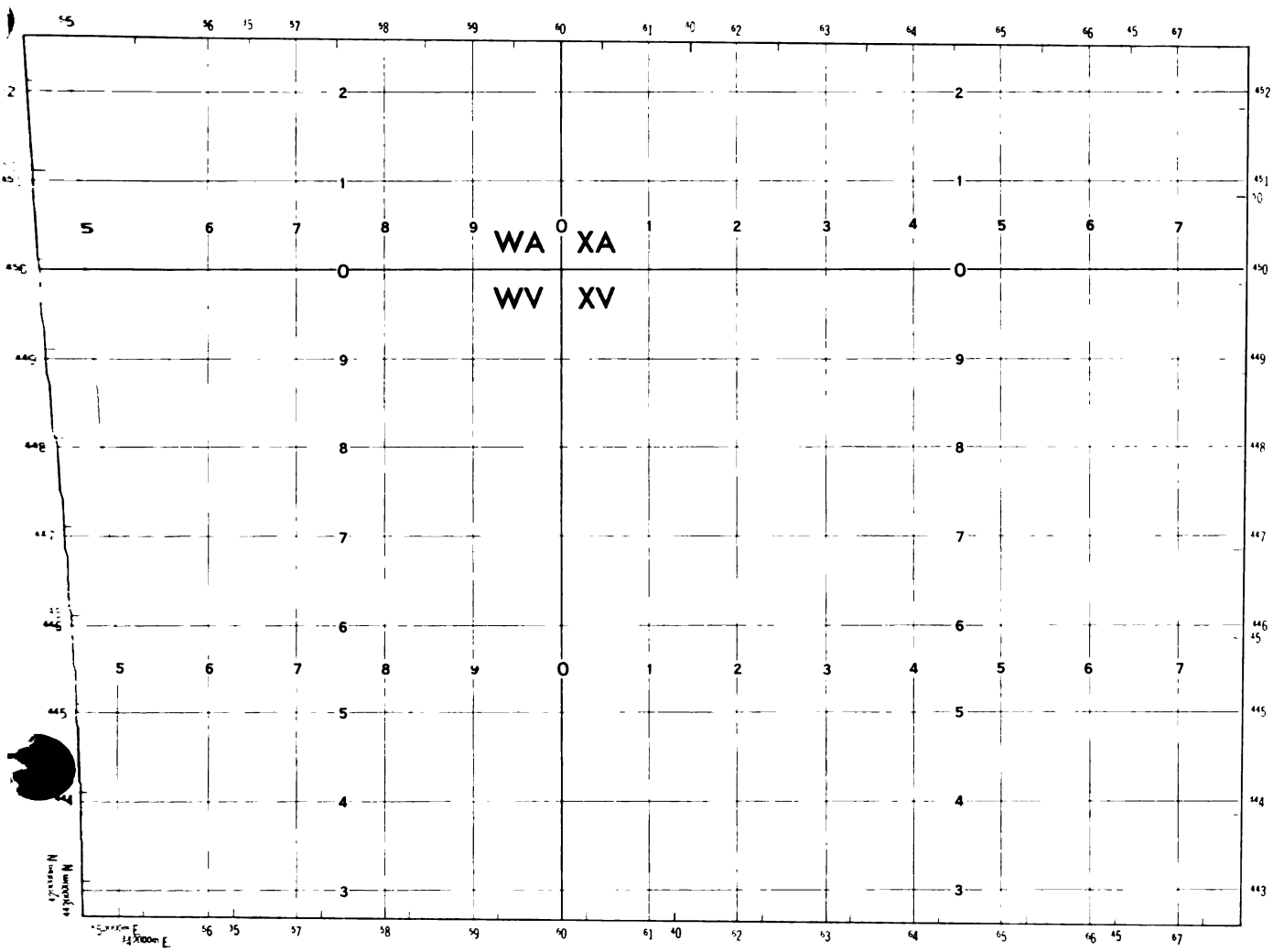


Figure 33. Treatment when grid falls within more than one UTM grid zone designation area as shown on a 1:250,000 scale map.

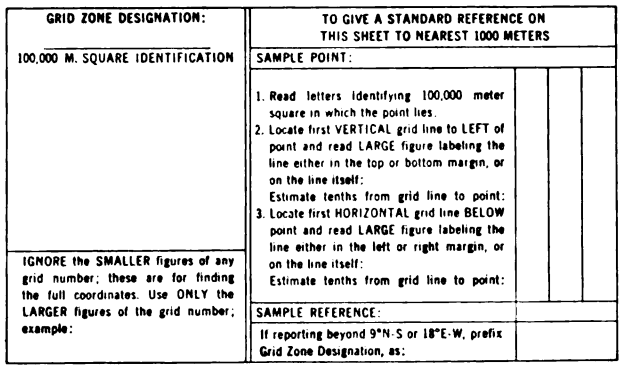


BLUE NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 30, INTERNATIONAL SPHEROID

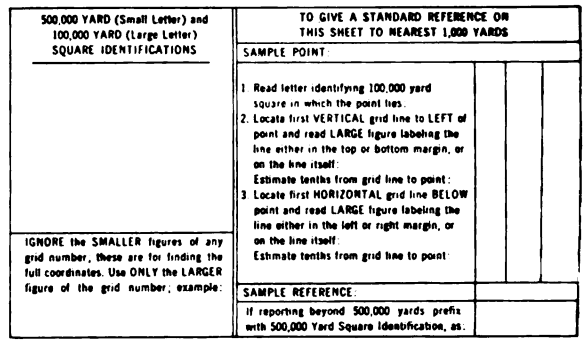
RED NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 10,000 METER NORTH SAHARA ZONE GRID CLARKE 1880 SPHEROID

Scale 1:250,000 (in miniature)

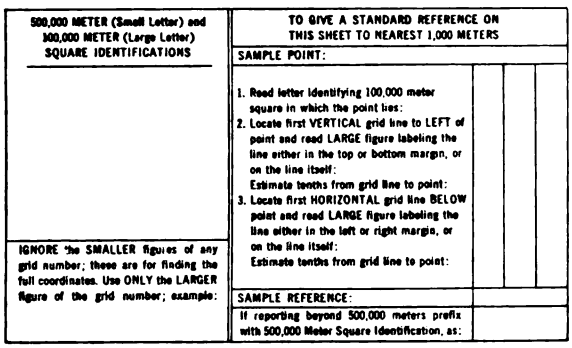
Figure 34. Major and secondary (obsolete) grids as shown on a 1:250,000 scale map.



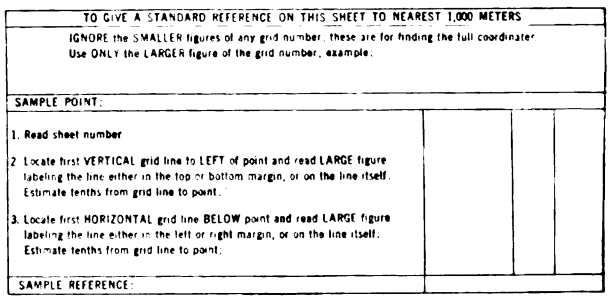
For use with UTM and UPS Grids.
(AMS Cut No. 141A)



For use with British Grids which identify the 500,000 and 100,000 yard squares.
(AMS Cut No. 163A)



For use with British Grids which identify the 500,000 and 100,000 meter squares.
(AMS Cut No. 162A)



For use with British Grids which do not identify the 100,000 unit squares.
(AMS Cut No. 7A)

Figure 35. Grid reference boxes most commonly used on maps at 1:250,000 and 1:500,000 scale.

(1) For the UTM and UPS grids, the miniature representation shows the grid zone designation, the 100,000-meter grid lines and their values in abbreviated form, and the 100,000-meter square identification(s), all printed in blue. If the map covers more than one grid zone, the zone designations, and junction lines labeled in degree values, are printed in black. Figure 36 illustrates the composition of the miniatures under various conditions.

(2) For British grids, the miniature representation shows the 100,000-unit square identifications, and the values of the 100,000-unit grid lines in abbreviated form. These data are printed in the same color as the grid values to which they pertain. If the grid system identifies larger squares, their identifications are shown in smaller type just preceding the 100,000-unit identifications. The 100,000-unit grid lines and grid junction lines are printed in blue. If a junction is a grid line, its value is shown in abbreviated form and printed in the same color as the grid values to which it pertains. Loxodromes are not labeled. Figure 37 illustrates the composition of this information under various conditions.

(3) For sheets having a land inset whose 100,000-unit square identification letters differ from those of the map proper, a representation of the inset and its identification letters are included in the grid reference box.

f. When more than one major grid appears on a sheet and the method for giving a reference is the same for all the grids, a common reference box is used.

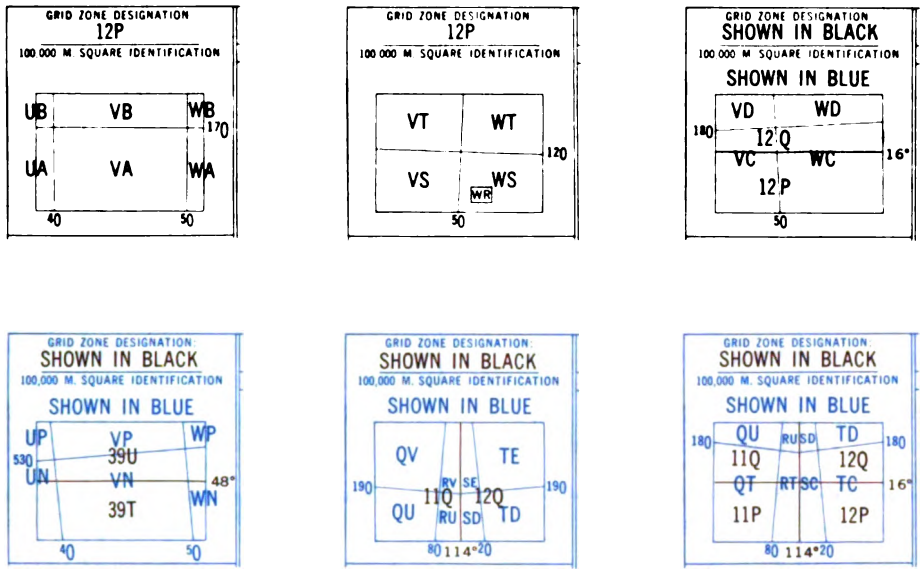
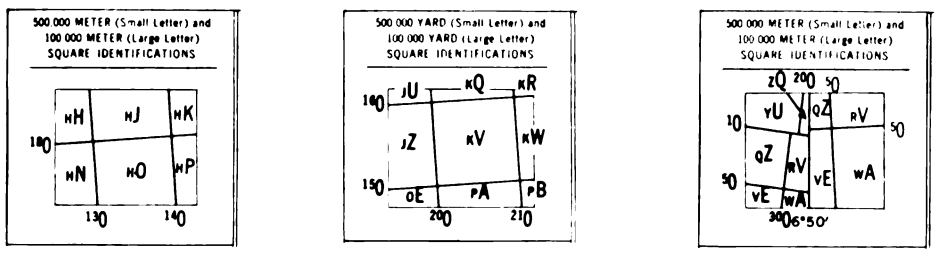


Figure 36. Methods of identifying grid zone designations and 100,000-meter squares of the UTM grid in the reference boxes of maps containing a 10,000-meter grid interval.



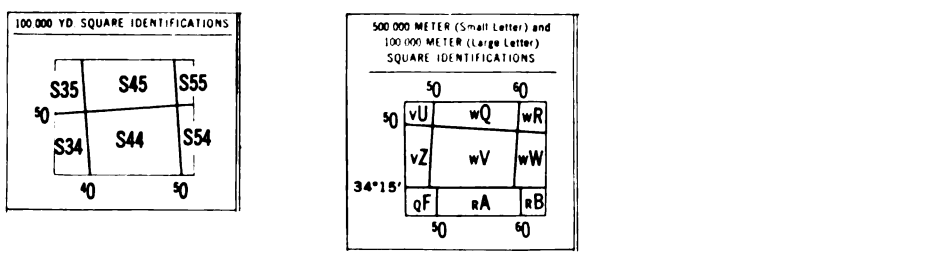
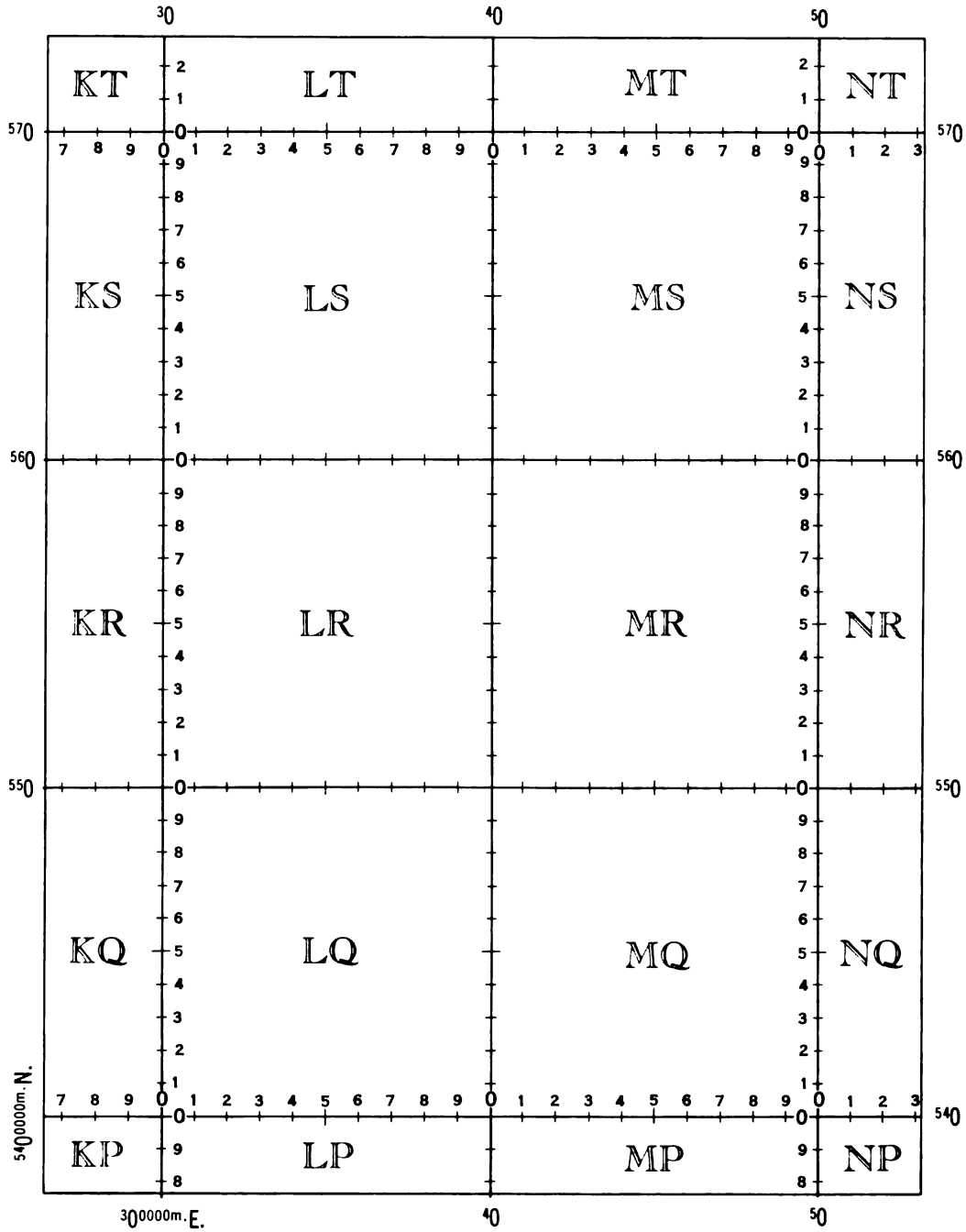


Figure 37. Methods of showing 100,000-unit, and larger, square identifications of British grids in the reference boxes of maps containing a 10,000-unit interval.



BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 38, INTERNATIONAL SPHEROID

Scale 1:1,000,000 (in miniature)

Figure 38. Treatment for the major grid in UTM areas as shown on maps at 1:1,000,000 scale.

g. When more than one major grid appears on a sheet and the method for giving a reference varies with the grids, circumstances control the treatment of the grid reference boxes.

(1) A grid reference box is shown in the margin for each grid, except those falling completely in open water areas. Over each box appears a note limiting the use of the box to the grid or grids concerned.

(*a*) When each box describes the method of referencing for one grid only, the note is printed in the same color as the values for its respective grid and is modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

USE THIS BOX FOR GIVING REFERENCES ON THE MADAGASCAR GRID

(*b*) When the same system of referencing is used for two grids (occurring on the same sheet with a third grid which uses a different reference system), the note for the common reference box is printed in blue and modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE INDIA ZONE I AND II A GRIDS

(2) When all reference boxes cannot be accommodated in the margin, the excess is shown in expanses of open water on the face of the map. When this is not practicable, a note which refers the user to an adjacent sheet is added to a reference box in the margin. This note is positioned below the note described in paragraph *g*(1) above. If only one grid is involved, the note is printed in the same color as the values for that grid. If more than one grid is involved, the note is printed in blue. The notes are modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

SEE SHEET NE 35-12 FOR GIVING REFERENCES ON THE MADAGASCAR GRID

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

SEE SHEET NJ 43-14 FOR GIVING REFERENCES ON THE INDIA ZONE I AND II A GRIDS

41. Grid Declination

Grid declinations from true north are not shown on maps at these scales.

42. Magnetic Declination

a. In the margin of each sheet a note is shown to give the magnetic declination, usually for the centers of the west and east edges of the sheet. The declination is expressed to the nearest ½ degree, with mil equivalents to the nearest 10 mils.

(1) The declination is obtained from the latest isogonic data for a standard epoch (i.e., a year that is divisible by five, such as 1965, 1970, etc.).

(2) No reference is made to the annual magnetic change.

b. The note is printed in black and is modeled after the following:

1965 MAGNETIC DECLINATION FROM TRUE NORTH VARIES FROM 1½° (30 MILS) WESTERLY FOR THE CENTER OF THE WEST EDGE TO 2° (40 MILS) WESTERLY FOR THE CENTER OF THE EAST EDGE

c. On sheets where there is no variation between the east and west edges, the note is modeled after the following:

MAGNETIC VARIATION FOR 1965 IS 1½° (30 MILS) WESTERLY OVER THE ENTIRE AREA

d. For land insets, grid-magnetic data are shown only when it differs from that of the map proper. The data are shown by a note modeled after the following:

MAGNETIC VARIATION FOR 1965 IS 1½° (30 MILS) WESTERLY OVER THE ENTIRE INSET

SECTION VIII

GRIDS ON MAPS AT 1:1,000,000 SCALE

43. General

a. Grid data and grid formats on maps prepared for the U.S. Army at the 1:1,000,000 scale generally appear as described in this chapter. Except for minor differences, which are explained, the design is essentially the same for Universal Transverse Mercator grids, Universal Polar Stereographic grids, and British grids.

b. Grids added on U.S. Army reprints of maps of other origin are made to adhere as closely as possible to these standards; there may be minor changes in limits of grid zones and variations in the color of grid lines and grid values. The changes and variations are explained, as necessary, in the margin of the sheet.

c. Grids on maps not prepared for the U.S. Army may not follow these standards. The variations however, usually are minor and self-explanatory.

d. The maps usually show grid lines and grid ticks, their values, grid reference boxes, and notes identifying the grids. Overlapping, extended and secondary grids are not shown.

44. The Major Grid

a. The major grid is shown by full lines at 100,000-unit intervals, intersected by ticks at 10,000-unit intervals. The 50,000-unit ticks are accentuated in length. Where a grid line coincides with a neatline of the map, the grid line and its intersecting ticks are omitted; however, the neatline is labeled in the margin with the values for the grid line.

b. Grid numbers appear on all four sides of the sheet, outside the neatline, labeling each grid line. Except for the values labeling the first grid line in each direction from the southwest corners of the sheet, the last four digits (0000) of the values are omitted. The values are shown in two sizes of type, with the larger size being used for the principal digits.

(1) With most grids, *one* principal digit is used. This represents the 10,000 digit of the grid values.

(2) *Two* principal digits are used with the Madagascar and French Lambert grids, and the Ceylon Belt. These represent the 100,000 and 10,000 digits of the grid values.

c. On the face of the map, the grid lines and ticks are identified with their values expressed in principal digits only. See figure 38.

(1) Two columns of values are shown. The first full easting grid lines from the east and the west neatlines are selected for ladder numbering.

(2) Similarly, two rows of values are shown. The first full northing grid lines from the north and the south neatlines are selected for ladder numbering.

(3) The principal digits labeling the 10,000-unit ticks are positioned beside their respective ticks on the interior side of the map. The principal digits labeling the 100,000-unit intersections are centered on their respective grid lines and aligned with the rows and columns of values labeling the grid ticks. When two principal digits are used, only the even numbered lines and ticks are identified.

d. When the grid system is one which identifies its 100,000-unit squares, the identifications appear on the face of the map, centered within the appropriate squares. If the system is a British grid which also identifies larger grid squares or areas—500,000-unit squares, for example—the additional identifications appear on the face of the map in smaller type immediately before each 100,000-unit square identification.

e. Blue is used for all grid information, including grid lines, grid ticks, 100,000-unit square identifications, grid values, and all marginal grid information.

f. A note, printed in blue, appears in the lower margin of each sheet to identify the grid. The note is modeled after the following:

BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 37, INTERNATIONAL SPHEROID

BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE MADAGASCAR GRID, INTERNATIONAL SPHEROID

g. On maps having a land inset for which the grid or grid zone differs from that of the map proper, the appropriate grid note is shown within the inset.

h. Figure 38 illustrates these principles.

45. Sheets Containing More Than One Major Grid

a. In many instances, a sheet contains more than one major grid. This occurs especially in the higher latitudes, where sheets are wide in longitudinal extent, and in areas covered by British grids, where grid junctions are not necessarily coincident with parallels or meridians. See paragraph 3.

b. Grid and zone junctions are indicated by accentuated lines, labeled on each side. The labels, printed in blue, identify the grids. The labels are shown parallel to the junction line and may appear more than once to facilitate identification. Where a grid or zone junction line is coincident with a neatline, both the junction line and the notes identifying the grids are omitted.

(1) For British grids, the label is modeled after one of the following:

INDIA ZONE IVB GRID
NORTHWEST AFRICA ZONE GRID
MADAGASCAR GRID

(2) The label for a UTM grid zone or a UPS grid includes the identification of the Grid Zone Designation and is modeled after the following:

UTM GRID ZONE DESIGNATION: 22W
UPS GRID ZONE DESIGNATION: A

c. Each grid is represented in its own area in the normal manner, by full lines at 100,000-unit intervals, intersected by ticks at 10,000-unit intervals. All grid lines and ticks are printed in blue.

d. Grid numbers appear on all four sides of the sheet, labeling each grid line. The composition of the numbers is similar to that described in paragraph 44*b*, except that full grid values label the first grid line in each direction from each corner of the sheet.

e. Grid values, expressed in principal digits only, appear on the face of the map identifying the grid lines and ticks. The design and layout of the columns and rows of numbers generally adhere to the principles described in paragraph 44*c*. Where the areas covered by the grids on one sheet are unequal in size or irregular in shape, the grid values for each are positioned in such a way that a balanced appearance is maintained on the sheet. See figures 39 and 40.

f. Where appropriate for the grid, identifications of 100,000-unit squares and larger unit squares appear on the face of the map, centered within the appropriate squares, as described in paragraph 44*d*.

g. The grid note in the lower margin of the sheet identifies each grid which appears on the sheet. The note is modeled after one of the following:

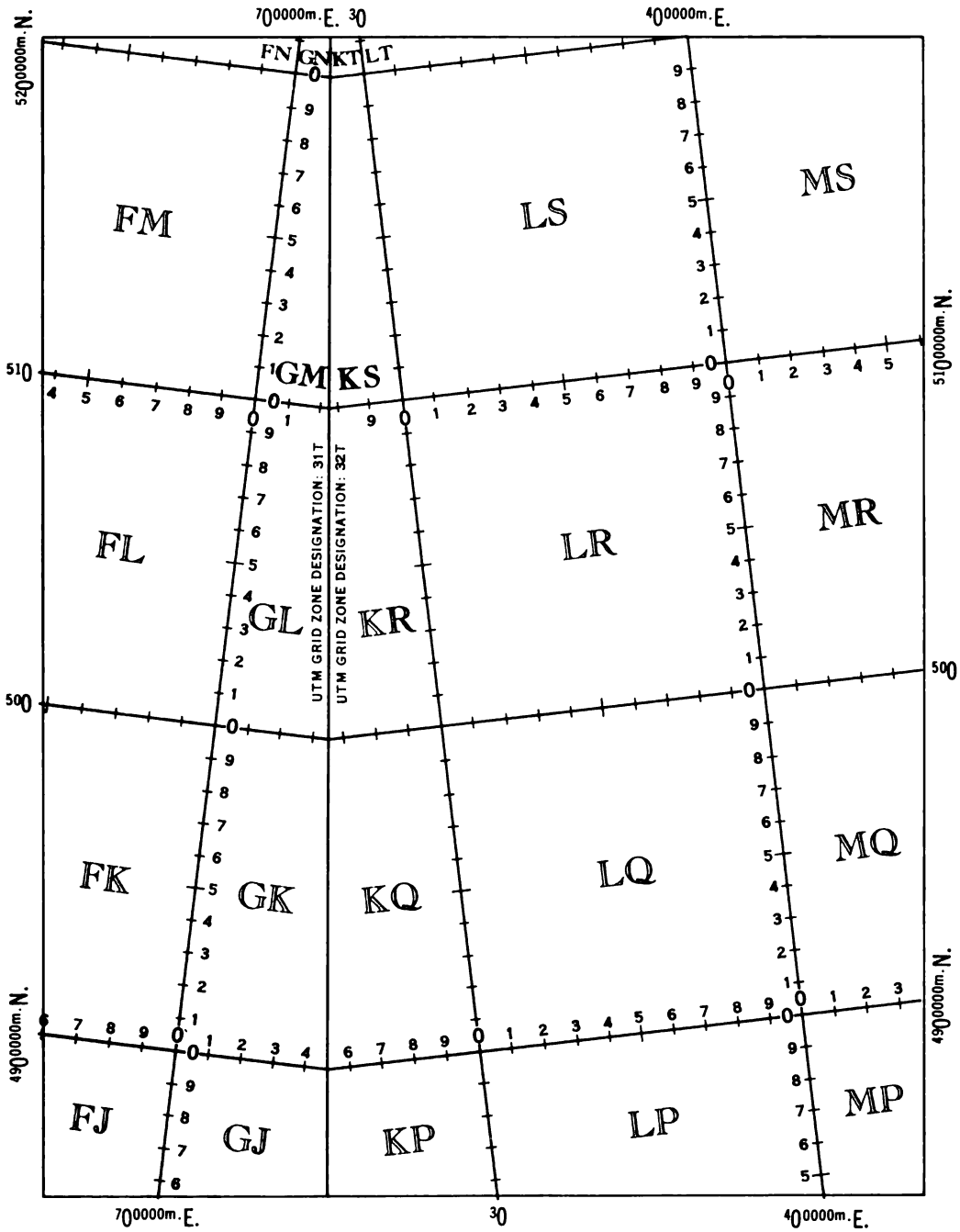
BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONES 22 AND 23, INTERNATIONAL SPHEROID

BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE FRENCH LAMBERT NORD MOROC GRID, CLARKE 1880 SPHEROID, AND THE NORTHWEST AFRICA ZONE GRID, CLARKE 1880 SPHEROID

h. In those cases where a sheet includes a spheroid junction, the grids for the two spheroids are treated in the same manner as that specified in paragraph 45*b*. In addition, type identifying each spheroid is added parallel to the junction line. Where a spheroid junction line is coincident with a neatline, both the junction line and the identifying labels are omitted. The grid note in the lower margin of the sheet identifies each spheroid which appears on that sheet. It is modeled after the following:

BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 50, INTERNATIONAL SPHEROID, AND ZONE 50, BESSEL SPHEROID

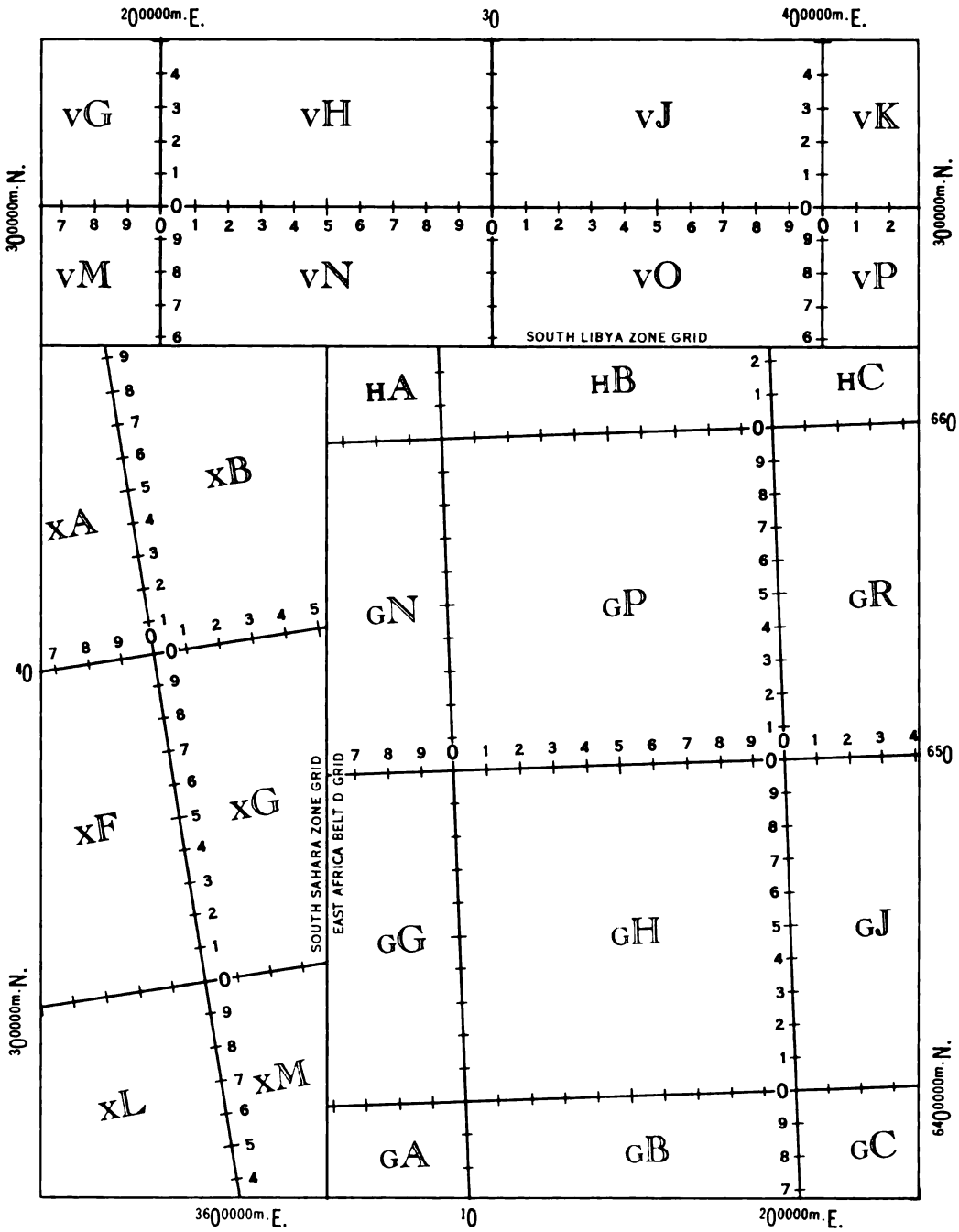
i. In certain isolated cases, a sheet bearing the UTM grid may straddle a parallel which marks the division between different Grid Zone Designations. A continuous line in black indicates the dividing parallel. The proper Grid Zone Designations, printed in blue, appear on each side of the line.



BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONES 31 AND 32, INTERNATIONAL SPHEROID

Scale 1:1,000,000 (in miniature)

Figure 39. Two major grids (in this case, zones of the UTM) separated by a grid junction, as shown on a map at 1:1,000,000 scale.



BLUE LINES AT 100,000 METER INTERVALS AND BLUE TICKS AT 10,000 METER INTERVALS INDICATE THE SOUTH LIBYA ZONE GRID, SOUTH SAHARA ZONE GRID, AND EAST AFRICA BELT D GRID. CLARKE 1880 SPHEROID

Scale 1:1,000,000 (in miniature)

Figure 40. Three major British grids as shown on a map at 1:1,000,000 scale.

j. Figures 39 and 40 illustrate principles described for sheets with more than one major grid.

46. Overlapping, Extended, and Secondary Grids

Overlapping, extended or secondary (obsolete) grids are not shown on the 1:1,000,000 scale map.

47. The Grid Reference Box

a. A grid reference box appears in the margin of each sheet. The box contains instructions and attendant data to enable the user to compose standard grid references. *The grid reference box and all attendant data are printed in blue.*

b. The grid system(s) in use on the map dictates the referencing instructions contained in the grid reference box.

(1) For maps having the UTM or UPS grids, AMS Cut No. 386A is used.

(2) For maps having British grids, the appropriate grid reference box and any modifications thereto are specified with each diagram of British grids beginning on page 153.

c. The grid reference boxes most commonly used on maps at this scale are shown in figure 41.

d. The *grid reference box* contains instructions for composing a grid reference and provides a step-by-step example referred to a sample point on the map. The selected point is one of the following, listed in order of preference:

(1) A small populated place which is named
(2) A named landmark feature
(3) A horizontal control point
(4) A small feature which is named, such as: pond, lake, dam, etc.
(5) A spot elevation
(6) A road, railroad, or stream junction
(7) A projection intersection

e. The grid reference box also contains a miniature representation of the map for defining applicable grid zone designations and grid square identifications.

(1) For the UTM and UPS grids, the miniature representation shows the grid zone designation, the 100,000-meter grid lines and their values in abbreviated form, and the 100,000-meter square identifications.

(2) For British grids, the miniature representation shows the 100,000-unit square identifications, and the 100,000-unit grid lines with their values in abbreviated form. Larger square identifications are shown by smaller type just preceding the 100,000-unit identifications.

(3) Grid and spheroid junctions are shown in the miniature by accentuated lines. When multiple grids appear on a sheet, each grid is identified in the diagram within its respective area. Spheroids and loxodromes are not identified in the box. When the junction is a grid line, its value is shown in abbreviated form. When the junction is a parallel or meridian it is labeled with degree values.

(4) For sheets having a land inset, a representation of the inset and its identification letters are included in the miniature when practicable.

(5) Figure 42 illustrates the composition of this information under various conditions.

f. When more than one major grid appears on a sheet and the method for giving a reference is the same for all the grids, a common reference box is used.

g. When more than one grid appears on a sheet, and the systems for giving a reference vary, the normal grid reference boxes are split into two separate entities. One entity contains an index to grids; the other indicates the different referencing systems.

(1) The index to grids is shown within a miniature representation of the sheet; its composition is similar to that described in paragraph *e* above. Figure 43 illustrates the index to grids.

(2) A partial reference box is shown for each different referencing system. Only that part of the appropriate grid reference box which provides instructions for giving a reference is shown.

(*a*) Over each referencing system, a note which limits its use to the grid concerned is shown. The note is modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE UNIVERSAL TRANSVERSE MERCATOR GRID

(*b*) When the same reference system is used for two grids (occurring on the

same sheet with a third grid which uses a different reference system), the note for the common reference is modeled after the following:

USE THIS BOX FOR GIVING REFERENCES ON THE INDIA ZONE I AND IIA GRIDS

(*c*) These principles are illustrated on the AMS 1:1,000,000 style sheet.

48. Grid and Magnetic Declinations

Grid and magnetic declination data are not shown on maps at the scale of 1:1,000,000.

GRID ZONE DESIGNATION: 100,000 M. SQUARE IDENTIFICATION	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 10,000 METERS
	SAMPLE POINT:
	1. Read letters identifying 100,000 meter square in which the point lies: 2. Locate first VERTICAL grid line to LEFT of point and estimate tenths from that line to point, using 10,000 meter ticks as guide: 3. Locate first HORIZONTAL grid line BELOW point and estimate tenths from that line to point, using 10,000 meter ticks as guide:
	SAMPLE REFERENCE:
	If reporting beyond 9° N S or 18° E-W, prefix Grid Zone Designation, as:

For use with UTM and UPS Grids.
(AMS Cut No. 386A)

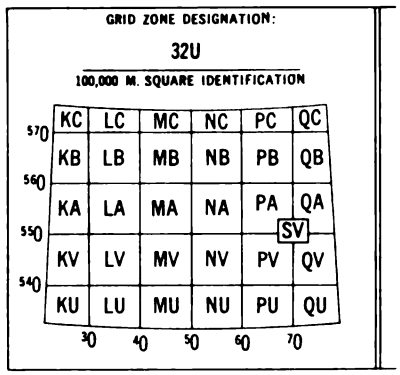
500,000 METER (Small Letter) and 100,000 METER (Large Letter) SQUARE IDENTIFICATIONS	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 10,000 METERS
	SAMPLE POINT:
	1. Read letter identifying 100,000 meter square in which the point lies: 2. Locate first VERTICAL grid line to LEFT of point and estimate tenths from that line to point, using 10,000 meter ticks as guide: 3. Locate first HORIZONTAL grid line BELOW point and estimate tenths from that line to point, using 10,000 meter ticks as guide:
	SAMPLE REFERENCE:
	If reporting beyond 500,000 meters prefix with 500,000 Meter Square Identification, as:

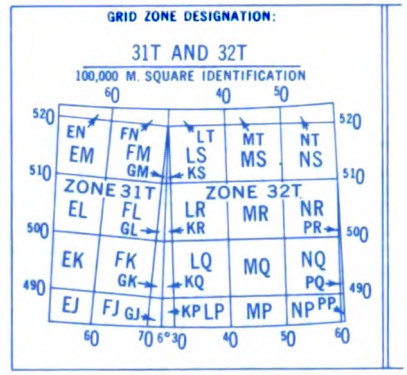
For use with British Grids which identify the 500,000 and 100,000 meter squares.
(AMS Cut No. 387A)

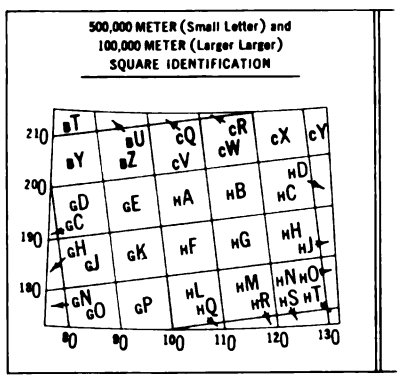
TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 10,000 METERS
SAMPLE POINT:
1. Read sheet number: 2. Locate first 10,000 meter VERTICAL grid tick to LEFT of point and read or determine LARGE figures identifying the tick: 3. Locate first 10,000 meter HORIZONTAL grid tick BELOW point and read or determine LARGE figures identifying the tick.
SAMPLE REFERENCE:

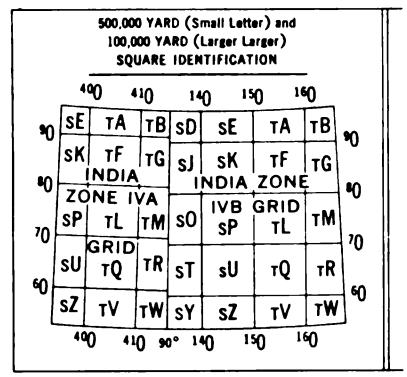
For use with British Grids which do not identify the 100,000 unit squares.
(AMS Cut No. 389A)

Figure 41. Grid reference boxes most commonly used on maps at 1:100,000 scale.









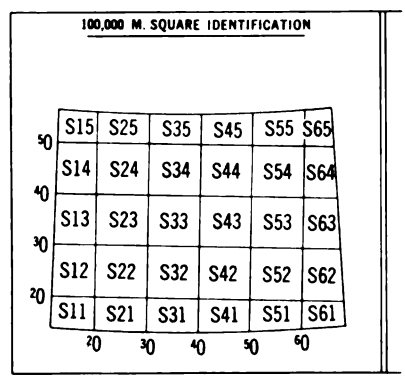


Figure 42. Methods of identifying grid zone designations and 100,000-meter squares of the UTM Grid, and 100,000-unit and larger-unit square identifications of British grids in the reference boxes of maps at the scale of 1:1,000,000.

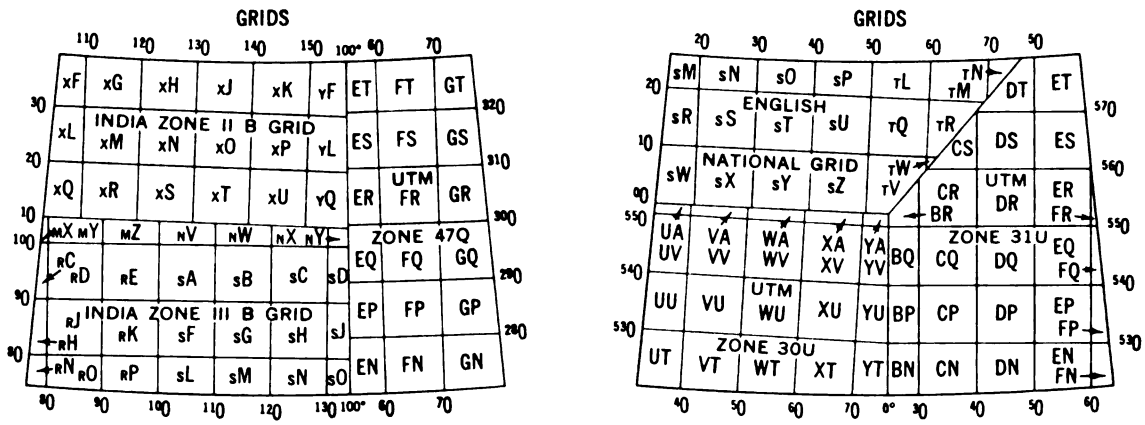


Figure 43. Methods of showing the Index to Grids on sheets at 1:1,000,000 scale showing more than one grid, and having more than one system of grid referencing.

APPENDIX I

RELATED REFERENCES

1. Department of the Army Publications

a. Field Manuals (FM's).

FM 6-40	Field Artillery Cannon Gunnery.
FM 21-26	Map Reading.
FM 21-31	Topographic Symbols.

b. Technical Manuals (TM's).

TM 5-231	Mapping Functions of the Corps of Engineers.
TM 5-232	Elements of Surveying.
TM 5-441	Topographic Surveying.
TM 5-235	Special Surveys.
TM 5-236	Surveying Tables and Graphs.
TM 5-237	Surveying Computer's Manual.
TM 5-240	Map Compilation, Color Separation, and Revision.
TM 5-241-2	Universal Transverse Mercator Grid Zone to Zone Transformation Tables.
TM 5-241-3/1	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: International Spheroid (Meters): Volume I: Transformation of Coordinates from Geographic to Grid.
TM 5-241-3/2	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: International Spheroid (Meters): Volume II: Transformation of Coordinates from Grid to Geographic.
TM 5-241-4/1	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Clarke 1866 Spheroid (Meters): Volume I: Transformation of Coordinates from Geographic to Grid.
TM 5-241-4/2	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Clarke 1866 Spheroid (Meters): Volume II: Transformation of Coordinates from Grid to Geographic.
TM 5-241-5/1	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Bessel Spheroid (Meters): Volume I: Transformation of Coordinates from Geographic to Grid.
TM 5-241-5/2	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Bessel Spheroid (Meters): Volume II: Transformation of Coordinates from Grid to Geographic.
TM 5-241-6/1	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Clarke 1880 Spheroid (Meters): Volume I: Transformation of Coordinates from Geographic to Grid.
TM 5-241-6/2	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Clarke 1880 Spheroid (Meters): Volume II: Transformation of Coordinates from Grid to Geographic.
TM 5-241-7	Universal Transverse Mercator Grid Tables for Latitudes 0°–45°: Everest Spheroid (Meters): Transformation of Coordinates from Geographic to Grid and from Grid to Geographic.
TM 5-241-8	Universal Transverse Mercator Grid.
TM 5-241-9	Universal Polar Stereographic Grid Tables for Latitudes 79°30'–90°: International Spheroid (Meters): Transformation of Coordinates from Geographic to Grid and from Grid to Geographic.
TM 5-241-10	Universal Transverse Mercator Grid: Extension of Zone to Zone Transformation Tables.
TM 5-241-11	Universal Transverse Mercator Grid Tables for Latitudes 0°–80°: Clarke 1866 Spheroid (Meters): Coordinates for 7½-Minute Intersections.
TM 5-241-12	Universal Transvere Mercator Grid Tables for Latitudes 0°–33°: Clarke 1866 Spheroid (Meters): Coordinates for 5-Minute Intersections.
TM 5-241-13	Universal Transverse Mercator Grid Table for Latitudes 0°–80°: International Spheroid (Meters): Coordinates for 5-Minute Intersections.
TM 5-241-14	Universal Transverse Mercator Grid Table for Latitudes 0°–80°: Bessel Spheroid (Meters): Coordinates for 5-Minute Intersections.
TM 5-241-15	Universal Transverse Mercator Grid Table for Latitudes 0°–40°05': Clarke 1880 Spheroid (Meters): Coordinates for 5-Minute Intersections.
TM 5-241-16	Universal Transverse Mercator Grid Table for Latitudes 0°–40°05': Everest Spheroid (Meters): Coordinates for 5-Minute Intersections.

TM 5-241-17	Latitude Functions: Hayford Spheroid (International Spheroid): Natural Values of the Meridional Arc A, B, C, D, E, and F Factors Radii of Curvature, R and N.
TM 5-241-18	Latitude Functions: Clarke 1866 Spheroid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors Radii of Curvature, R and N.
TM 5-241-19	Latitude Functions: Bessel Spheroid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors Radii of Curvature, R and N.
TM 5-241-20	Latitude Functions: Clarke 1880 Spheroid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors Radii of Curvature, R and N.
TM 5-241-21	Latitude Functions: Everest Spheroid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors Radii of Curvature, R and N.
TM 5-241-22	Latitude Transformation: Clarke 1866 Spheroid: Geodetic Latitude to Rectifying Latitude and Rectifying Latitude to Geodetic Latitude.
TM 5-241-23	Latitude Transformation Tables: International Spheroid: Geodetic Latitude to Rectifying Latitude and Rectifying Latitude to Geodetic Latitude.
TM 5-241-24	Latitude Transformation: Clarke 1880 Spheroid: Geodetic Latitude to Isometric Latitude and Isometric Latitude to Geodetic Latitude.
TM 5-241-25	Latitude Transformation: Bessel Spheroid: Geodetic Latitude to Isometric Latitude and Isometric Latitude to Geodetic Latitude.
TM 5-241-26	Latitude Transformation: Clarke 1866 Spheroid: Geodetic Latitude to Authalic Latitude and Authalic Latitude to Geodetic Latitude.
TM 5-241-27	Latitude Transformation: Clarke 1866 Spheroid: Geodetic Latitude to Isometric Latitude and Isometric Latitude to Geodetic Latitude.
TM 5-241-28	Latitude Transformation: Everest Spheroid: Geodetic Latitude to Isometric Latitude and Isometric Latitude to Geodetic Latitude.
TM 5-241-29	Latitude Transformation: International Spheroid: Geodetic Latitude to Isometric Latitude and Isometic Latitude to Geodetic Latitude.
TM 5-241-30	Universal Transverse Mercator Grid Tables For Latitudes 72°-84° International Spheroid (Meters).
TM 5-241-31	Universal Transverse Mercator Grid Tables For Latitudes 72°-84° Clarke 1866 Spheroid (Meters).
TM 5-241-32/1	Universal Transverse Mercator Grid Tables for Latitudes 0°-80°: Australian National Spheroid (Meters): Volume I: Transformation of Coordinates from Geographic to Grid.
TM 5-241-32/2	Universal Transverse Mercator Grid Tables for Latitudes 0°-80°: Australian National Spheroid (Meters): Volume II: Transformation of Coordinates from Grid to Geographic.
TM 5-241-33	Latitude Functions: Australian National Spheroid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors; Radii of Curvature, R and N.
TM 5-241-34	Universal Transverse Mercator Grid Tables for Latitudes 0°-80°: Australian National Spheroid: Coordinates for 5-Minute Intersections.
TM 5-241-35	Latitude Functions: Fischer 1960 Ellipsoid: Natural Values of the Meridional Arc A, B, C, D, E, and F Factors; Radii of Curvature, R and N.
TM 5-243	Cartographic Aerial Photography.
TM 5-244	Multiplex Mapping.
TM 5-245	Map Reproduction.
TM 5-248	Foreign Maps.
TM 5-249	Terrain Models and Relief Map Making.
TM 30-245	Photographic Interpretation Handbook.

c. Graphic Training Aids

5-2	Elementary Map Reading.
5-12	Coordinate Scales and Protractors.

2. Department of Commerce Publications

U.S. Coast & Geodetic Survey Special Publications (SP's).

SP 8	Tables and Formulas for the Computation of Geodetic Positions.
SP 68	Elements of Map Projection.
SP 193	Manual of Plane Coordinates Computation.
SP 200	Formulas and Tables for the Computation of Geodetic Positions on the International Ellipsoid.
SP 235	State Coordinate System.
SP 241	Natural Tables for Computation of Geodetic Positions.

3. Miscellaneous Publications*

a. Propection Tables (for British Grids):

English National Grid, Transverse Mercator Projection Tables.

India Zone I, Lambert Conical Orthomorphic Projection Tables.

*Available from Commanding Officer, Army Map Service, Corps of Engineers, U.S. Army, Washington, D.C. 20315.

India Zones IIA and IIB, Lambert Conical Orthomorphic Projection Tables.
India Zones IIIA and IIIB, Lambert Conical Orthomorphic Projection Tables.
India Zones IVA and IVB, Lambert Conical Orthomorphic Projection Tables.
Irish Grid, Cassini-Soldner Projection Tables.
Madagascar Grid, Laborde Projection Tables.
Netherlands East Indies Equatorial Zone, Lambert Conical Orthomorphic Projection Tables.
New Zealand North Island Belt, Transverse Mercator Projection Tables.
New Zealand South Island Belt, Transverse Mercator Projection Tables.

b. Style Sheets:

AMS Military City Map	UTM Grid (1:25,000 and larger).
AMS 25–50	UTM and British Grids (1:25,000 and 1:50,000).
AMS–250	UTM and British Grids (1:250,000).
AMS 1:1,000,000	UTM and British Grids.

c. Miscellaneous:

Conversion Tables: Centesimal to Sexagesimal and Reverse.

APPENDIX II

TABLE OF MIL EQUIVALENTS

DEGREES TO MILS

Deg.	Mils	Deg.	Mils	Deg.	Mils
1	17.7778	21	373.3333	41	728.8889
2	35.5556	22	391.1111	42	746.6667
3	53.3333	23	408.8889	43	764.4444
4	71.1111	24	426.6667	44	782.2222
5	88.8889	25	444.4444	45	800.0000
6	106.6667	26	462.2222	46	817.7778
7	124.4444	27	480.0000	47	835.5556
8	142.2222	28	497.7778	48	853.3333
9	160.0000	29	515.5556	49	871.1111
10	177.7778	30	533.3333	50	888.8889
11	195.5556	31	551.1111	51	906.6667
12	213.3333	32	568.8889	52	924.4444
13	231.1111	33	586.6667	53	942.2222
14	248.8889	34	604.4444	54	960.0000
15	266.6667	35	622.2222	55	977.7778
16	284.4444	36	640.0000	56	995.5556
17	302.2222	37	657.7778	57	1013.3333
18	320.0000	38	675.5556	58	1031.1111
19	337.7778	39	693.3333	59	1048.8889
20	355.5556	40	711.1111	60	1066.6667

MINUTES TO MILS

Min.	Mils	Min.	Mils	Min.	Mils
1	0.2963	21	6.2222	41	12.1481
2	0.5926	22	6.5185	42	12.4444
3	0.8889	23	6.8148	43	12.7407
4	1.1852	24	7.1111	44	13.0370
5	1.4815	25	7.4074	45	13.3333
6	1.7778	26	7.7037	46	13.6296
7	2.0741	27	8.0000	47	13.9259
8	2.3704	28	8.2963	48	14.2222
9	2.6667	29	8.5926	49	14.5185
10	2.9630	30	8.8889	50	14.8148
11	3.2593	31	9.1852	51	15.1111
12	3.5556	32	9.4815	52	15.4074
13	3.8519	33	9.7778	53	15.7037
14	4.1481	34	10.0741	54	16.0000
15	4.4444	35	10.3704	55	16.2963
16	4.7407	36	10.6667	56	16.5926
17	5.0370	37	10.9630	57	16.8889
18	5.3333	38	11.2593	58	17.1852
19	5.6296	39	11.5556	59	17.4815
20	5.9259	40	11.8519	60	17.7778

SECONDS TO MILS

Sec.	Mils	Sec.	Mils	Sec.	Mils
1	0.0049383	21	0.1037037	41	0.2024691
2	0.0098765	22	0.1086420	42	0.2074074
3	0.0148148	23	0.1135802	43	0.2123457
4	0.0197531	24	0.1185185	44	0.2172840
5	0.0246914	25	0.1234568	45	0.2222222
6	0.0296296	26	0.1283951	46	0.2271605
7	0.0345679	27	0.1333333	47	0.2320988
8	0.0395062	28	0.1382716	48	0.2370370
9	0.0444444	29	0.1432099	49	0.2419753
10	0.0493827	30	0.1481481	50	0.2469136
11	0.0543210	31	0.1530864	51	0.2518519
12	0.0592593	32	0.1580247	52	0.2567901
13	0.0641975	33	0.1629630	53	0.2617284
14	0.0691358	34	0.1679012	54	0.2666667
15	0.0740741	35	0.1728395	55	0.2716049
16	0.0790123	36	0.1777778	56	0.2765432
17	0.0839506	37	0.1827160	57	0.2814815
18	0.0888889	38	0.1876543	58	0.2864198
19	0.0938272	39	0.1925926	59	0.2913580
20	0.0987654	40	0.1975309	60	0.2962963

PLATE I

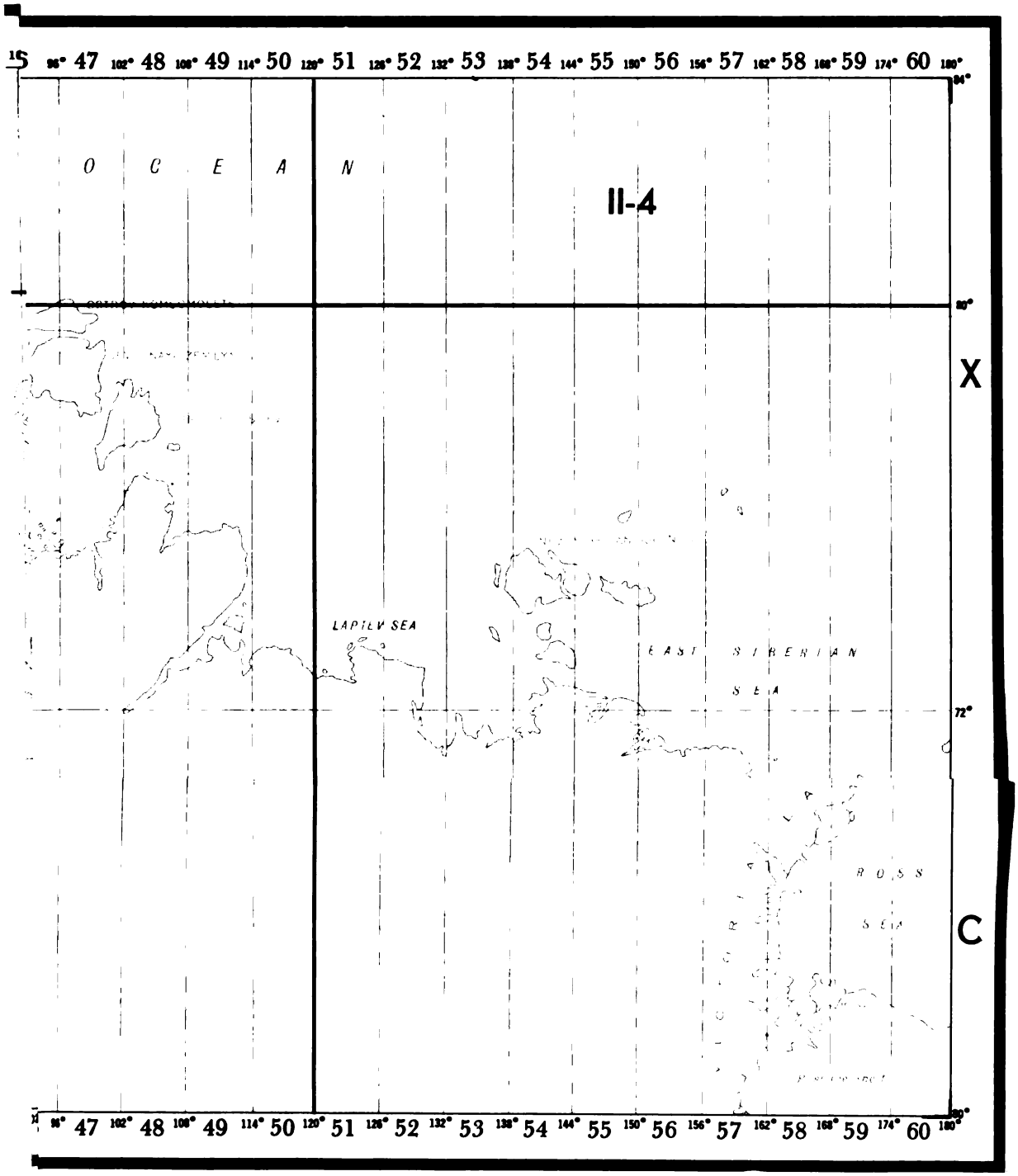
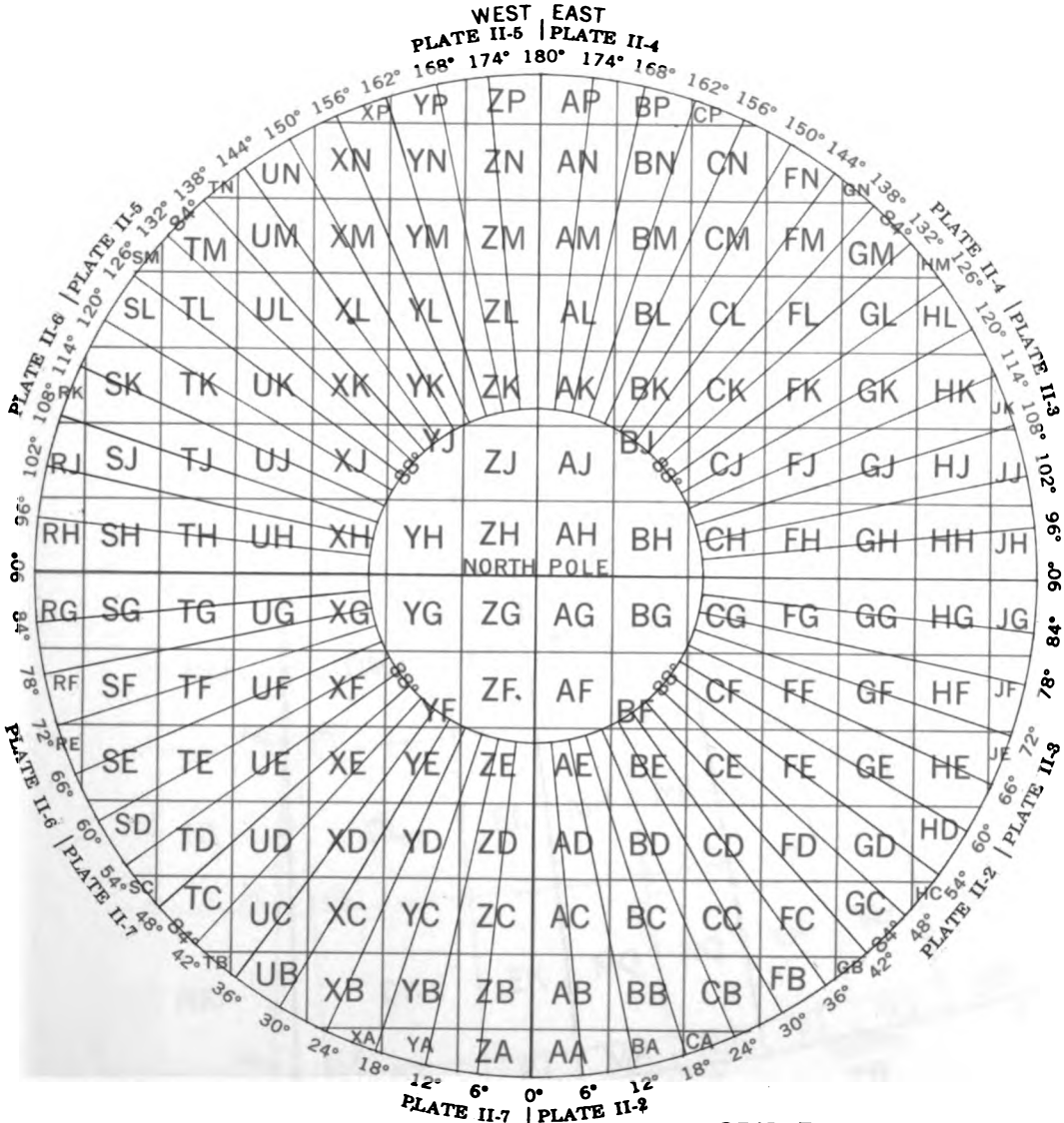
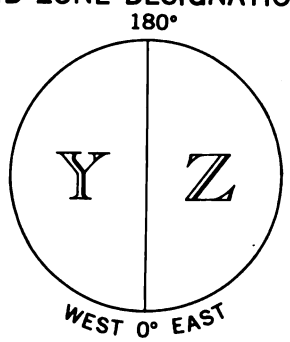


PLATE II-1

100,000 METER SQUARE IDENTIFICATIONS FOR THE MILITARY GRID REFERENCE SYSTEM



GRID ZONE DESIGNATIONS



INTERNATIONAL SPHEROID

PLATE II-2

INTERNATIONAL SPHEROID

QUARE IDENTIFICATIONS
OR THE
) REFERENCE SYSTEM

LATE II-1

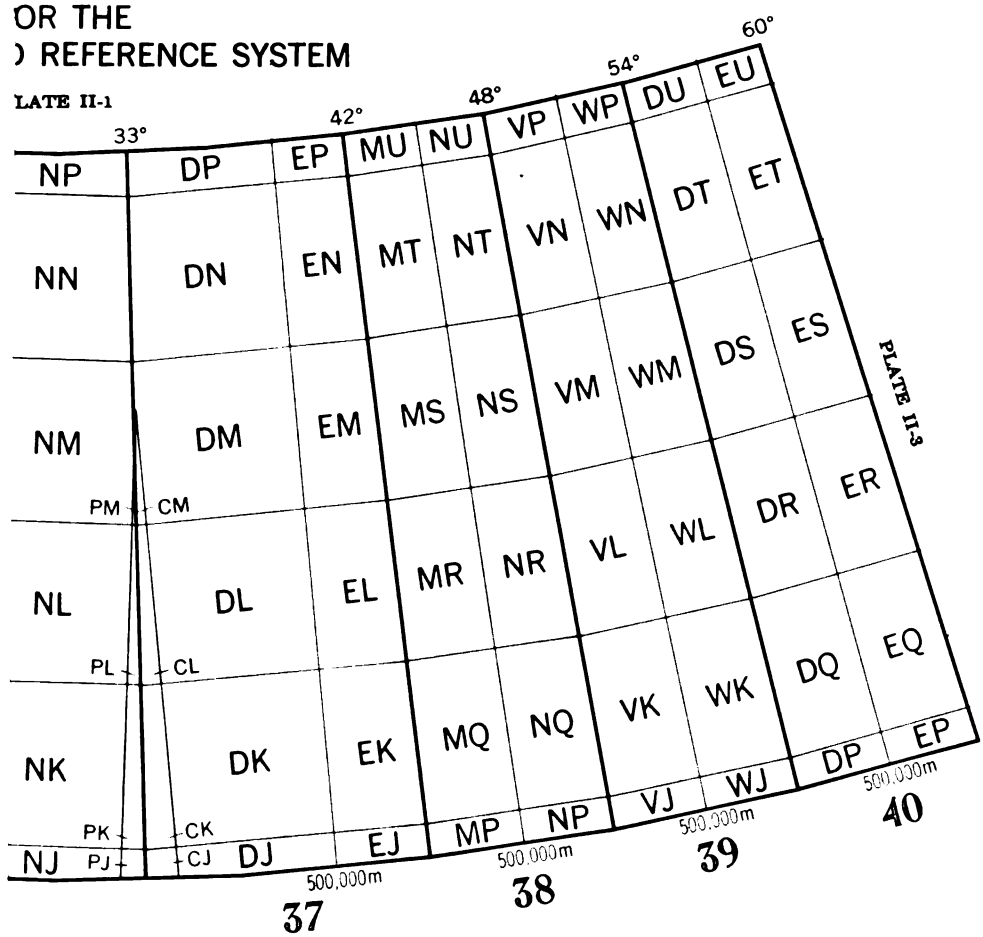


PLATE II-8

PLATE II-3

INTERNATIONAL SPHEROID

SQUARE IDENTIFICATIONS
FOR THE
D REFERENCE SYSTEM

PLATE II-1

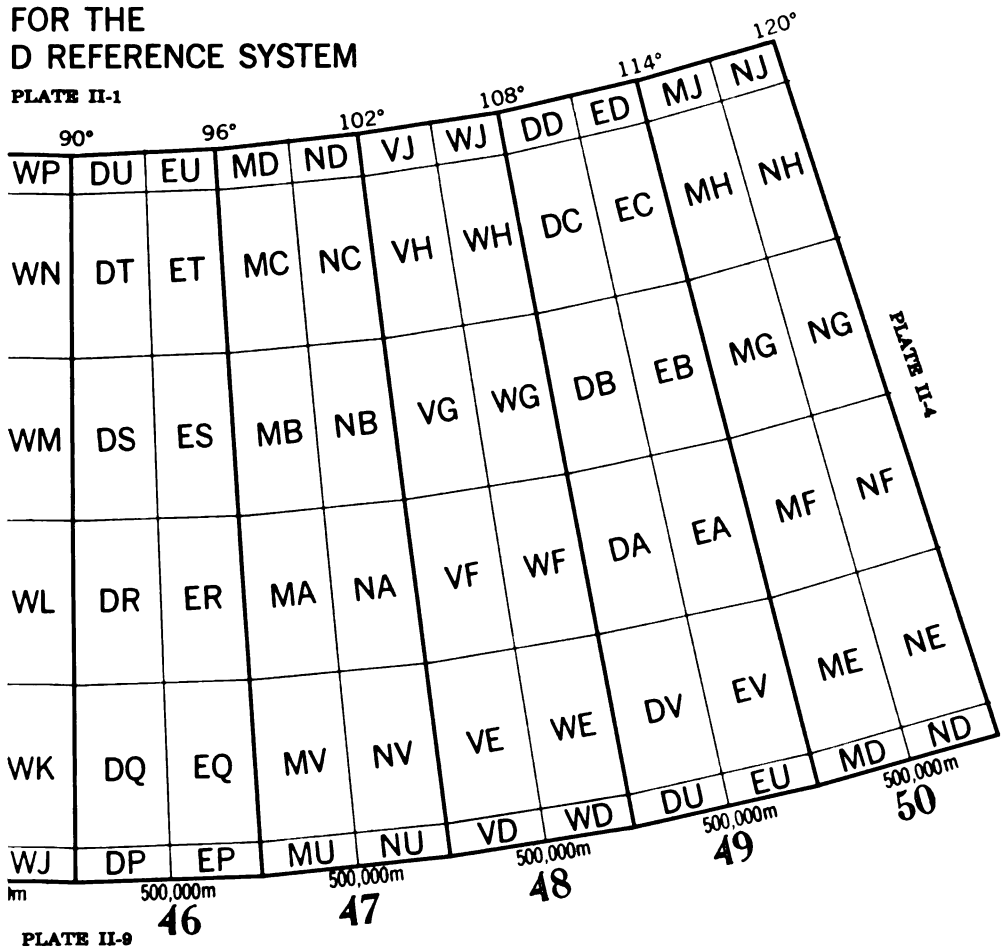
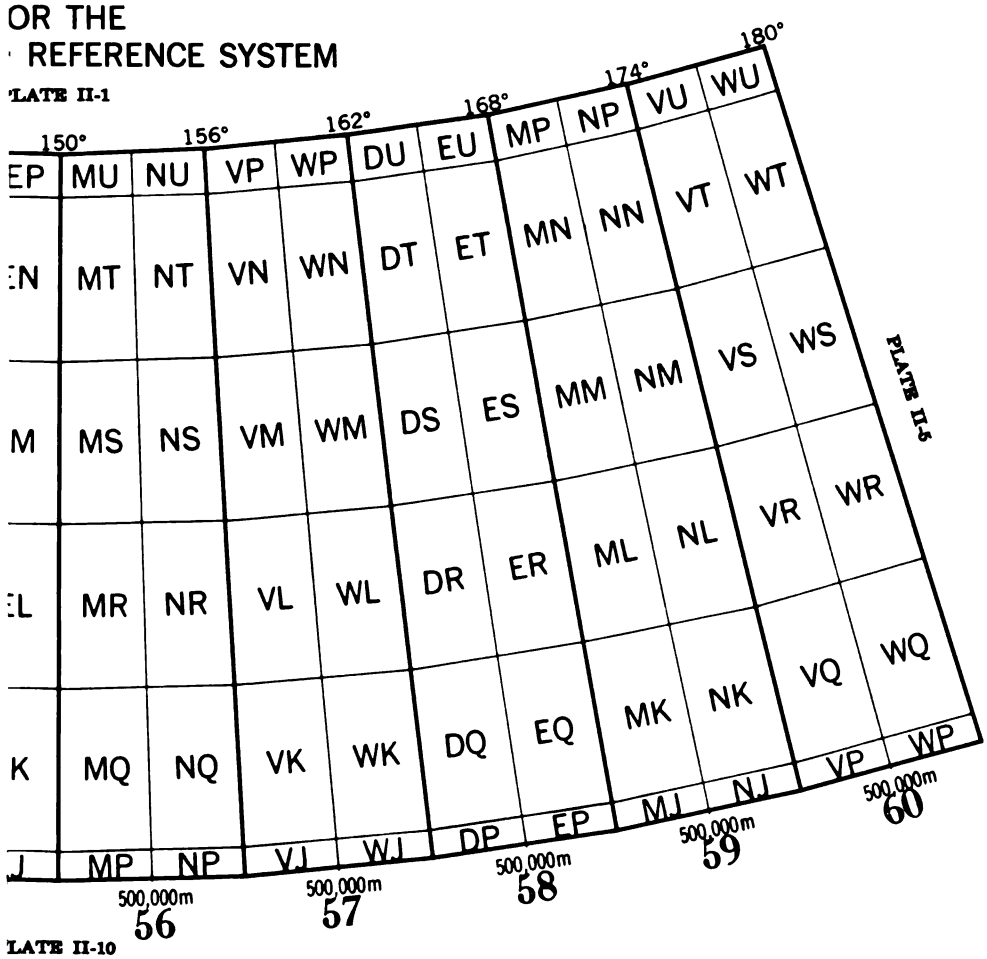


PLATE II-4

INTERNATIONAL SPHEROID

QUARE IDENTIFICATIONS
OR THE
· REFERENCE SYSTEM

LATE II-1



LATE II-10

PLATE II-5

INTERNATIONAL SPHEROID
CLARKE 1866 SPHEROID

QUARE IDENTIFICATIONS
FOR THE
) REFERENCE SYSTEM

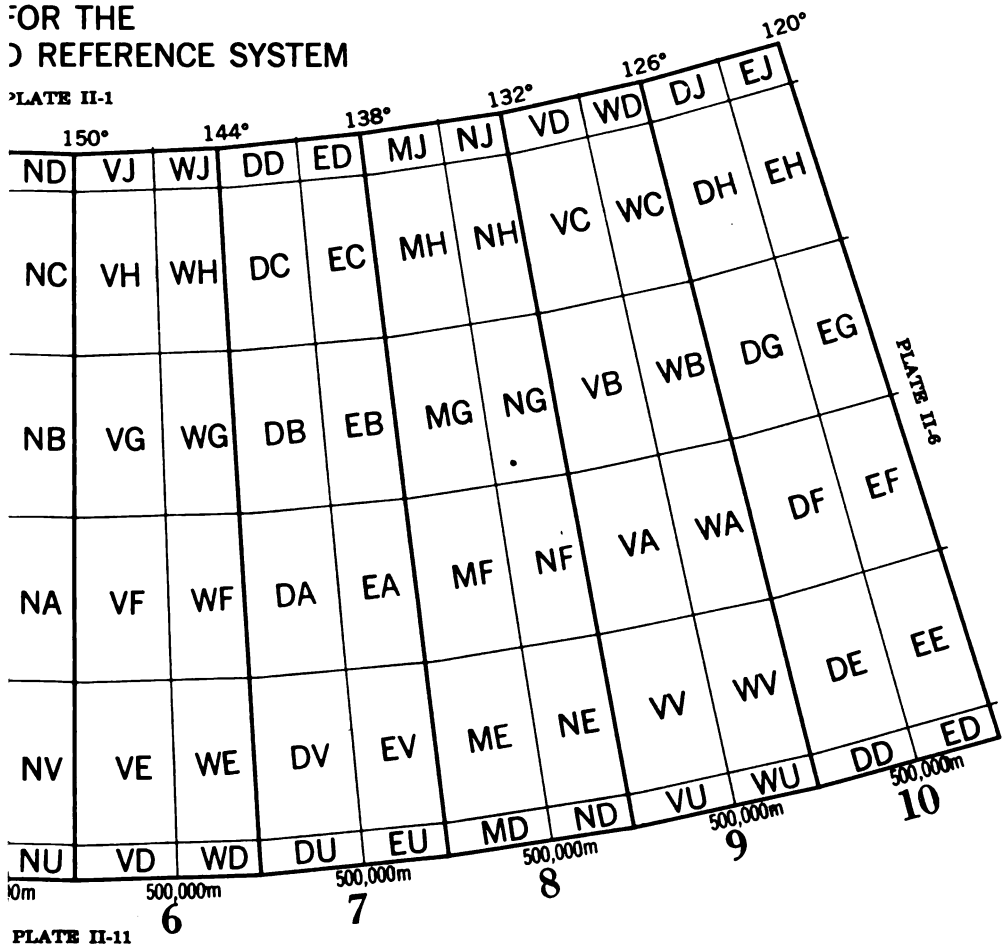
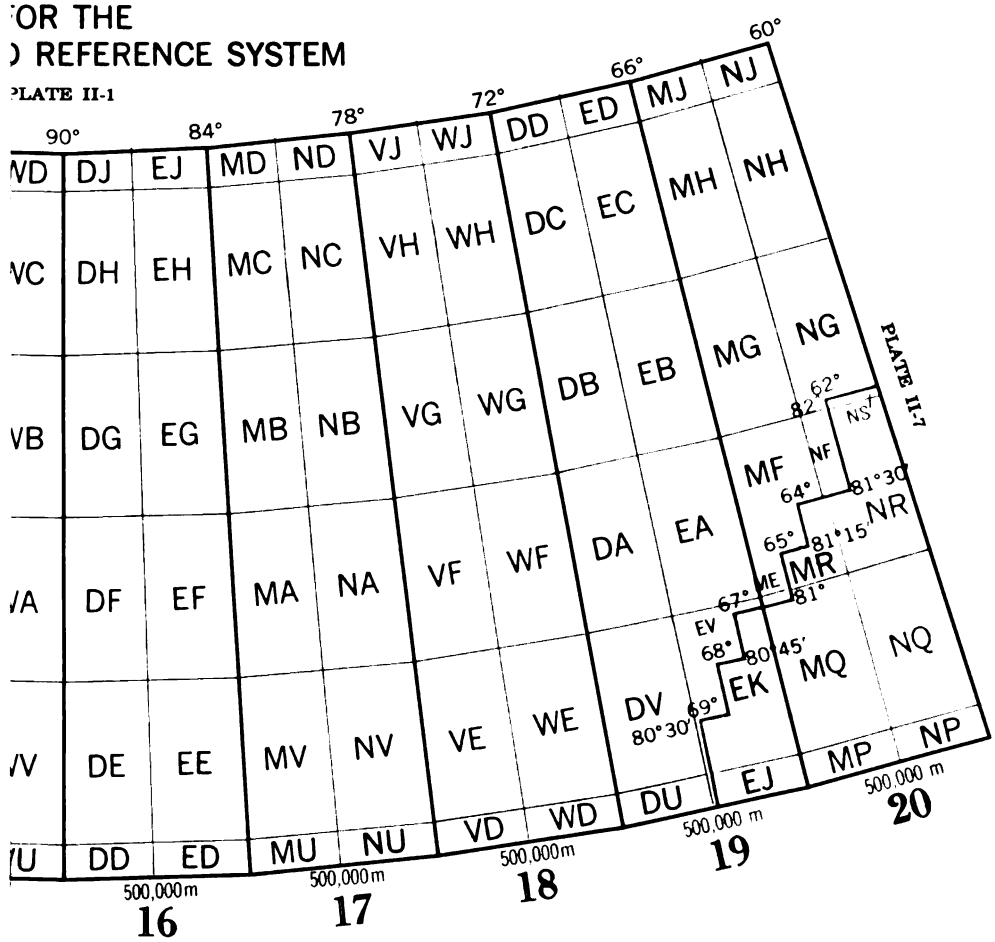


PLATE II-6
INTERNATIONAL SPHEROID
CLARKE 1866 SPHEROID

QUARE IDENTIFICATIONS
'OR THE
) REFERENCE SYSTEM

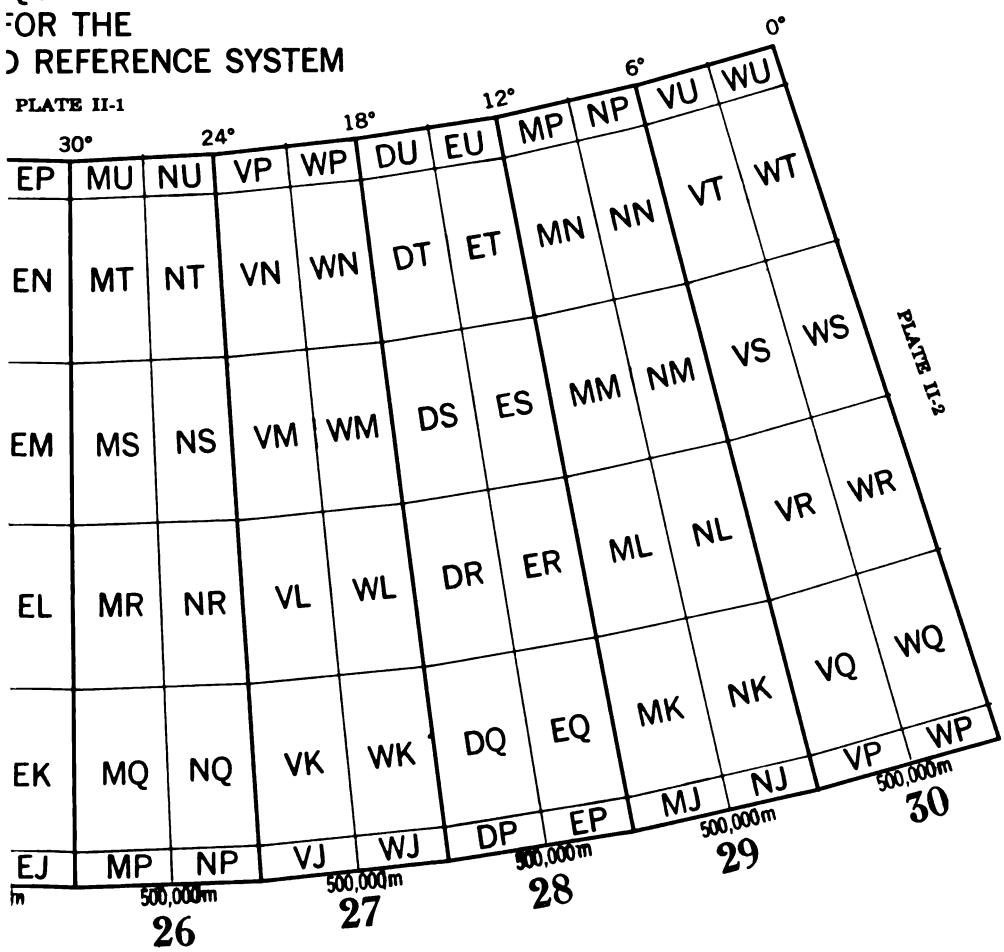
'LATE II-1

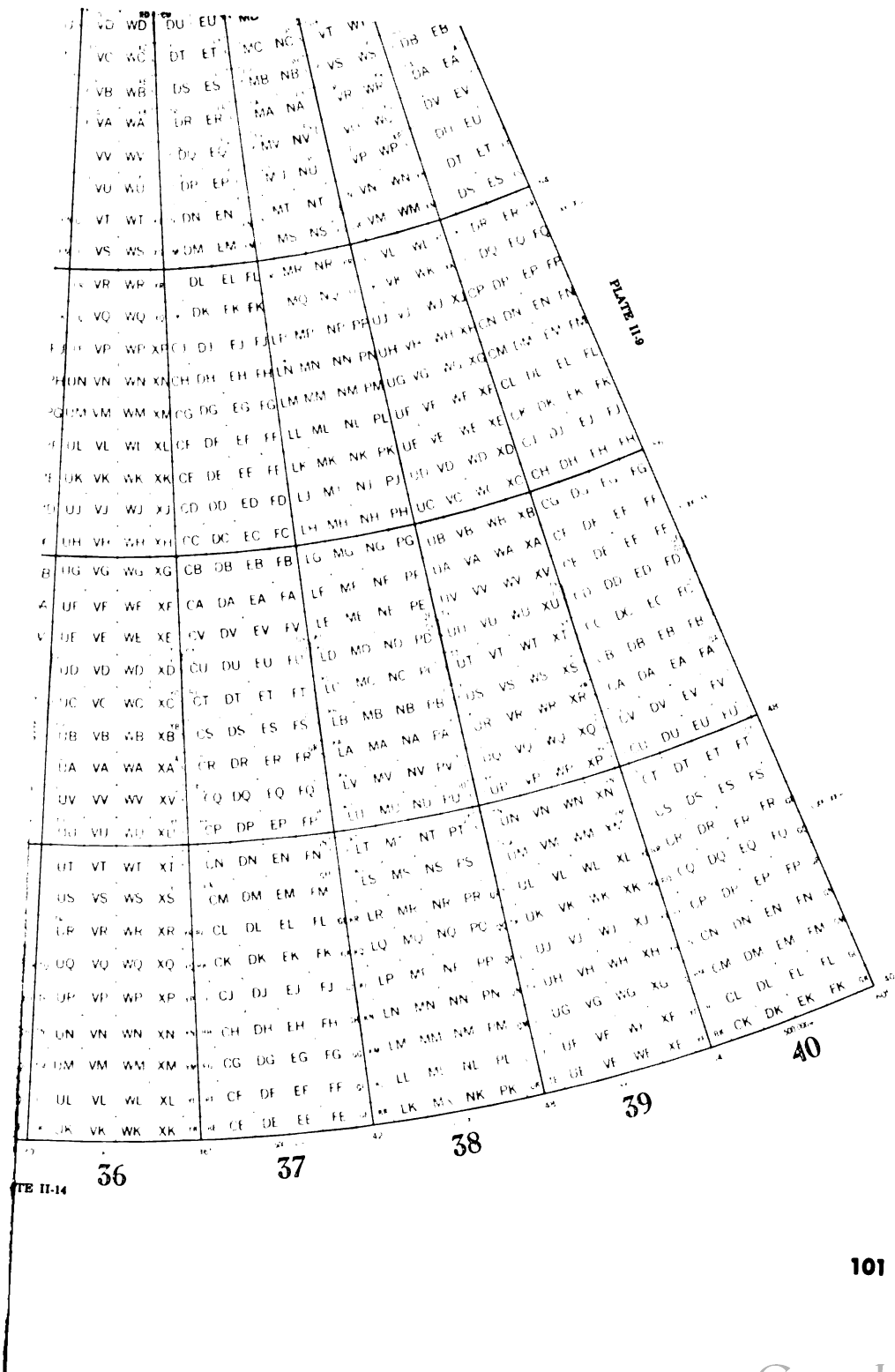


'LATE II-12

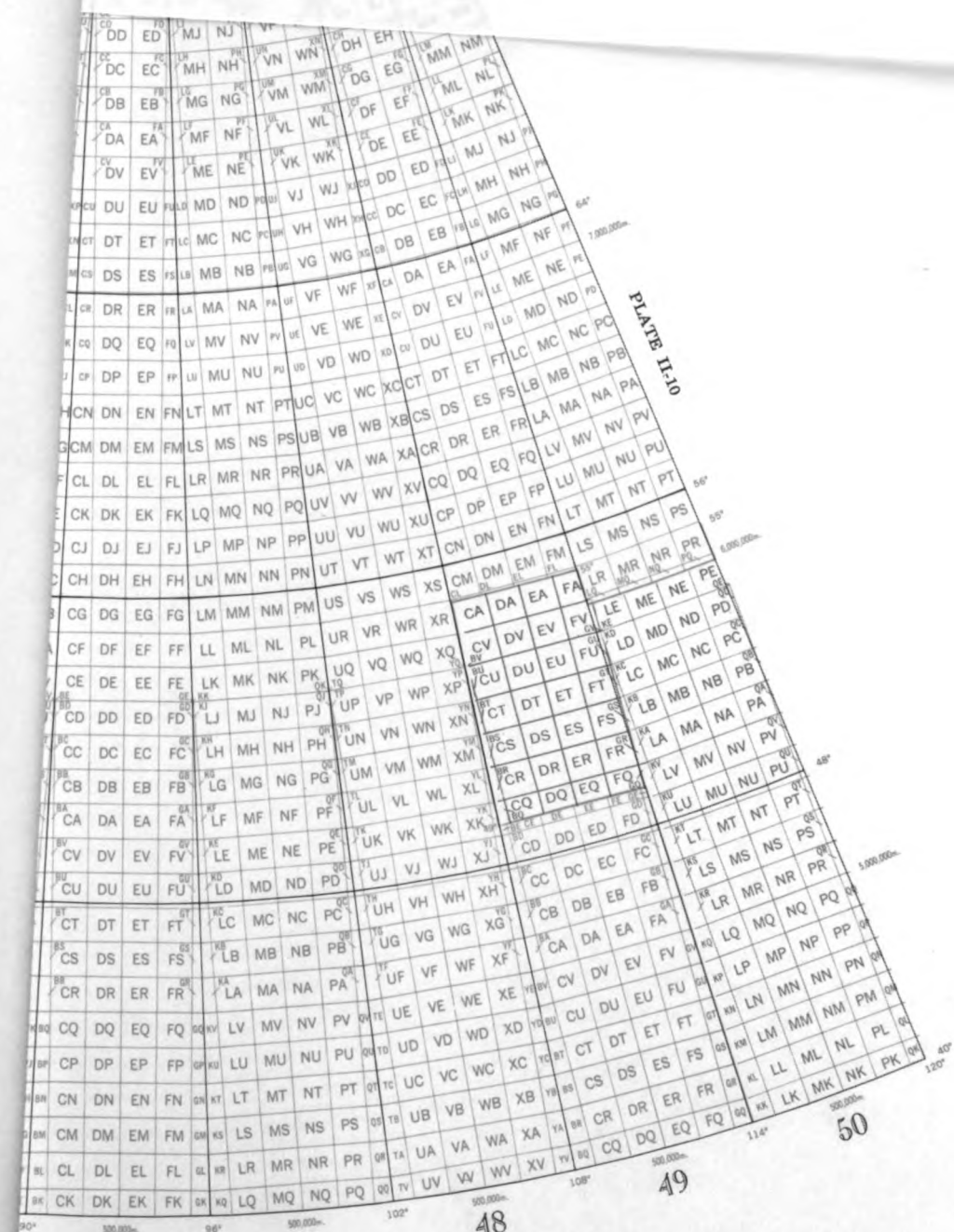
PLATE II-7
INTERNATIONAL SPHEROID

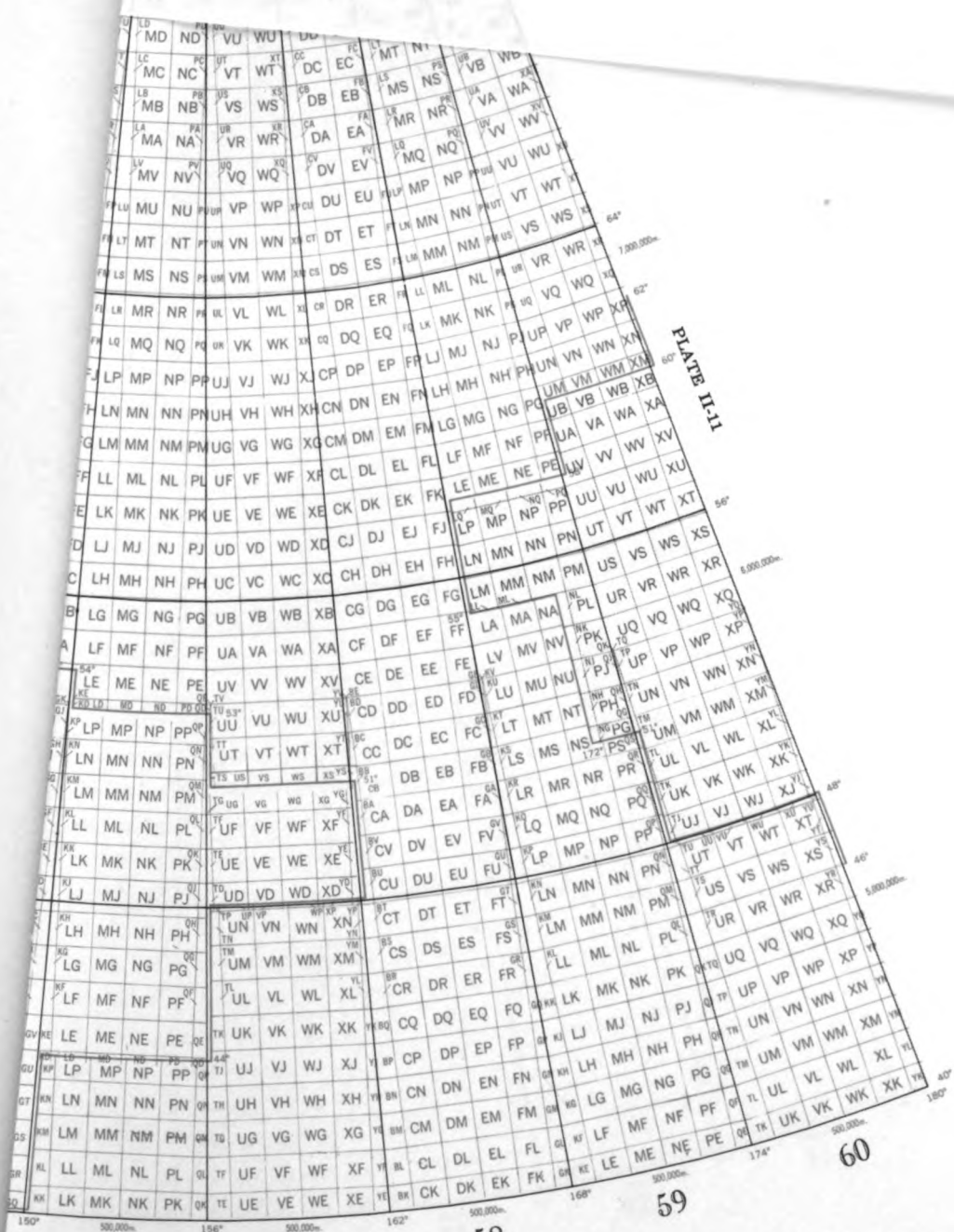
QUARE IDENTIFICATIONS
FOR THE
) REFERENCE SYSTEM



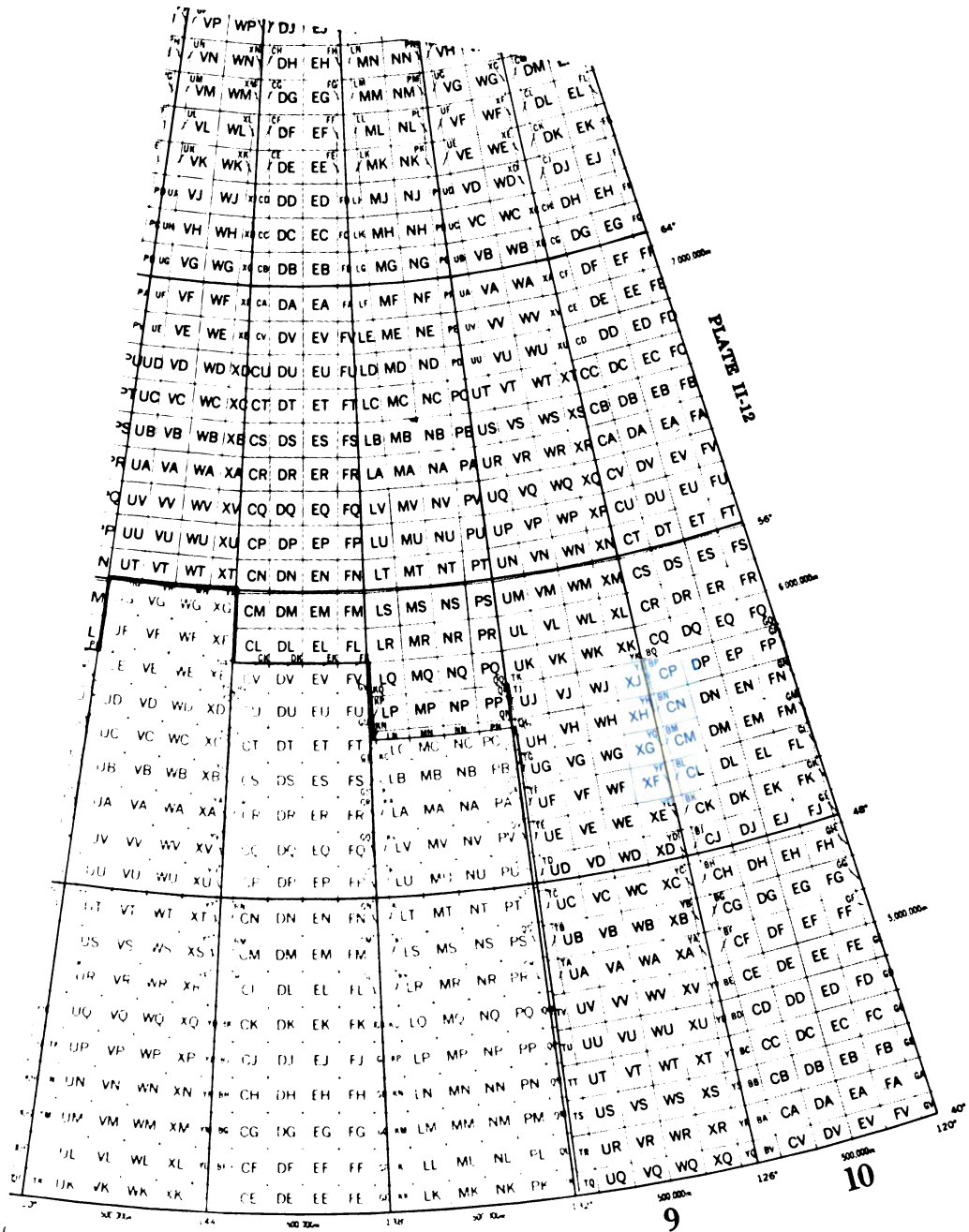


TE II-14

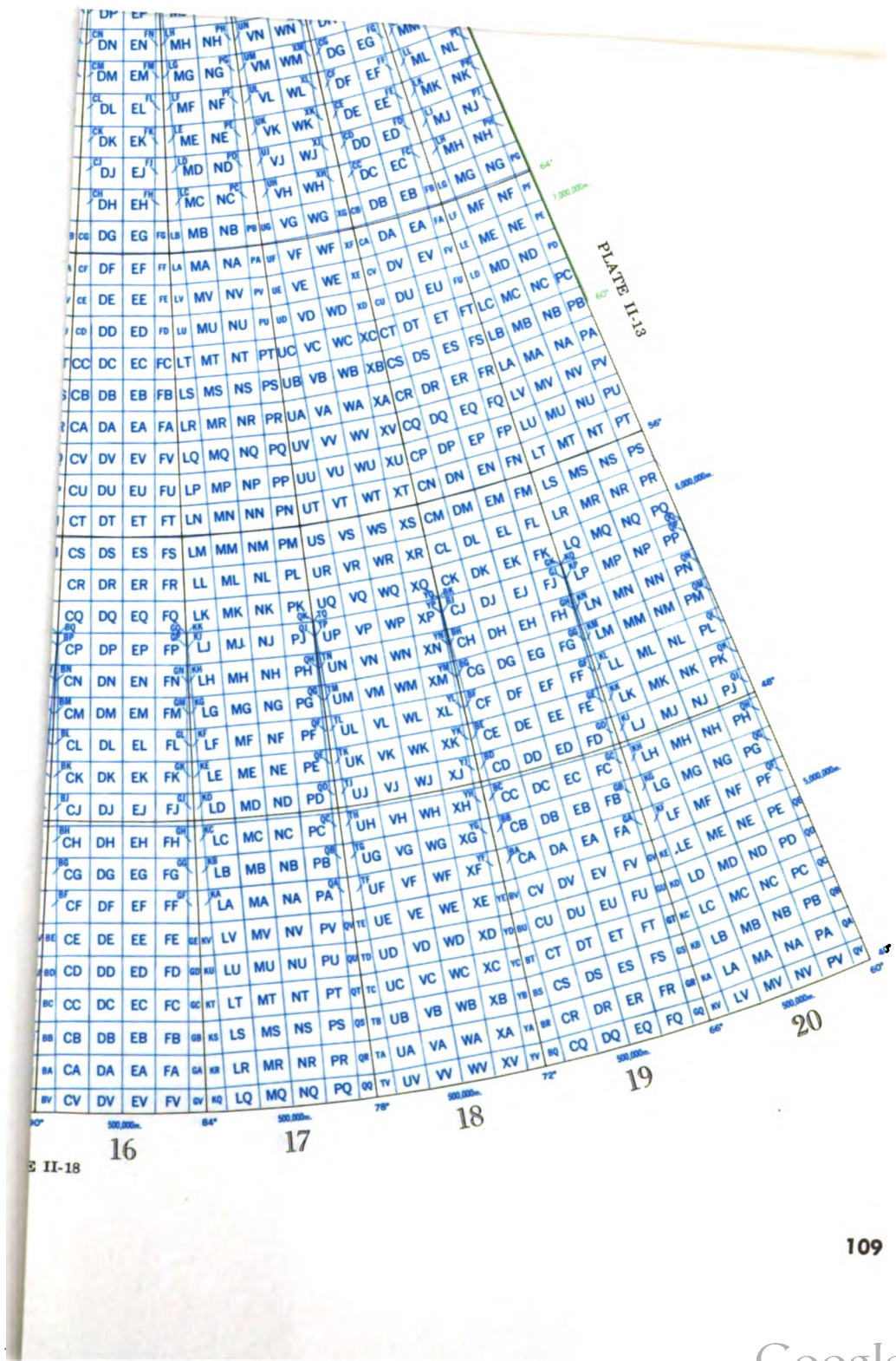




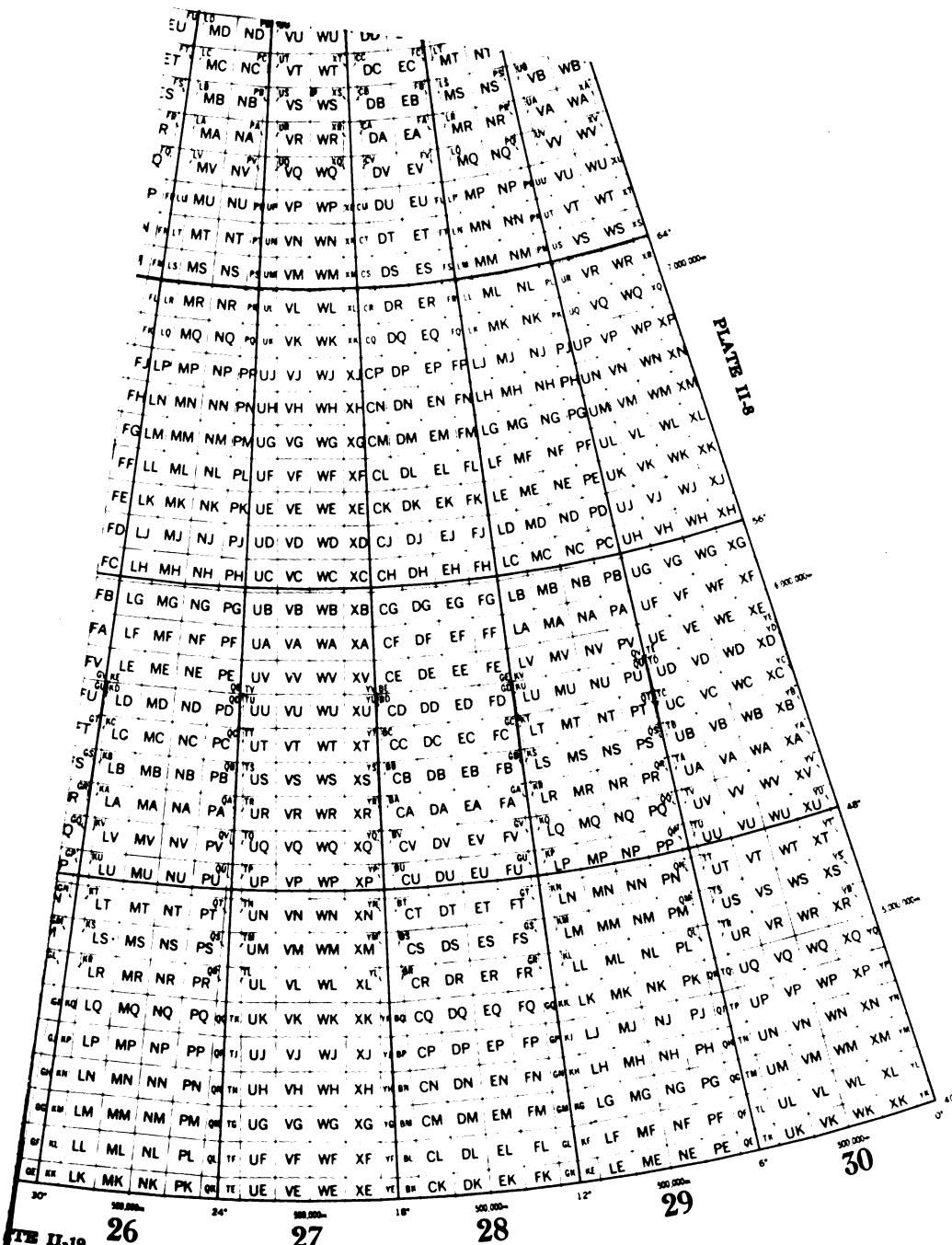
TE II-16

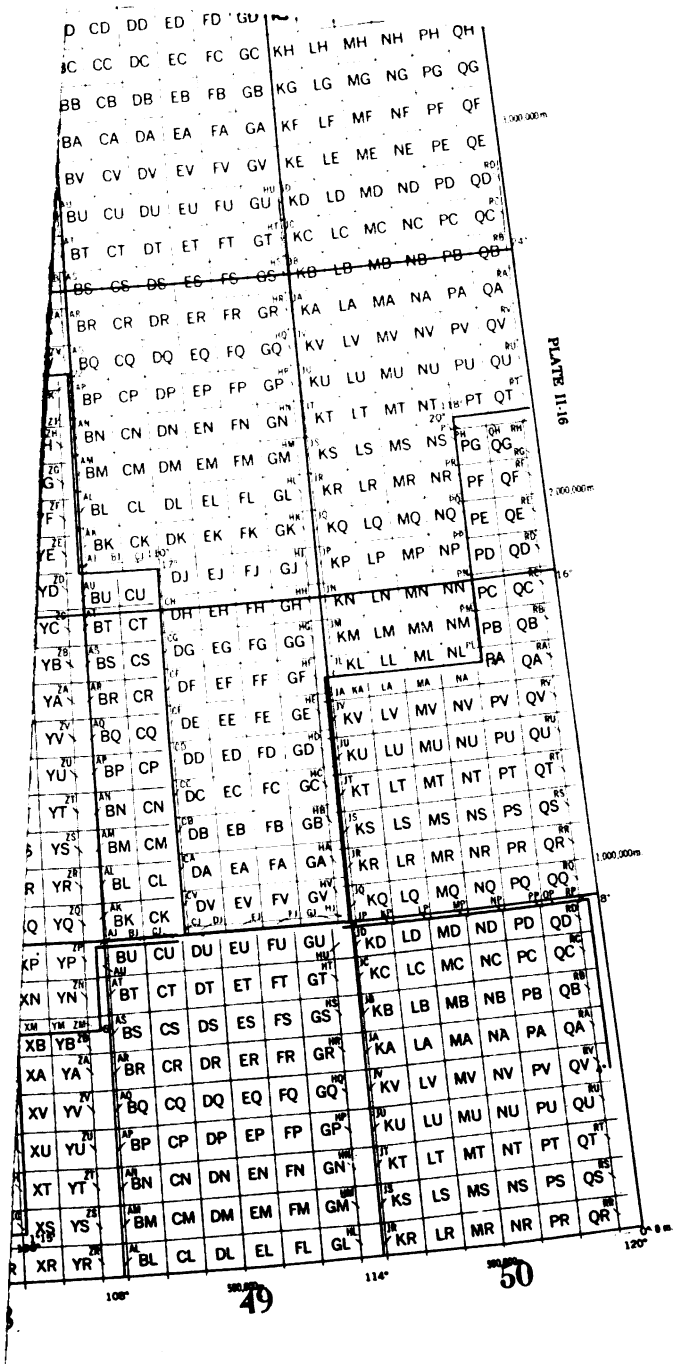


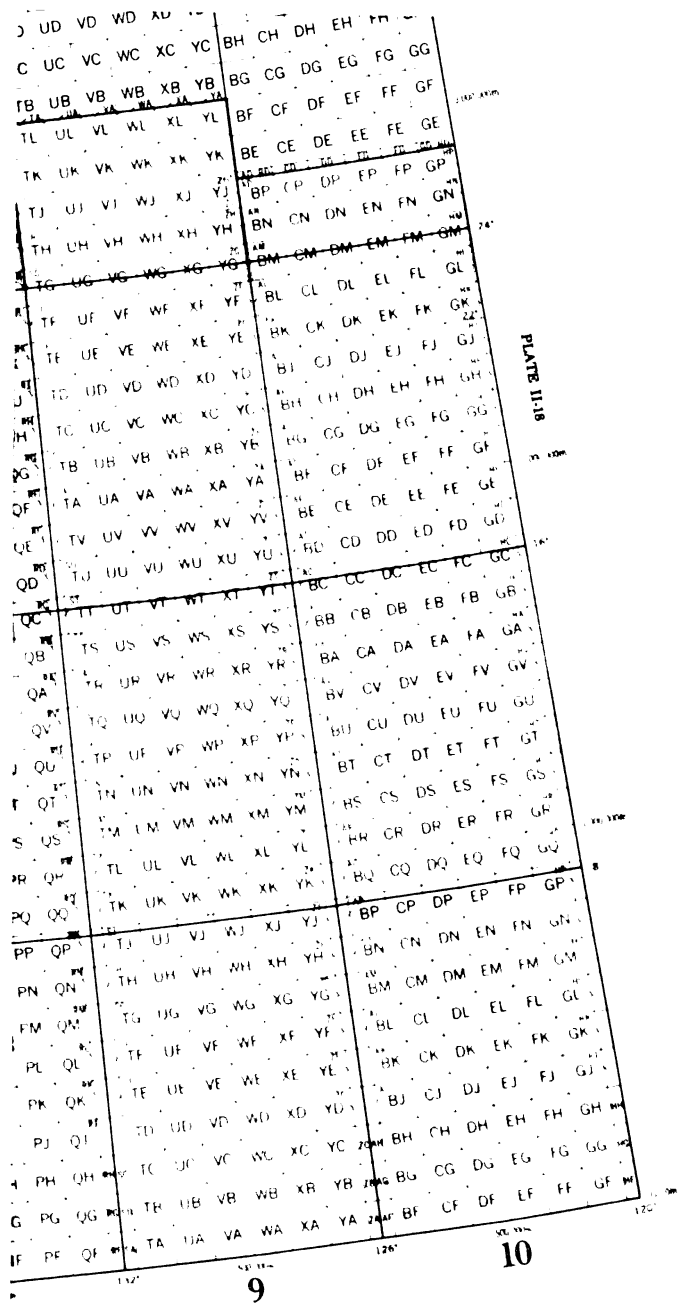
E II-17



E II-18







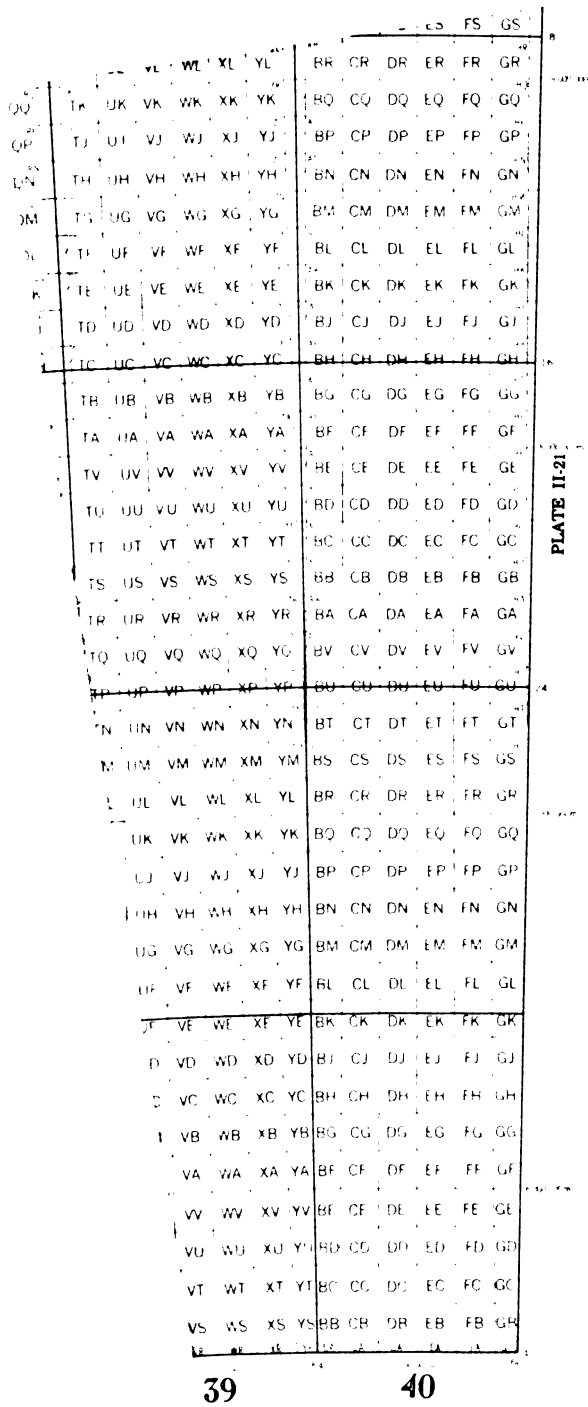
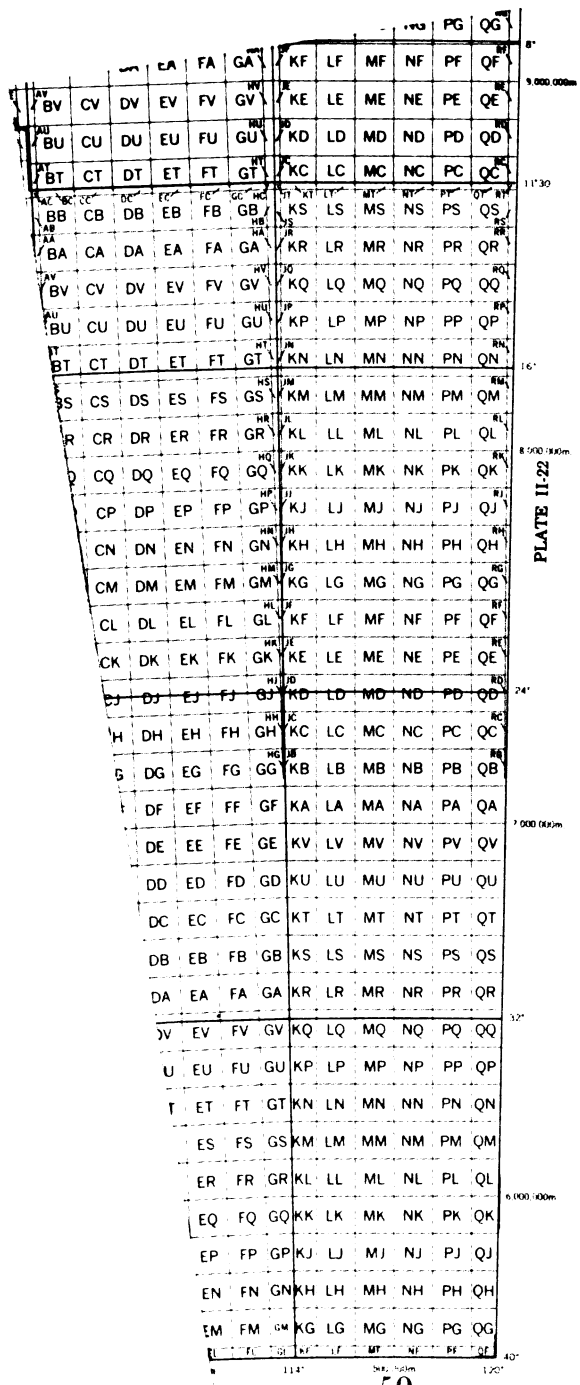
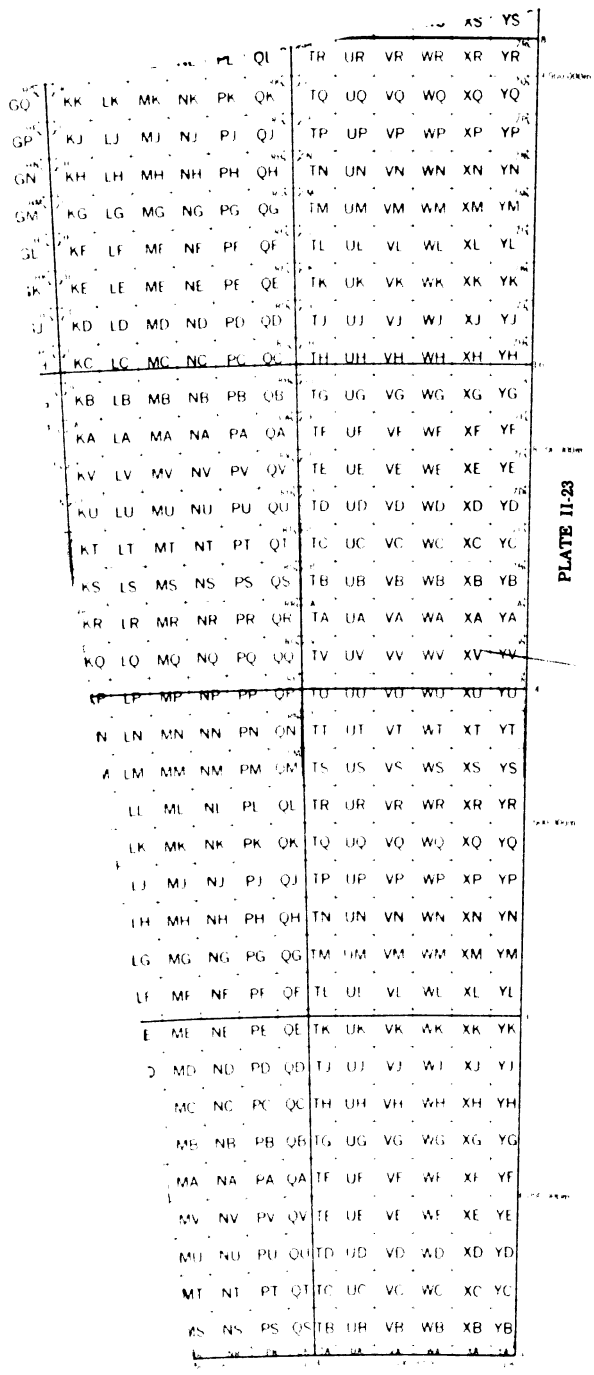


PLATE II-21





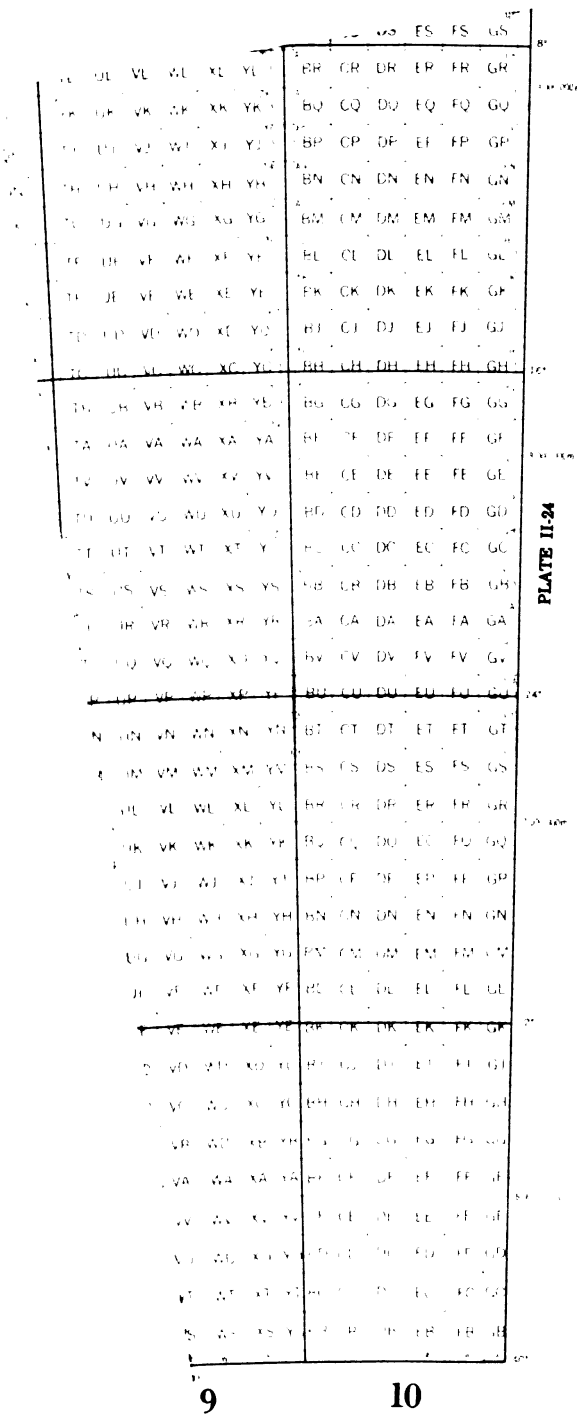
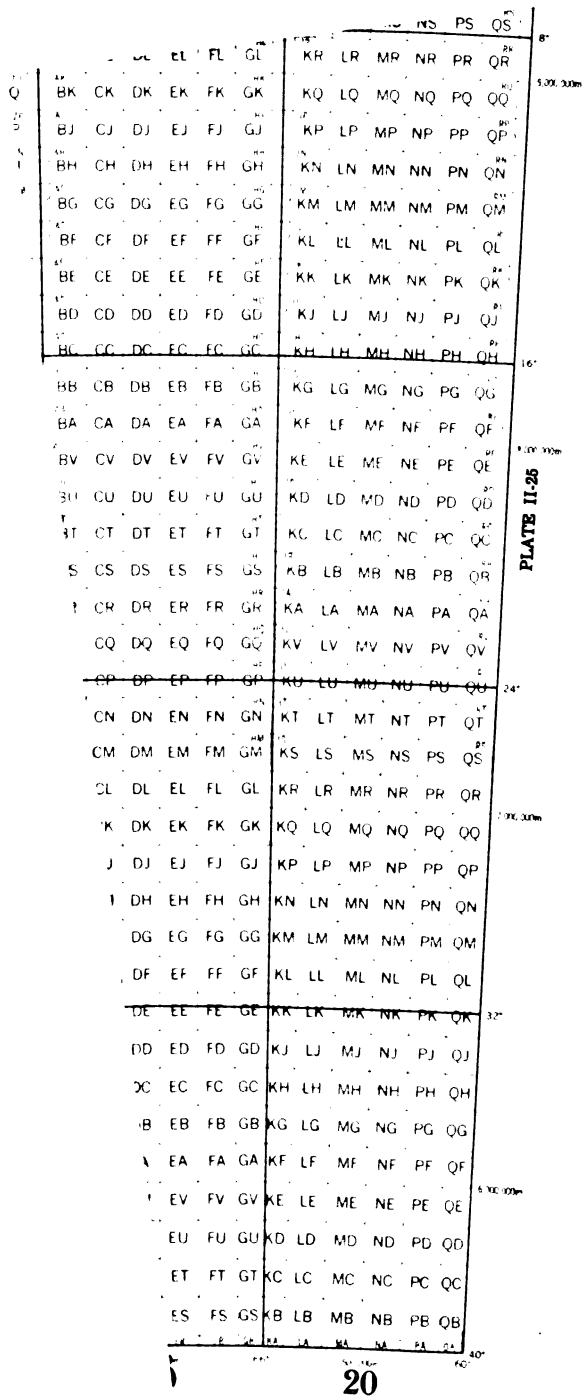


PLATE II-24



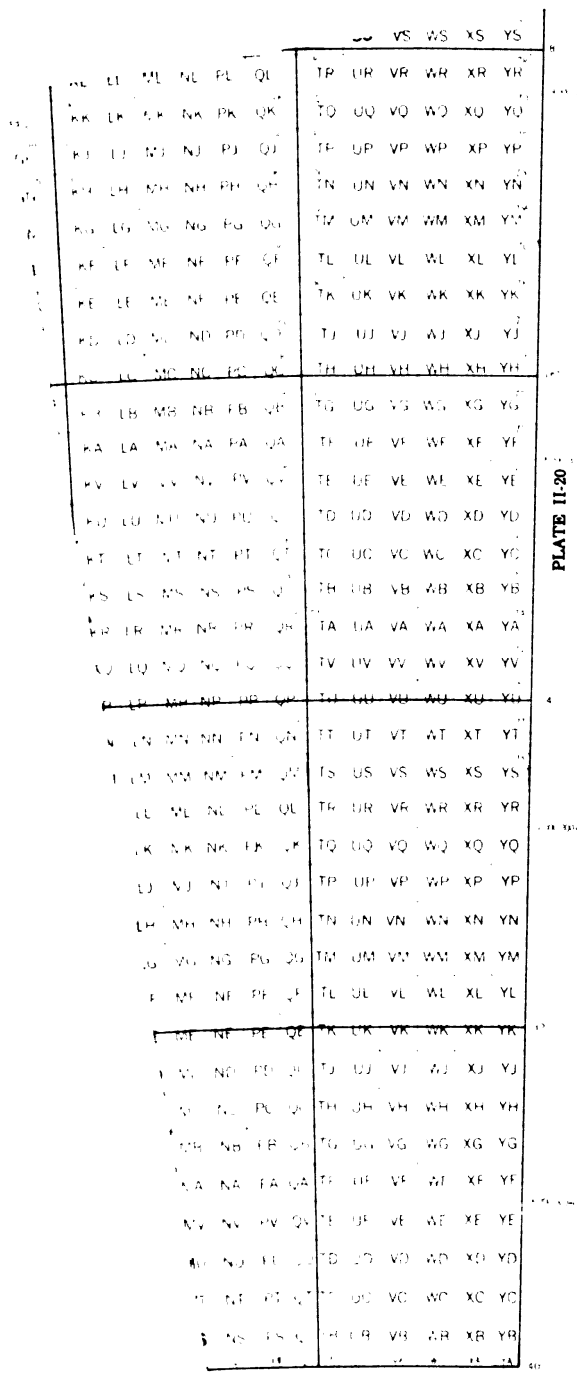


PLATE 11-20

29 30

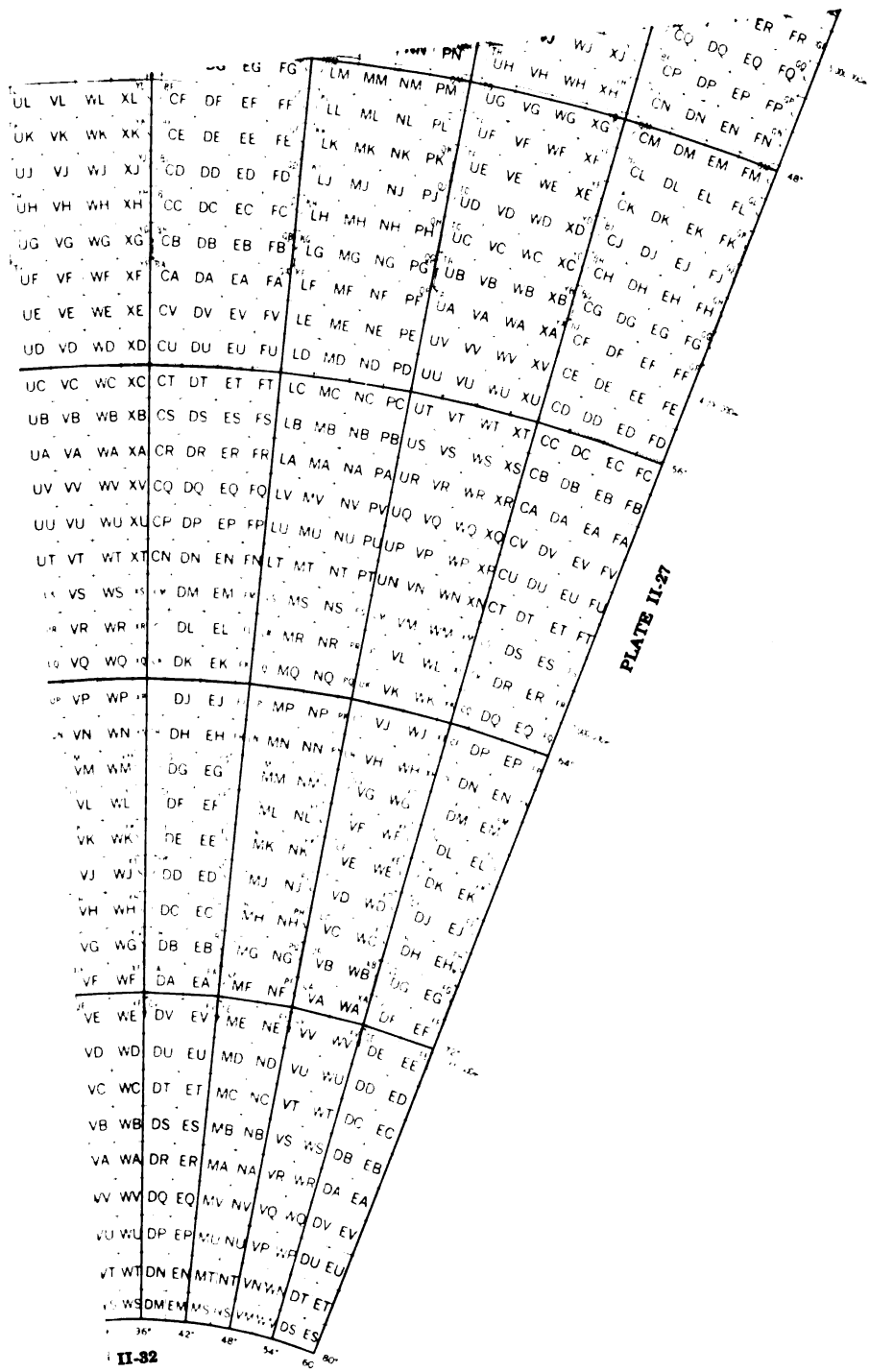
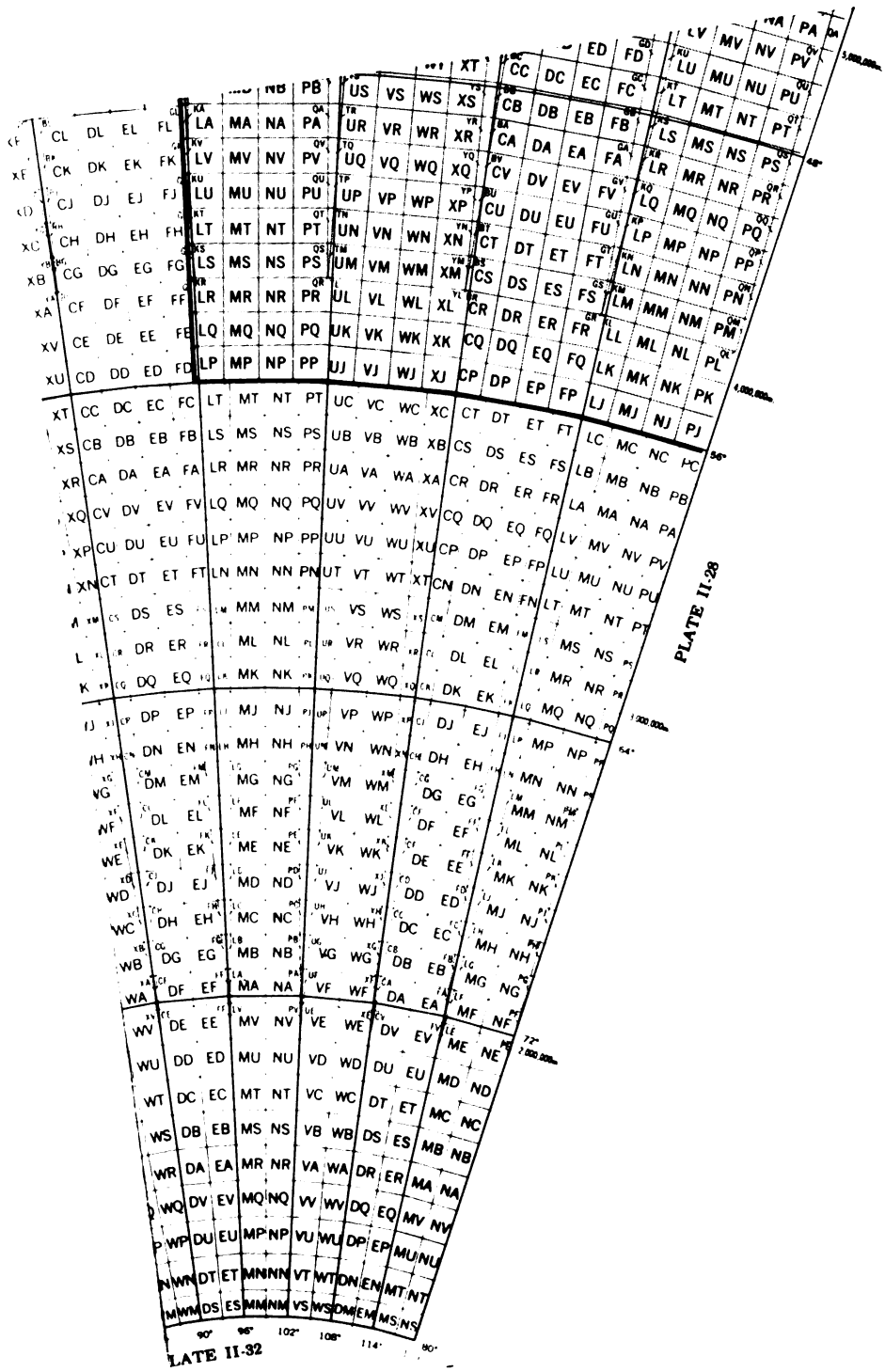


PLATE II-27

II-32



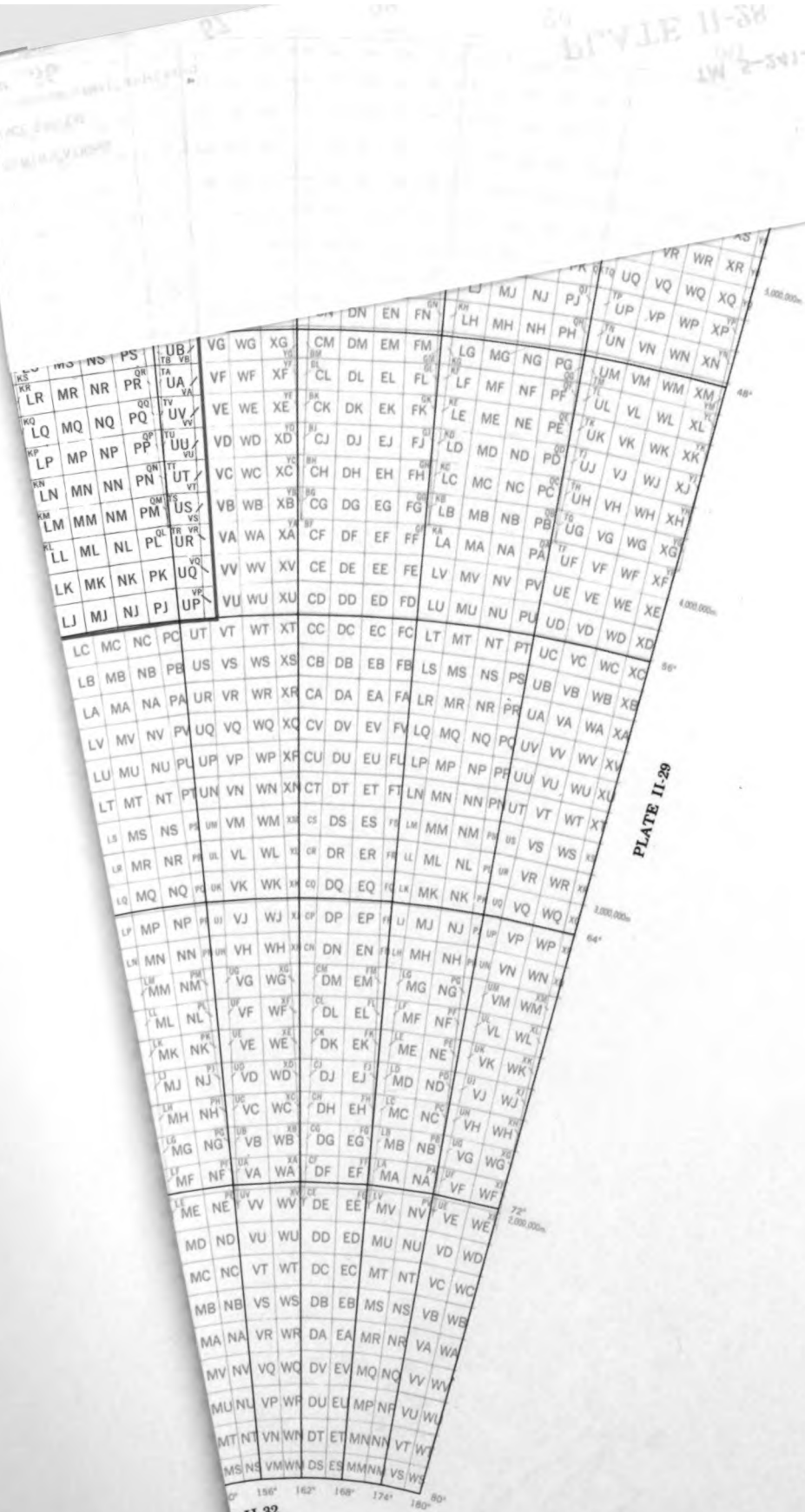


PLATE II-29
PLATE II-32
141
Digitized by Google

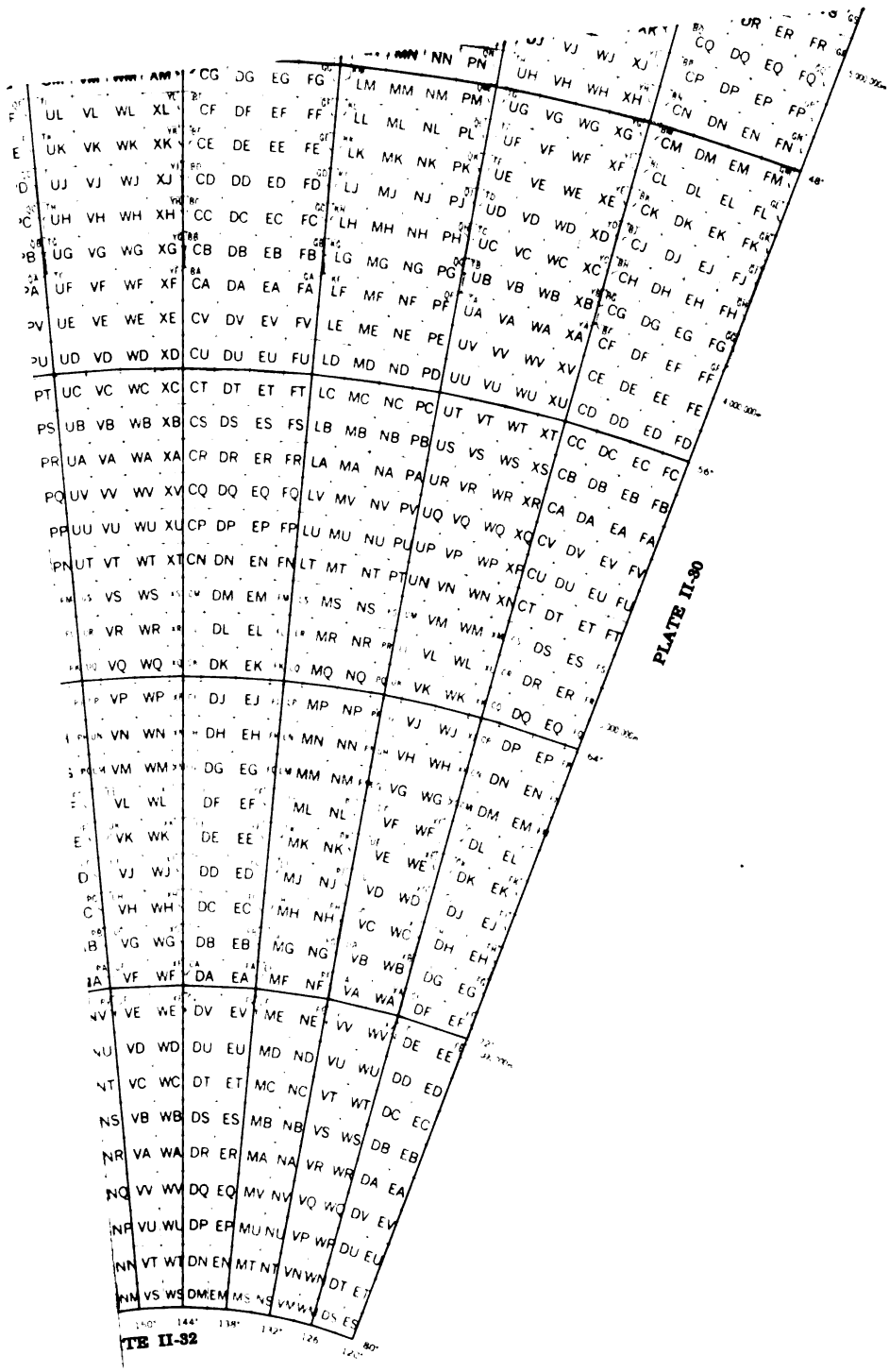
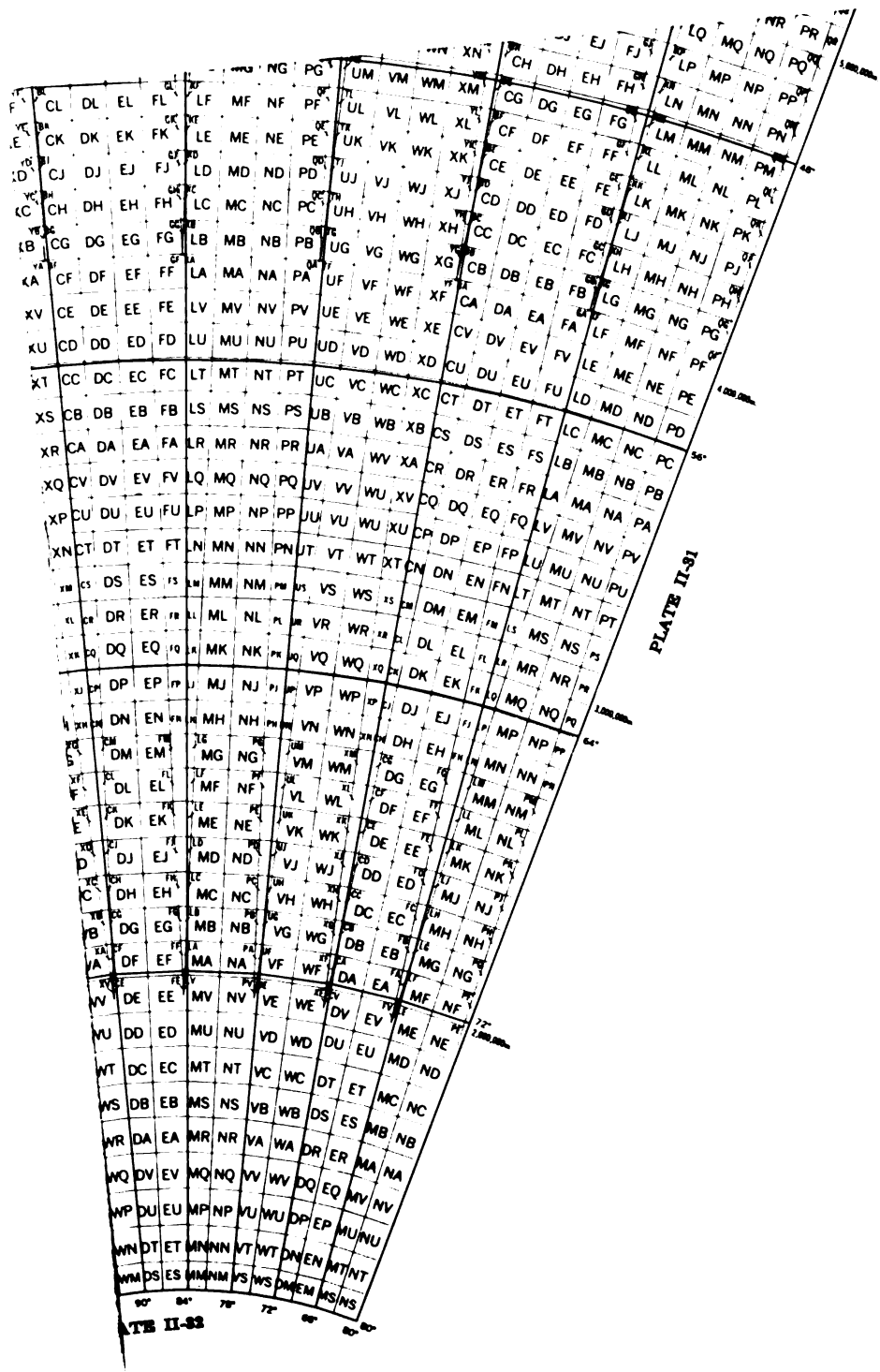



PLATE II-30

PLATE II-32



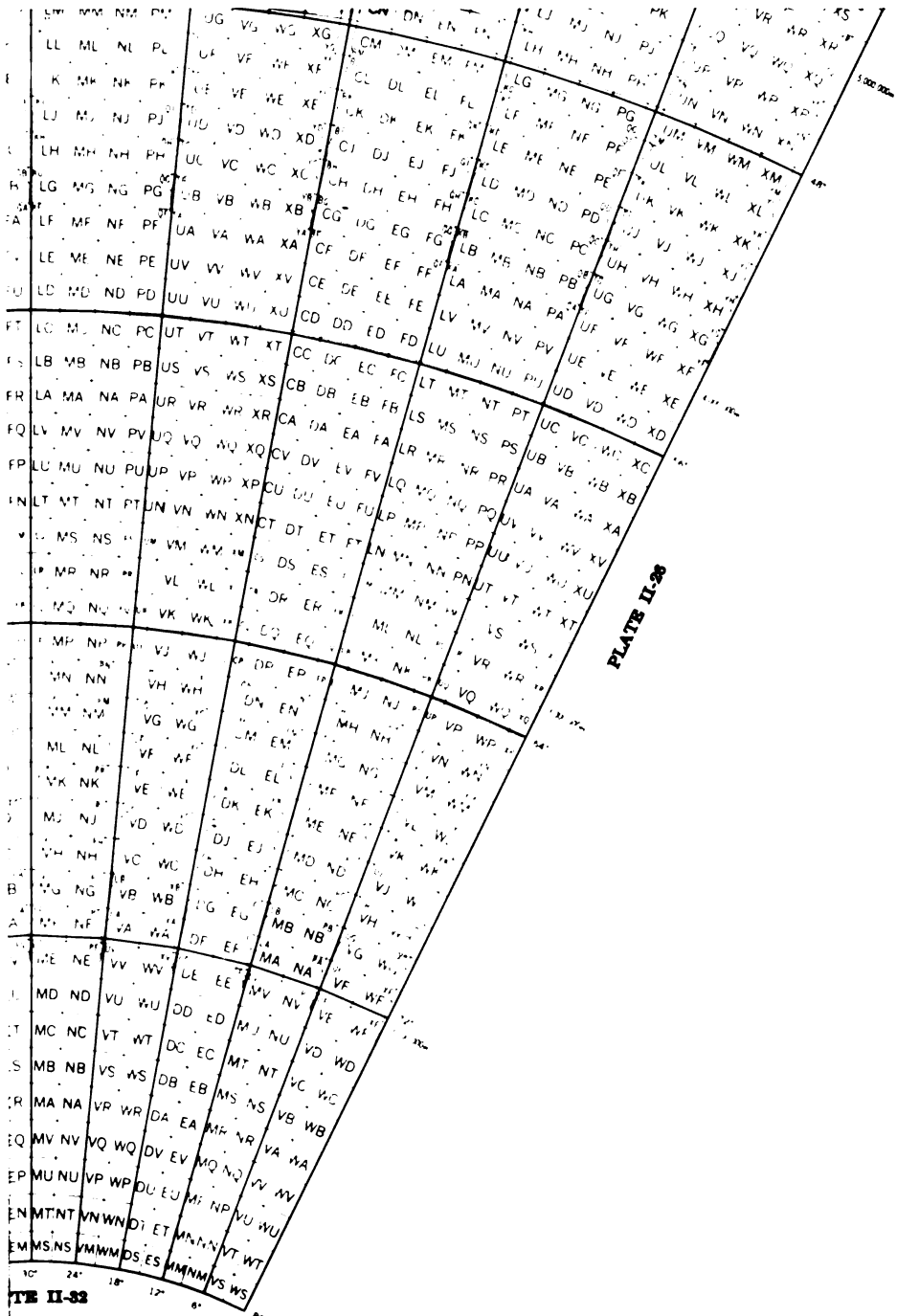
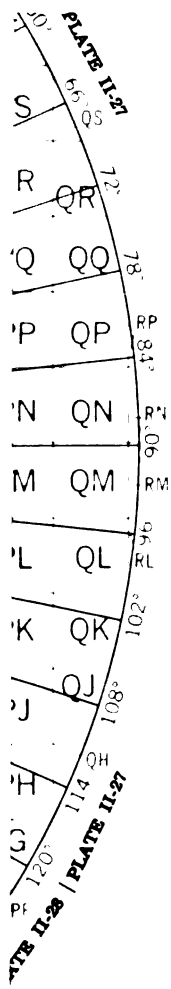


PLATE II-28



GRID ZONE DESIGNATIONS

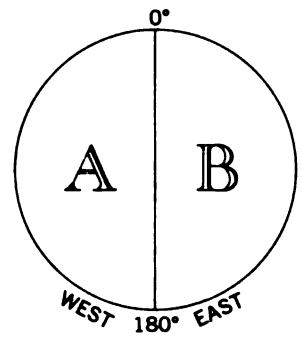
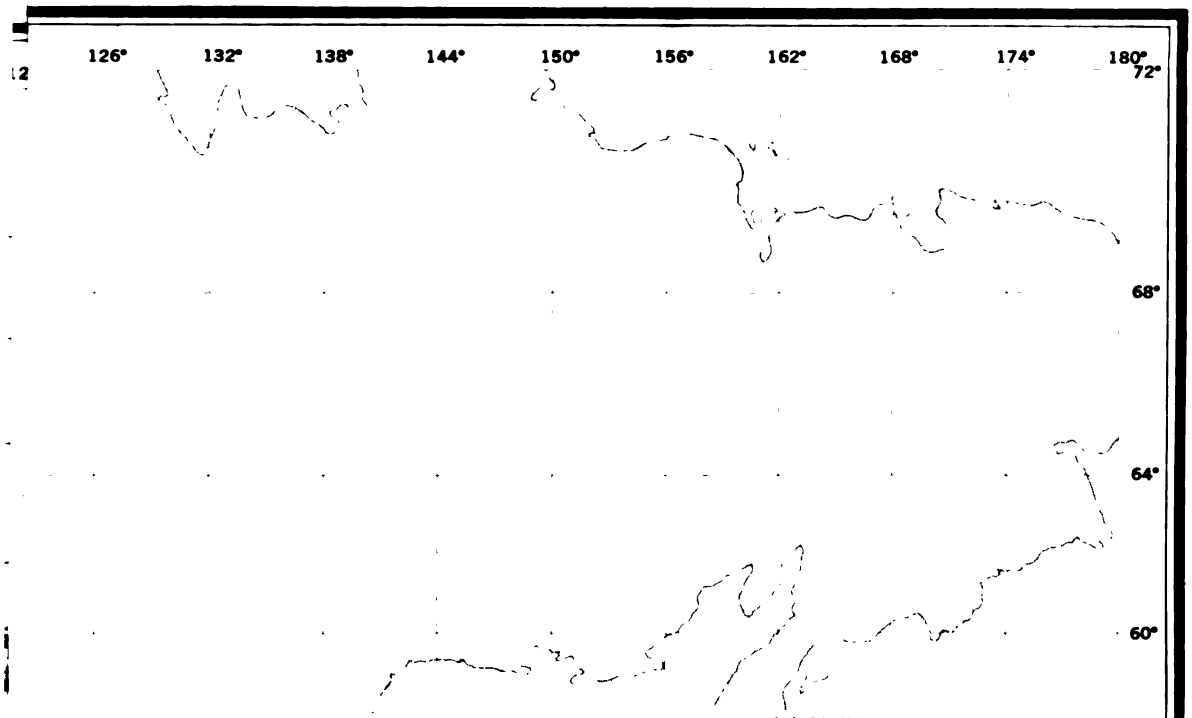
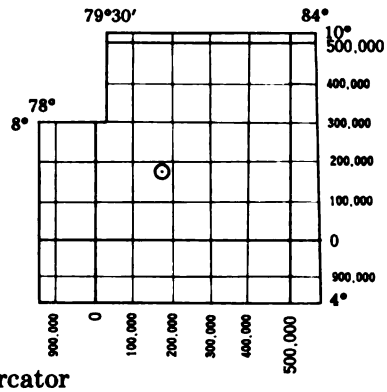


PLATE III



THIS INDEX MUST NOT BE CONSIDERED AUTHORITATIVE

CEYLON BELT



PROJECTION: Transverse Mercator

SPHEROID: Everest

UNIT: Indian Yard

ORIGIN: 7°00′01.729″N., 80°46′18.160″E.

FALSE COORDINATES OF ORIGIN: 176,000 yards E.; 176,000 yards N.

(South and west of the false origin (0 yards E. and 0 yards N. grid lines) add 1,000,000 yards to the eastings and northings.

SCALE FACTOR: Unity

INCIDENCE OF GRID LETTERS: No letters used

GRID TABLES: *Transverse Mercator Projection Tables, Ceylon Belt,* AMS (Key No. 201063)

GRID "COLOR": Brown

REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):

Principal digits: (2); 10,000, 1,000

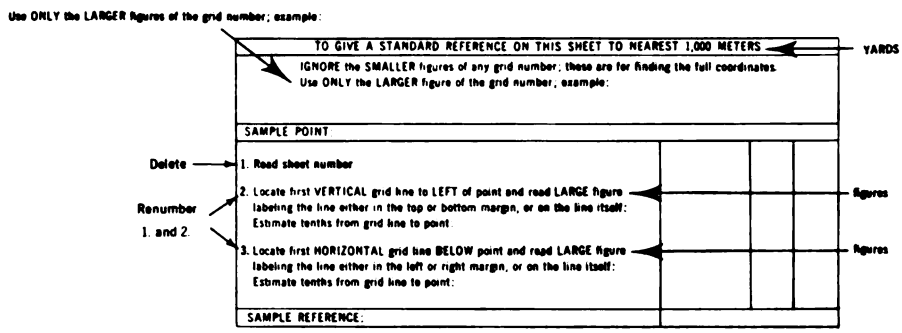
Reference box: AMS Cut No. 16 A

Modifications to box: Substitute type as shown in illustration.

TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METERS ← YARDS			
IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number; example:			
SAMPLE POINT:			
1. Read sheet number 2. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labeling the line either in the top or bottom margin, or on the line itself: Estimate tenths from grid line to point: 3. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labeling the line either in the left or right margin, or on the line itself: Estimate tenths from grid line to point:			
SAMPLE REFERENCE:			

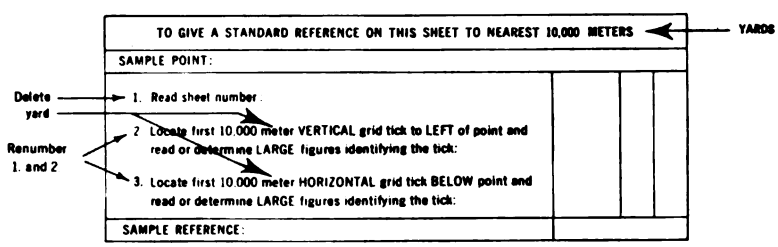
See back of this page)

REFERENCING FOR 10,000-YARD GRID (6-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 7A
Modifications to box: Substitute type as shown in illustration.

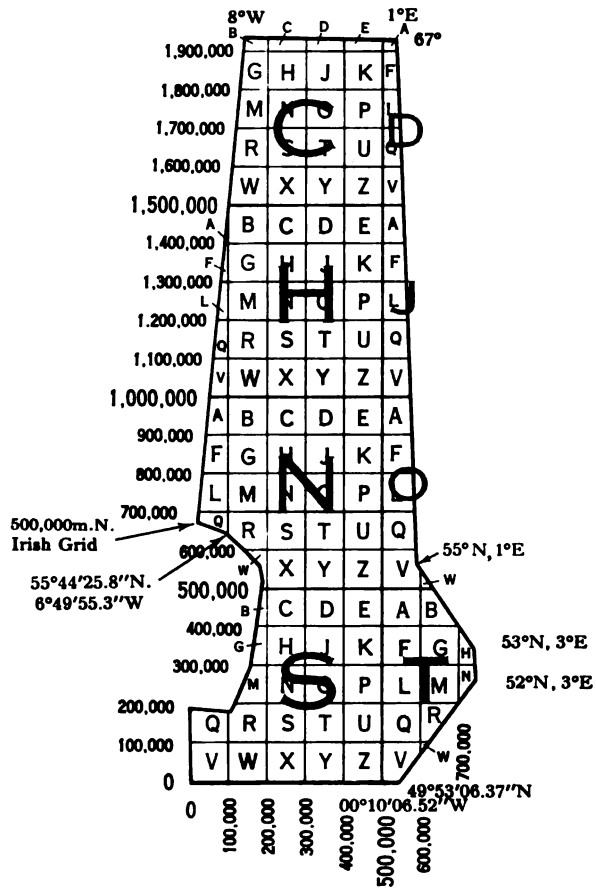


REFERENCING FOR 100,000-YARD GRID (4-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 389A

Modifications to box: Substitute type as shown in illustration



ENGLISH NATIONAL GRID



PROJECTION: Transverse Mercator

SPHEROID: Airy

UNIT: Meter

ORIGIN: 49°N., 2°W.

FALSE COORDINATES OF ORIGIN: 400,000 meters E.; −100,000 meters N.

SCALE FACTOR: 0.9996

INCIDENCE OF GRID LETTERS: The 500,000-meter square letter S and the 100,000-meter square letter V are both north and east of the false origin.

GRID TABLES: *Transverse Mercator Projection Tables, English Belt,* AMS (Key No. 201067) with modifications for unit of measure and false coordinates.

GRID "COLOR": Purple or blue (GSGS); black or blue (AMS)

REFERENCING FOR 1,000-METER GRID (6-digit numerical reference):

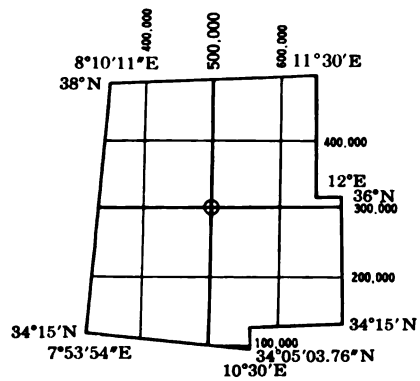
(*See back of this page*)

Principal digits: (2); 10,000, 1,000
Reference box: AMS Cut No. 160 A Modifications to box: None

REFERENCING FOR 10,000-METER GRID (4-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 162 A Modifications to box: None

REFERENCING FOR 100,000-METER GRID (2-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 387 A Modifications to box: None

FRENCH LAMBERT NORD TUNISIE GRID



PROJECTION: Lambert Conical Orthomorphic

SPHEROID: Clarke 1880

UNIT: Meter

ORIGIN: 36°N., 9°54'E.

FALSE COORDINATES OF ORIGIN: 500,000 meters E.; 300,000 meters N.

SCALE FACTOR: .99962 5544

INCIDENCE OF GRID LETTERS: No letters used

GRID TABLES: *Tables de Projection Systeme Lambert Nord Algerie*

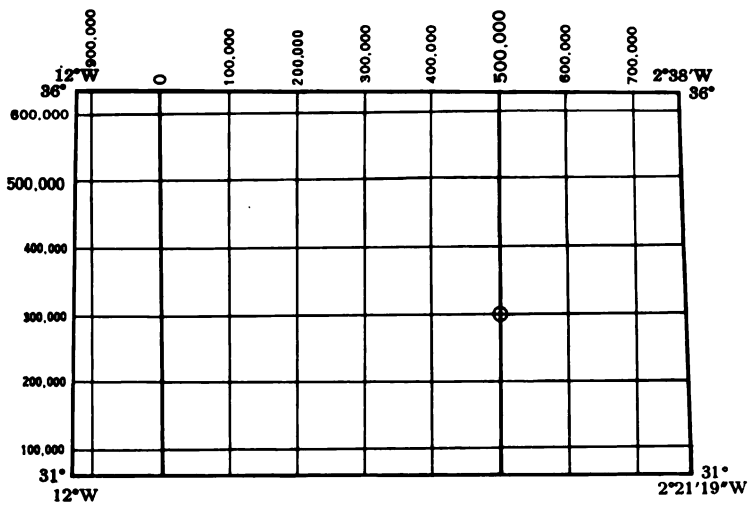
GRID "COLOR": Brown

REFERENCING FOR 1,000-METER GRID (8-digit numerical reference):
Principal digits: (3); 100,000, 10,000, 1,000
Reference box: AMS Cut No. 16A. Modifications to box: None

REFERENCING FOR 10,000-METER GRID (6-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No.7A. Modifications to box: None

REFERENCING FOR 100,000-METER GRID (4-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 389A. Modifications to box: None

FRENCH LAMBERT NORD MAROC GRID



PROJECTION: Lambert Conical Orthomorphic

SPHEROID: Clarke 1880

UNIT: Meter

ORIGIN: 33°18'N., 5°24'W.

FALSE COORDINATES OF ORIGIN: 500,000 meters E.; 300,000 meters N.

(West of the false origin add 1,000,000 meters to the eastings)

SCALE FACTOR: .99962 5769

INCIDENCE OF GRID LETTERS: No letters used

GRID TABLES: *Tables de Projection Systeme Lambert Nord Maroc*

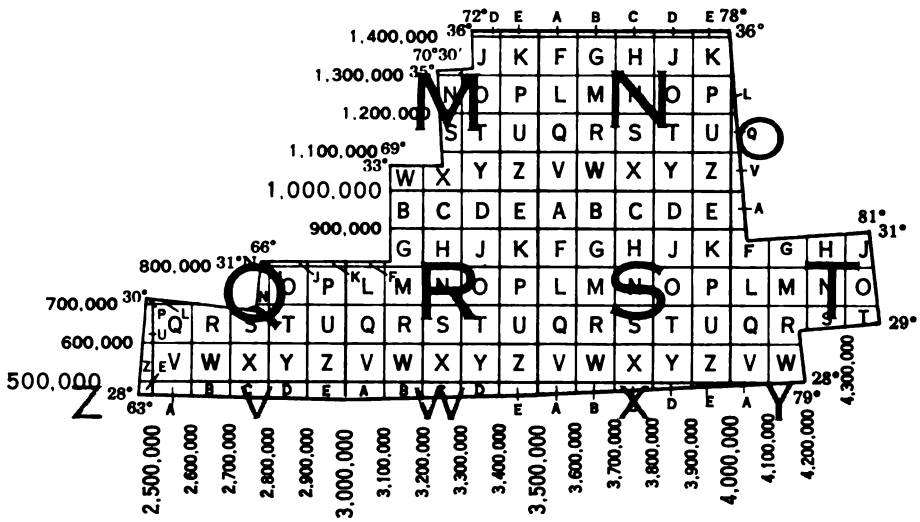
GRID "COLOR": Red

REFERENCING FOR 1,000-METER GRID (8-digit numerical reference):
Principal digits: (3); 100,000, 10,000, 1,000
Reference box: AMS Cut No. 16A. Modifications to box: None

REFERENCING FOR 10,000-METER GRID (6-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 7A. Modifications to box: None

REFERENCING FOR 100,000-METER GRID (4-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 389A. Modifications to box: None

INDIA ZONE I



PROJECTION: Lambert Conical Orthomorphic

SPHEROID: Everest

UNIT: Indian Yard

ORIGIN: 32°30′N., 68°E.

FALSE COORDINATES OF ORIGIN: 3,000,000 yards E.; 1,000,000 yards N.

SCALE FACTOR: 0.998786408

INCIDENCE OF GRID LETTERS: Normal

GRID TABLES: *Lambert Conical Orthomorphic Projection Tables, India Zone I,* AMS (Key No. 200586)

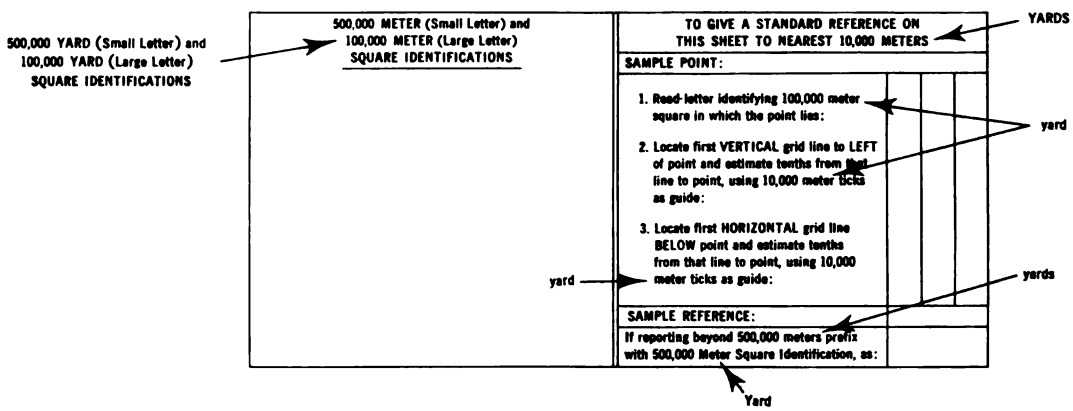
GRID "COLOR": Black

REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):
Principal digits: (2); 10,000, 1,000
Reference box: AMS Cut No. 161A Modifications to box: None

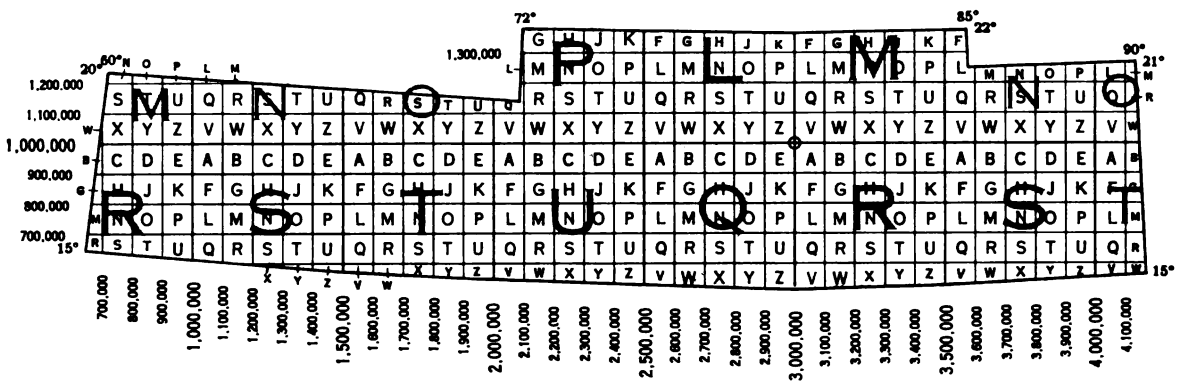
REFERENCING FOR 10,000-YARD GRID (4-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 163A Modifications to box: None

(*See back of this page*)

REFERENCING FOR 100,000-YARD GRID (2-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 387A
Modifications to box: Substitute type as shown in illustration.



INDIA ZONE IIIA



PROJECTION: Lambert Conical Orthomorphic

SPHEROID: Everest

UNIT: Indian Yard

ORIGIN: 19°N., 80°E.

FALSE COORDINATES OF ORIGIN: 3,000,000 yards E.; 1,000,000 yards N.

SCALE FACTOR: 0.998786408

INCIDENCE OF GRID LETTERS: Normal

GRID TABLES: *Lambert Conical Orthomorphic Projection Tables, India Zone IIIA*, AMS (Key No. 200588)

GRID "COLOR": Black

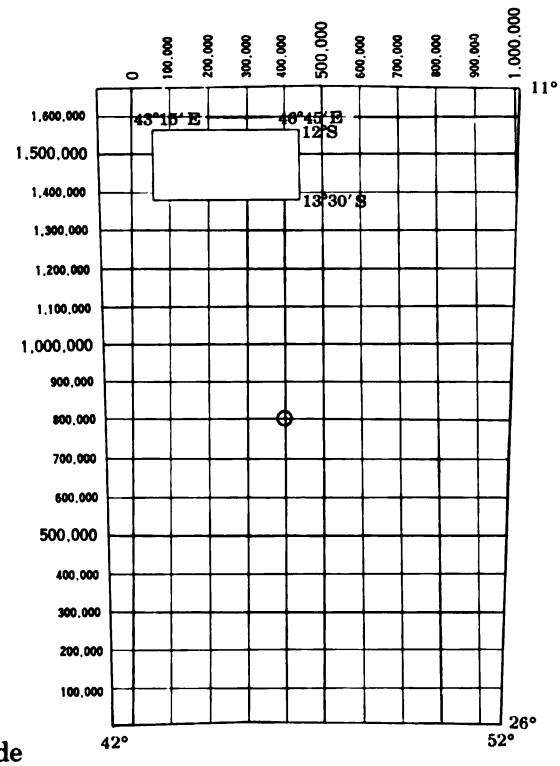
REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):
Principal digits: (2); 10,000, 1,000
Reference box: AMS Cut No. 161 A Modifications to box: None

REFERENCING FOR 10,000-YARD GRID (4-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 163 A Modifications to box: None

REFERENCING FOR 100,000-YARD GRID (2-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 387 A
Modifications to box: Substitute type as shown in illustration.

(*See back of this page*)

MADAGASCAR GRID



PROJECTION: Laborde

SPHEROID: International

UNIT: Meter

ORIGIN: 18°54′S., 46°26′13.95″E.

FALSE COORDINATES OF ORIGIN: 400,000 meters E.; 800,000 meters N.

(West of the false origin add 1,000,000 meters to the eastings.)

SCALE FACTOR: 0.9995

INCIDENCE OF GRID LETTERS: No letters used

GRID TABLES: *Laborde Projection Tables, Madagascar Grid*, AMS (Key No. 201070)

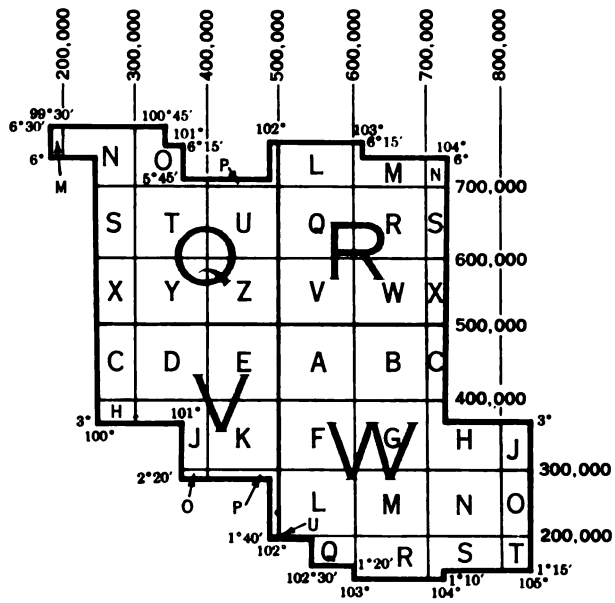
GRID "COLOR": Red

REFERENCING FOR 1,000-METER GRID (8-digit numerical reference):
Principal digits: (3); 100,000, 10,000, 1,000
Reference box: AMS Cut No. 16A Modifications to box: None

REFERENCING FOR 10,000-METER GRID (6-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 7A Modifications to box: None

REFERENCING FOR 100,000-METER GRID (4-digit numerical reference):
Principal digits: (2); 100,000, 10,000
Reference box: AMS Cut No. 389 A Modifications to box: None

MALAYAN RECTIFIED SKEW ORTHOMORPHIC GRID



PROJECTION: Rectified Skew Orthomorphic

SPHEROID: Modified Everest

UNIT: British Yard

ORIGIN: 4°N., 102°15′E.

FALSE COORDINATES OF ORIGIN: 517121 yards E., 483838 yards N.

SCALE FACTOR: 0.99984

INCIDENCE OF GRID LETTERS: Normal

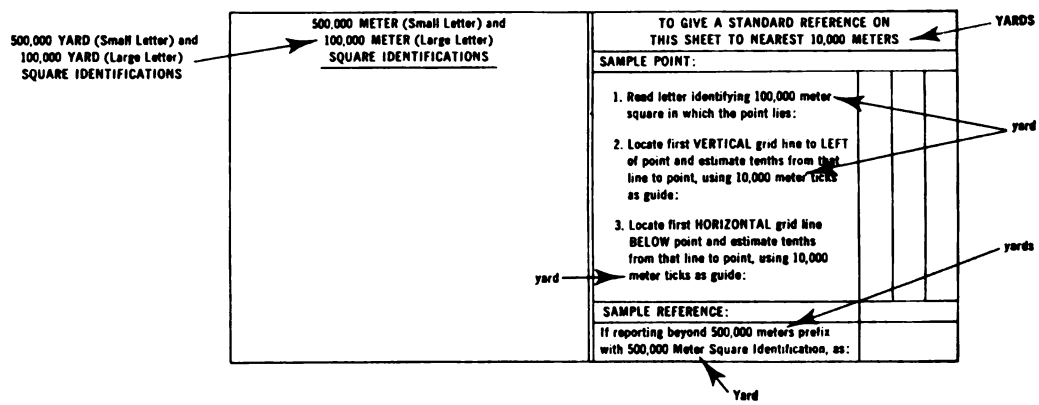
GRID COLOR: Black

REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):
Principal digits: (2); 10,000, 1,000
Reference box: AMS Cut No. 161A Modifications to box: None

REFERENCING FOR 10,000-YARD GRID (4-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 163A Modifications to box: None

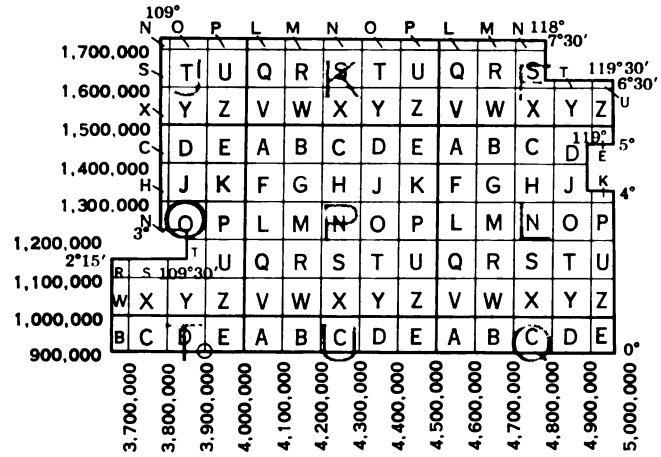
(See back of this page)

REFERENCING FOR 100,000-YARD GRID (2-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 387A
Modifications to box: Substitute type as shown in illustration.



NETHERLANDS EAST INDIES EQUATORIAL ZONE

BRITISH METRIC GRID



PROJECTION: Lambert Conical Orthomorphic

SPHEROID: Bessel

UNIT: Meter

ORIGIN: Equator, 110°E.

FALSE COORDINATES OF ORIGIN: 3,900,000 meters E.; 900,000 meters N.

SCALE FACTOR: 0.997

INCIDENCE OF GRID LETTERS: The 500,000-meter square letter P and the 100,000-meter square letter V are both east of the 4,000,000-meter grid line and north of the 1,000,000-meter grid line.

GRID TABLES: *Lambert Conical Orthomorphic Projection Tables, Netherlands East Indies Equatorial Zone*, AMS (Key No. 200576)

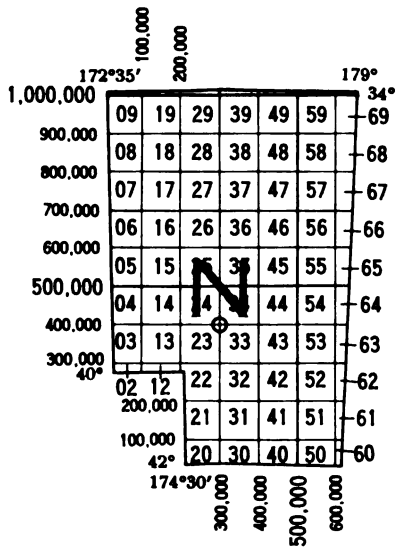
GRID "COLOR": Blue

REFERENCING FOR 1,000-METER GRID (6-digit numerical reference):
Principal digits: (2); 10,000, 1,000
Reference box: AMS Cut No. 160A. Modifications to box: None

REFERENCING FOR 10,000-METER GRID (4-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 162A. Modifications to box: None

REFERENCING FOR 100,000-METER GRID (2-digit numerical reference):
Principal digits: (1); 10,000
Reference box: AMS Cut No. 387A. Modifications to box: None

NEW ZEALAND NORTH ISLAND BELT



PROJECTION: Transverse Mercator

SPHEROID: International

UNIT: Yard

ORIGIN: 39°S., 175°30'E.

FALSE COORDINATES OF ORIGIN: 300,000 yards E.; 400,000 yards N.

SCALE FACTOR: Unity

INCIDENCE OF GRID LETTERS: Each 100,000-yard square is designated by a 2-digit number (corresponding to the 100,000-unit square letter). The first of these digits is the hundred-thousands digit of the easting line forming the west side of the particular square; the second digit is the hundred-thousands digit of the northing line forming the south side of that square.

GRID TABLES: *Transverse Mercator Projection Tables, New Zealand North Island Belt*, AMS (Key No. 201065)

GRID "COLOR": Black

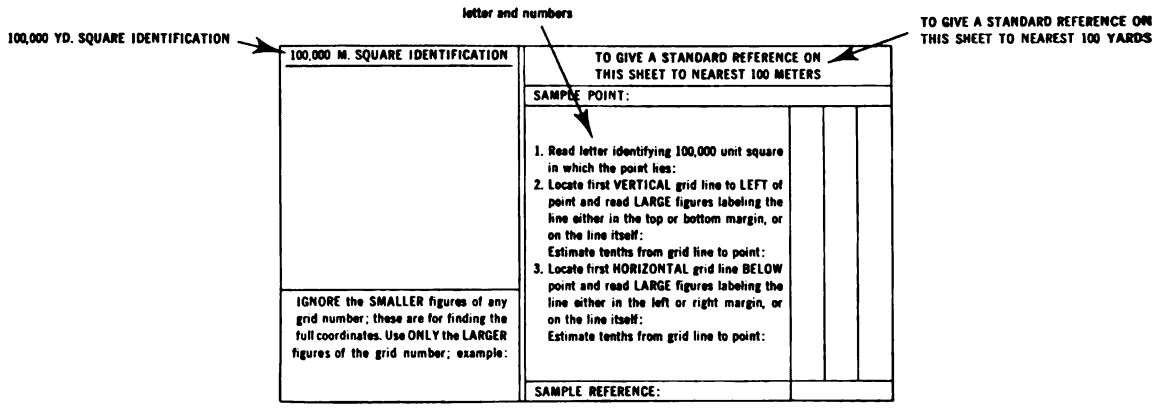
REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):

Principal digits: (2); 10,000, 1,000

100,000-yard square: The letter N shall be incorporated as part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000-yard square digits as N36 and is used when reporting beyond 100,000 yards. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: N36-769341

(See back of this page)

Reference box: AMS Cut No. 164 A
Modifications to box: Substitute type as shown in illustration.



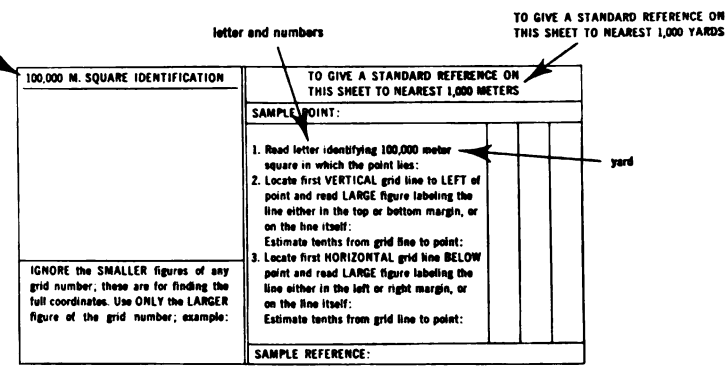
Referencing for 10,000-Yard Grid (4-digit numerical reference):

Principal digits: (1); 10,000

100,000-yard square: The letter N shall be incorporated as part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000-yard square digits as N36. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: N36-7734

Reference box: AMS Cut No. 165 A

Modifications to box: Substitute type as shown in illustration.



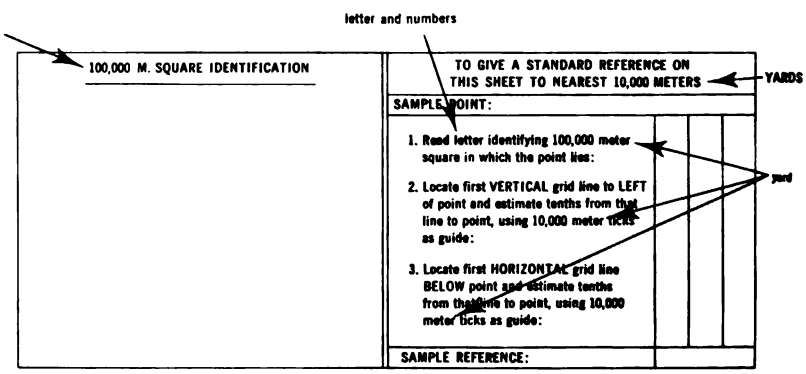
Referencing for 100,000-Yard Grid (2-digit numerical reference):

Principal digits: (1); 10,000

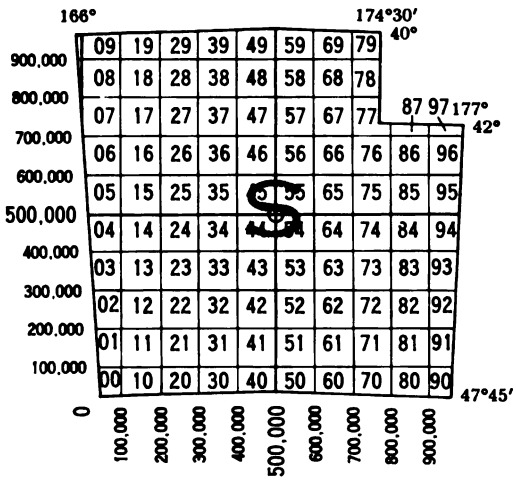
100,000-yard square: The letter N shall be incorporated as part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000-yard square digits as N36. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: N36-73.

Reference box: AMS Cut No. 388 A

Modifications to box: Substitute type as shown in illustration.



NEW ZEALAND SOUTH ISLAND BELT



PROJECTION: Transverse Mercator

SPHEROID: International

UNIT: Yard

ORIGIN: 44°S., 171°30′E.

FALSE COORDINATES OF ORIGIN: 500,000 yards E.; 500,000 yards N.

SCALE FACTOR: Unity

INCIDENCE OF GRID LETTERS: Each 100,000-yard square is designated by a 2-digit number (corresponding to the 100,000-unit square letter). The first of these digits is the hundred-thousands digit of the easting line forming the west side of the particular square; the second digit is the hundred-thousands digit of the northing line forming the south side of that square.

GRID TABLES: *Transverse Mercator Projection Tables, New Zealand South Island Belt*, AMS (Key No. 201066)

GRID "COLOR": Black

REFERENCING FOR 1,000-YARD GRID (6-digit numerical reference):

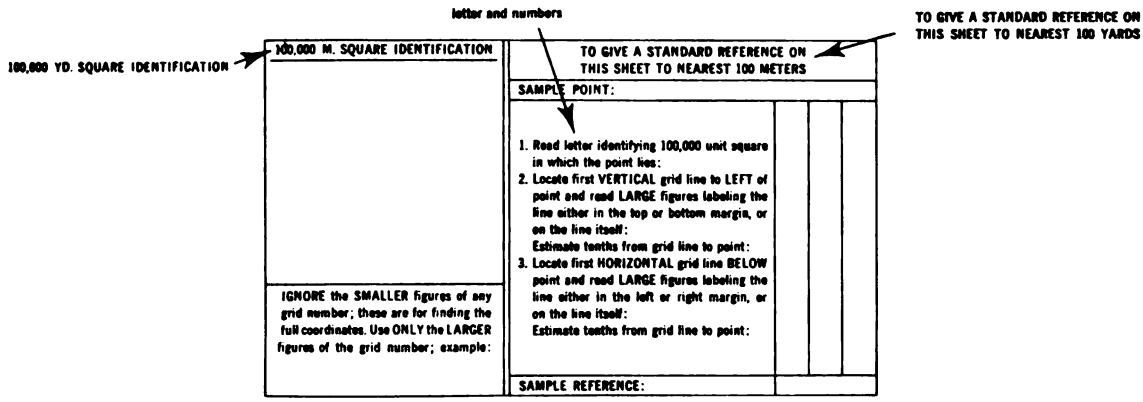
Principal digits: (2); 10,000, 1,000

100,000-yard square: The letter S shall be incorporated as part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000-yard square digits as S36 and is used when reporting beyond 100,000 yards. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: S36-769341

Reference box: AMS Cut No. 164 A

(*See back of this page*)

Modifications to box: Substitute type as shown in illustration.



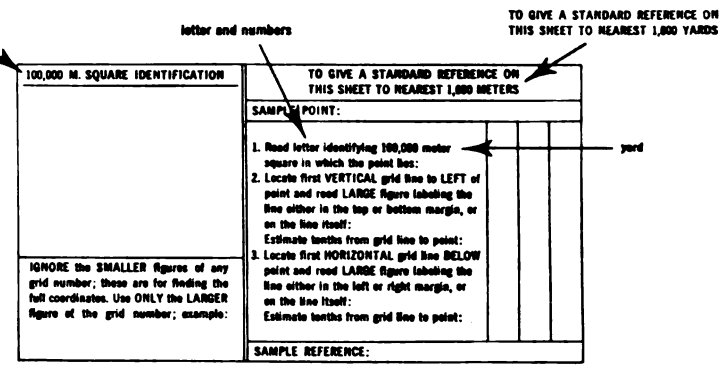
REFERENCING FOR 10,000 YARD GRID (4-digit numerical reference):

Principal digits: (1); 10,000

100,000-yard square: The letter S shall be incorporated a part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000 yard square digits as S36. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: S36-7734.

Reference box: AMS Cut No. 165 A

Modifications to box: Substitute type as shown in illustration.



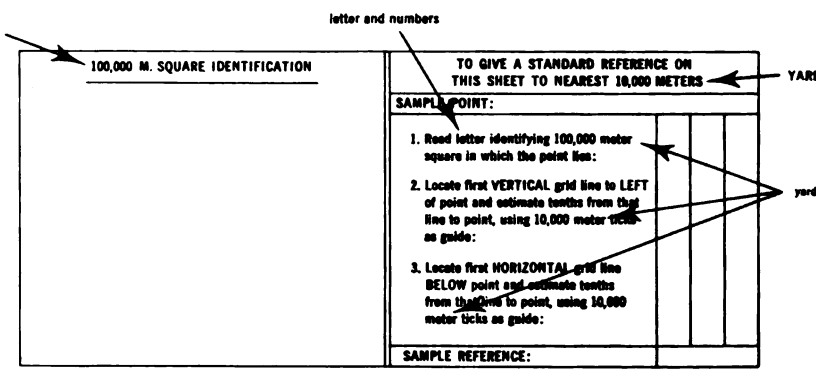
REFERENCING FOR 100,000-YARD GRID (2-digit numerical reference):

Principal digits: (1); 10,000

100,000-yard square: The letter S shall be incorporated as part of the 100,000-yard square identification when this identification is used in giving references. It is shown preceding the 100,000-yard square digits as S36. Always insert a dash between the 100,000-yard square identification and the numerical part of the reference, as: S36-73.

Reference box: AMS Cut No. 388 A

Modifications to box: Substitute type as shown in illustration.



By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:

ACSI (2)
DCSPER (2)
DCSLOG (2)
DCSOPS (2)
CORC (2)
CRD (1)
COA (1)
CINFO (1)
TIG (1)
TJAGSA (1)
USCONARC (5)
CNGB (2)
ARADCOM (2)
ARADCOM Rgn (1)
USACDC (2)
Armies (5)
Corps (3)
Div (2)
Div Arty (1)
CofEngrs (10)
OS Maj Comd (5)
Instl (1)
Engr Cen (2)
PMS Sr Div Units (1)
Br Svc Sch (2) except
USAES (25)
USMA (1)
USATC (7)
MDW (1)
USA Arty Bd (1)
Units organized under following TOE's:
5-301 (2)
5-305 (2)
5-306 (1)
5-308 (2)
5-327 (3)
5-346 (2)
5-347 (1)
5-348 (4)
5-349 (2)
5-500 (IA-IC, IJ, IL, IM) (1)

NG: None.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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