Drawing specifications for international ski orienteering maps

INTERNATIONAL
ORIENTEERING
FEDERATION

1984

DRAWING SPECIFICATIONS FOR INTERNATIONAL SKI ORIENTEERING MAPS

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Hannu Kovalainen, Lasse Niemelä
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1. INTRODUCTION

In recent years ski orienteering has developed into a international sport, and it has become necessary to make the maps for all international events as similar as possible. It is the aim of the following "Drawing specifications for international ski-o-maps" to standardise the production of ski orienteering maps, since this is important for the future expansion of the sport and is essential for fair competition.

Maps for international ski orienteering events must be produced in accordance with these drawing specifications.

2. GENERAL REQUIREMENTS

2.1. Ski orienteering and the map

Ski orienteering is a sport in which the skier completes a course of control points in the shortest possible time, aided only by map and compass. As in all forms of sport, it is necessary to ensure that the conditions of competition are the same for all competitors. The more accurate the map, the better this can be done, and the greater the opportunity for the course planner to set a good and fair course.

The map is the most important aid in ski orienteering. Without it the sport in its true form cannot take place at all. It is through a good map that a forest becomes a ski orienteering area.

From the competitor's point of view, a detailed and legible map provides a realiable guide for route choice and navigation. No competitor should obtain an advantage or suffer a disadvantage because of faults in the map.

Skill in route choice loses all meaning if the map is not a true picture of the ground - if it is inaccurate or out of date. When he chooses a route, a competitor bases his decision on the map, but takes into account also his own navigational skill and fitness. Once he has made his choice, he fixes his position and maintains direction as he progresses by map reading (or compass and distance estimation). Hence an inaccurate map leads to unequal conditions.

Controls are the most important building blocks of a course. Choice of sites, placing of the markers, checking their positions, and locating controls in competition, all put definite demands on the map. For an international event, it must be up to date in all parts which could affect the end result of the competition. If it is not up to date it must be improved.

The aim of the course planner is a course where the deciding factor in the results will be navigational skill. This can be achieved only if the map is sufficiently accurate, complete and reliable, and is also clear and legible under competition conditions. The better the map the course planner has, the greater the chance he has of setting good, fair courses, whether it be for the elite or for the novice. A detailed map gives the course planner possibility for a wide selection of good control sites and a chance for choosing suitable legs, so that the route choise is the most important aim.

2.2. Content

A ski orienteering map is a topcgraphic map. It must show every feature which could influence map reading or route choice - path and track network, all ski tracks and ski courses, land form, hydrography, buildings, the ground surface and features which aid ski navigation.

As far as the selected scale will allow, the ski orienteering map should include all features which are clearly visible on the terrain covered with snow and the ski track network is very important.

The map must contain the features which are obvious on the ground and which are of value from the point of view of map reading. Nevertheless an attempt must be made when surveying to maintain the clarity and legibility of the map. i.e. the minimum dimensions designed for normal sight must not be forgotten when choosing the degree of generalisation.

The map should contain some place names to help the competitor to orientate his map to north. Names should be written from west to east and chosen and placed to avoid obscuring important features. The style of lettering should be simple.

North lines must be black 0,175 mm lines pointing to magnetic north. Their spacing on the map should represent 1000 m on the ground. North lines should be broken if they obscure small features such as path ends, buildings etc.

2.3. Scale and vertical interval

Choice of scale and vertical interval should take into account relative height difference, quantity of detail and the intricacy of the features.

A large scale could be used for the areas where are much details. However, a large scale must not be used in order to include on the map more detail than is necessary for ski orienteering. The map must not be made too large and difficult to handle with a scale which is too big.

Ski orienteering maps should be drawn at the scale of 1:20 000, 1:25 000 or 1:30 000 with a 5 or 10 m vertical interval.

A deviation from this is permissable where there is good reason for it, but permission from the national map committee must be obtained.

2.4. Accuracy

General requirement is that the accuracy of the map must be consistent with the scale. The general rule should be that competitors shall not perceive any inaccuracy.

The accuracy of the map as a whole depends upon the accuracy of measurement (position, height, and shape) and the accuracy of drawing. Accuracy of position on a ski orienteering map must be consistent with the estimation of distance. A feature must be positioned with sufficient accuracy to ensure that a competitor with his distance estimation will perceive no discrepancy between map and ground. Hence a tolerance of at most 10-20 m is acceptable in the positions of nearby features.

Absolute height accuracy is of no significance on a ski orienteering map. On the other hand, it is important that the map shows as correctly as possible the relative height difference between neighbouring features.

Accurate representation of shape is of great importance for the competitor, because an essential precondition for the map reading is a correct and detailed picture of the ground.

The drawing accuracy of a ski orienteering map is the degree to which the approved specifications are followed. Drawing accuracy is of primary importance to any map user because it is closely connected with the reliability of the final map.

As a general rule, these specifications should be followed closely. However, when drawing a surveyed feature, consideration must be given to its immediate surroundings, and in order to improve legibility deviations from the specified line widths can be tolerated, see sect. 2.6.

2.5. Generalisation and legibility

A good ski orienteering map must be reliable, accurate and complete and must at the same time be clear and legible in competition. To achieve this, cartographic generalisation must be employed, since the format of the map is very small compared with the ground, and the terrain can be covered with a whole variety of features. Among these, the most important ones for the ski orienteer, and those most characteristic, must be selected (selective generalisation), and then these must be shown in a clear and simple manner (graphic generalisation). The aim of cartographic generalisation, therefore, is to make the map clear and legible. At the survey stage, completeness and clarity will clash. Legibility must be ensured at the expense of completeness.

A decision as to how many features can be shown - selective generalisation - is the first phase of generalisation. The most important aspects of selective generalisation are the representation, and also sometimes the exaggeration, of land forms and features which are essential and characteristic of orienteering. Unnecessary features are omitted.

When deciding whether or not to put a particular feature on the map, account should be taken of the importance of that feature from a map reading point of view. An attempt must be made to establish criteria of selection for the type of terrain in question, and to adhere to these so that the map is as uniform as possible.

The second phase of generalisation - graphic generalisation - can greatly affect the clarity of the map. Simplification, displacement and exaggeration are used to this end.

Legibility requires that the size of symbols, line thichnesses and spacing between lines be based on the perception of normal sight in daylight. In devising symbols, all factors except the distance between neighbouring symbols are considered.

The size of the smallest feature which will appear on the map depends partly on the graphic qualities of the symbol (shape, format and colour) and partly on the position of neighbouring symbols. When immediately neighbouring features, which take up more space on the map than on the ground, are drawn, it is essential that the correct relationships between these and other nearby features are also maintained.

2.6. Dimensions of map symbols

It is recommended that the ski orienteering map is drawn in twice the printing scale but also other reduction ratios may be used. The line widths given in these specifications are based on the micronorm pen scale and a 2:1 reduction. When scribing a 1:1 ratio is recommended. All line widths must be held within 20 % of the specified value. Deviations from the nominal value must only be employed in order to improve legibility. Certain minimum dimensions must also be observed. These are based on both printing technology and the need for legibility **(measures are at the printed scale):**

- The gap between two fine lines of the same colour, in brown or black, must be at least 0,15 mm.
- The smallest gap between two blue lines be 0,25 mm.

Other minimum dimensions

- Shortest rock face symbol: 1,0 mm
- Shortest stream or ditch symbol: 0,6 mm
- Smallest bend in contour (spur or reentrant): 0,25 mm (from centre to centre of the lines)
- Shortest dotted line: at least two dots
- Shortest dashed line: at least two dashes
- Smallest area enclosed by a dotted line: 1,5 mm (diameter) with 5 dots
- Smallest area of colour
  Blue, green or yellow full colour: 0,5 mm^2
  Green or yellow dot screen: 1,0 mm^2.

All features smaller than the dimensions above must be either exaggerated or omitted, depending on whether or not they are of significance to the orienteer. When a feature is enlarged, neighbouring features must be displaced so that the correct relative positions are retained.

2.7. Printing

The features on a ski orienteering map are shown in several colours. Brown and blue indicate the natural features - land forms, water and marshes. Black is used primarily for man-made features - tracks, settlements, rides, but is also used for some natural features - cliffs, boulders. Yellow indicates open and semi-open areas, and green shows vegetation and ski track network.

A ski orienteering map must be printed on good, possible water resistent, paper (weight 100-135 g/m^2). It will be in 4-6 colours depending on the level of cartography and the nature of the terrain it covers.

Special care must be taken to ensure an exact register of the colours. On a map printed in several colours the course planner must have the opportunity to check the register via superimposed crosses in the different colours. The maximum acceptable error is 0,2 mm.

Legibility depends on the correct choise of colours. The following recommendations are intended to help standardise maps as much as possible. The alternatives given can be used in preference to the recommended colours, since the ultimate choise of colour also depends on the structure of the terrain. The recommendations are given on the PMS system (Pantone Matching System).

Colour	Recommendation	Alternative
Black	Process black	-
Brown	471	-
Yellow	136	122, 129
Blue	299	-
Green	361	-
Violet	Purple	-

3. EXPLANATION OF SKI MAP SYMBOLS

The drawing specification and the definition of the map symbols are given in this chapter. They are classified in 5 groups:

1. Land forms, shown in brown
2. Rock and boulders, shown in black
3. Water and marsh, shown in blue
4. Vegetation, shown in green and yellow
5. Man-made features, shown in black

All specified dimensions **are in mm at** the printed scale (1:1). The map symbols are in 3 categories A, B and C:

A - symbols obligatory for maps for international events and world championships
B - symbols may be used for certain types of terrain
C- national symbols acceptable only for non-international events and used only in special terrain in order to supplement class A and B. Class C will not be included here.

Symbols for normal orienteering maps could be used on ski orienteering maps, if it is essential to show a particular detail.

3.1. Land forms

The shape of land is shown in brown by means of contours aided by the special symbols for earth banks, gullies, steep slopes and embankmets. This is complemented in black by the symbols for cliffs.

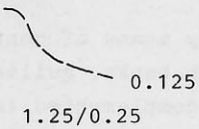
Choise of vertical interval depends on the relative height difference of the area and the steepness and intricacy of the terrain. Terrain suited to ski orienteering is normally best shown with a 5 or 10 m vertical interval. It is not permissible to use two different vertical intervals on the same map.

If the representation of an area requires a large number of form lines, a smaller vertical interval provides a more legible alternative. If this applies only to a small part of an area, the vertical interval should not be reduced. Form lines will be more effective.

Absolute height accuracy is of no importance on a ski orienteering map. This means that it is permissible to slightly alter the height of a contour if this will improve the representation of a feature. But the alteration should normally not exceed 25 % of the vertical interval. Attention should be paid to the relationship with neighbouring features when employing this device. The relative height difference of neighbouring features must be represented on the map as accurately as possible.

A 101 Contour
The vertical interval of the contours should generally be 5 or 10 m.
Colour: brown

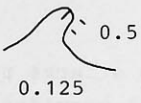
A 102 Index contour
To make rough assessment of height differences easier, every fifth contour should be drawn as an index contour.
Colour: brown



A 103 Form line

To supplement the contour information, use is made of form lines at approximately half the vertical interval. They are employed wherever more information can be given about the shape of the ground. Form lines must only be used if representation is not possible with ordinary contours. Only one form line may be used between two contours.

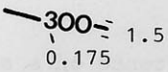
Colour: brown



A 104 Slope line

Slope lines are drawn on the lower side of contour line wherever it is necessary to clarify the fall of the ground.

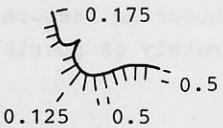
Colour: brown



B 105 Contour value

Contour values are often included to aid the assessment of large height differences. They are inserted in the index contours in positions where other detail is not obscured. The figures should be orientated so that the top of the figure is on the higher side of the contour.

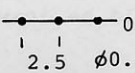
Colour: brown



A 106 Earth bank

A steep earth bank is an abrupt change in ground level which can be clearly distinguished from its surroundings, e.g. gravel and sand pits, river, road and railway cuttings. The tags should show the full extent of the slope, but may be omitted if two banks are close together. Impassable banks should be drawn with symbol A 201.

Colour: brown



A 107 Earth wall

Distinct earth wall or boundary bank.

Colour: brown

A 109 Erosion gully

A single line is used to represent an erosion gully which is too small to be shown by symbol A 106.

Colour: brown

A 111 Knoll

A small, easily recognised hill is drawn with the appropriate contour.

The use of the symbol requires a height of at least 2 m from the surrounding ground.

Colour: brown

A 113 Depression

A natural hollow, which can be shown by contours.

The use of the symbol requires a depth of at least 2 m from the surrounding ground.

Colour: brown

B 117 Special landform feature

This symbol can be used for a special small landform feature. The definition of the symbol must be given in the legend.

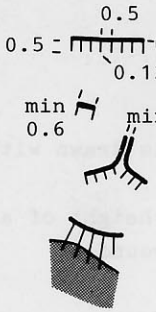
Colour: brown

B 118 Spot height

Spot heights are used for the rough assessment of height differences. The height is given to the nearest metre. The figures are orientated to the north. Water levels are given without the dot.

Colour: black

3.2. Rock and boulders



A 201 Impassable cliff

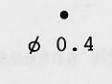
An impassable cliff, quarry or earth bank (see A 106) is shown with a 0.35 mm line and a downward tags showing its full extent from the top line to the foot. The tags may extend over an area symbol representing detail immediately below the rock face. The tags may be omitted if space is short. This is to be used particulary for narrow passages. The passage should be drawn with a width of at least 0.3 mm.

Colour: black

B 202 Sandstone cliff

In the case of unusual features such as sandstone pillars, the rocks may be shown in plan shape without tags. To help clarify the picture, the rocks may be drawn with different line thickness according to their height.

Colour: black



B 206 Boulder

This symbol is used for obvious boulders to be seen during the winter - usually large ones. Every boulder marked on the map should be easily identifiable on the ground.

Colour: black

ø 0.4

B 208 Boulder field

Boulder fields, which can be seen during the winter, are shown with solid triangles for larger blocks larger symbols.

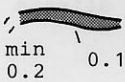
Colour: black

0.3 - 0.6

3.3. Water and marsh

This category includes water and the special types of vegetation caused by the presence of water (marsh). Their drawing is important because they provide features for map reading.

A 301 Lake
Large areas of water are shown with full colour or a dot screen of at least 50 %.
Colour: blue, black

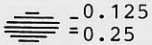


A 304 River
Rivers, streams and canals are drawn with 0.175 mm bank lines.
Colour: blue, black

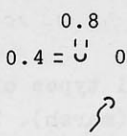
A 305 Wide stream
Watercourses, over 5 m wide, are shown to scale without the black bank line.
Colour: blue

A 306 Stream
Streams or ditches, ca. 2-5 m wide. The stream must be clearly visible on the ground.
Colour: blue

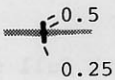
B 307 Small stream
Streams or ditches less than ca. 2 m wide. The watercourse must be clearly visible on the ground.
Colour: blue



B 311 Marsh
Marsh with a distinct edge. The marsh can be distinguished from the surrounding forest by its vegetation.
Colour: blue



B 315 Spring, visible during the winter
When the spring has no outflow, the symbol opens towards the north.
Otherwise, the symbol faces the outflow.
Colour: blue



B 317 Footbridge
A footbridge over a river, stream or ditch.
Colour: black

3.4. Vegetation

The meaningfulness of a ski orienteering map is increased by the representation of vegetation as it affects map reading.

In terrain with few other features, a detailed representation of vegetation can provide useful features for map reading. However, for international events, the detailed representation must be limited to the symbols contained in this list.

The basic principle is as follows:
- white represents typical forest for the particular type of terrain
- yellow represents the degree of openness of an area in two categories
- green represents thicket for map reading.

A 401 Open land
Cultivated land, fields, meadows, etc. are shown as open land.
Colour: yellow

A 402 Semi-open land
Meadow with scattered trees, new plantations, felled areas, etc. are shown as semi-open land.
Colour: yellow

50%, 40 l/cm

50%, 40 l/cm

B 405 Thicket

A thicket is shown as an feature for map reading.

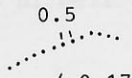
Colour: green

0.125

A 409 Very distinct forest edge

A distinct edge between forest and open land may be shown by a continuous line.

Colour: black



0.5

ø 0.175

A 410 Distinct vegetation boundary

A forest edge which is distinct but not 100 % sharp, and clear vegetation boundaries within the forest.

Colour: black

B 411 Indistinct vegetation boundaries

Indistinct boundaries are shown without a line. The edge of the area is shown only by the change in colour or dot screen.

B 412, B 413 Special vegetation feature

0.8 : o 0.175

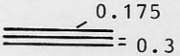
0.8 : x 0.175

Symbols 412 and 413 can be used for special small vegetation features. The definition of the symbol must be given in the legend.

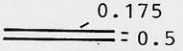
Colour: green

3.5. Man-made features

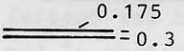
The track network provides important information about the ski possibilities of an area and the classification must be clearly recognisable on the map.



A 501 Motorway
Dual carriageway roads for the use of motortraffic only. To distinguish a road more clearly the space between the black lines must be filled in with brown (50-100 %).
Colour: black and brown



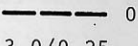
A 502 Major road
Public or private asphalt roads wider than 5 m. To distinguish a road more clearly the space between the black lines may be filled in with brown (50-100 %).
Colour: black and brown



A 503 Minor road
Public or private asphalt roads less than 5 m wide. This symbol may also be used for wide, well maintained dirt roads. To distinguish a road more clearly the space between the black lines may be filled in with brown (50-100 %).
Colour: black and brown

Roads under construction (symbols 501, 502 and 503) may be shown with broken lines. Normal traffic or sanding keeps major and minor roads (502 and 503) clear of snow and ice and therefore not suitable for ski-ing.

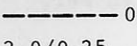
A 504 Dirt road
Maintained dirt roads suitable for motor vehicles in all weather.
Normally covered with snow and therefore suitable for ski-ing.
Colour: black



A 505 Vehicle track

Tracks or poorly maintained roads, suitable for vehicles only when travelling slowly. Width less than ca. 3 m.

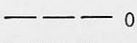
Colour: black



A 506 Footpath

Large paths, or old vehicle tracks. A footpath must be clearly visible during the winter.

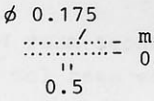
Colour: black



A 510 Narrow ride

Obvious rides, less than ca. 5 m wide.

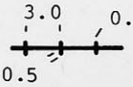
Colour: black



A 511 Wide ride

Ride, wider than ca. 5 m.

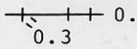
Colour: black



A 512 Railway

Railway or other kinds of railed tracks.

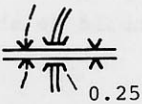
Colour: black



A 513 Power line

Power lines, cableways and skilifts. The bars indicate the exact location of the pylons.

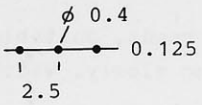
Colour: black



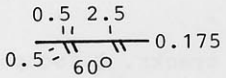
A 514 Tunnel

Ways under roads, railways etc., which may be used by the runner. This symbol is also used where the tunnel has no track leading to it.

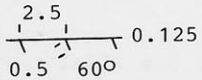
Colour: black



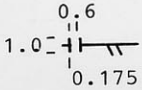
A 515 Stone wall
Crossable obvious stone walls and stone-faced banks.
Colour: black



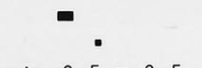
A 517 High fence
Boarded or wire fence higher than ca. 1.5 m, not crossable by the average orienteer.
Colour: black



A 518 Fence
Clearly visible wooden or wire fences less than ca. 1.5 m high.
Colour: black

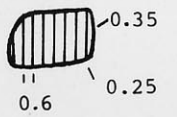


A 520 Crossing point
All ways through or over high fences must be indicated. The symbol may also be used for stone walls (515) and crossable fences (518).
Colour: black



A 521 Building
The ground plan of all buildings must be shown to scale, down to the minimum size shown opposite.
Colour: black

A 522 Settlement
Built-up area with or without gardens. The most important roads must be shown. Conspicuous buildings within a settlement should be shown.
Colour: black

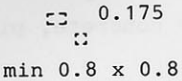


B 523 Permanently out of bounds
Areas which are permanently forbidden to the runner are shown as out of bounds. The screen is superimposed on the normal map detail. The perimeter line is used where there is no natural boundary (e.g. fence, road etc.).
Colour: black or purple

50 - 100 %
40 lin/cm

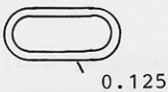
B 524 Parking area

A paved, asphalt or other surfaced area for parking or other purposes.
Colour: brown, black



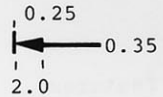
A 525 Ruin

The ground plan for a ruin is shown to scale, down to the minimum size shown opposite.
Colour: black



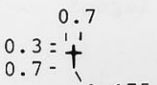
A 526 Sport track

The plan of a sport track is shown to scale with yellow superimposed.
Colour: black + yellow



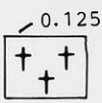
A 527 Firing range

A firing range is shown with a special symbol. Associated buildings are individually marked.
Colour: black



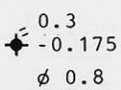
B 528 Field grave

A field grave may be shown with this special symbol. Location is the centre of gravity of the symbol.
Colour: black



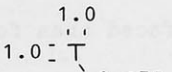
B 529 Cemetery

A cemetery may be shown using several symbols for a field grave.
Colour: black



A 530 High tower

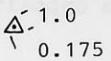
High tower standing above the level of the surrounding forest. Location is the centre of gravity of the symbol.
Colour: black



A 531 Shooting platform

Free-standing shooting platform or seat, or small tower. Location is the centre of gravity of the symbol.

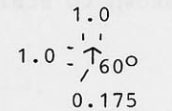
Colour: black



B 533 Trigonometric point

Trigonometric point marked by concrete, pillar or other marker.

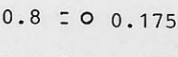
Colour: black



B 534 Fodder rack

Fodder rack which is free-standing or built on a tree. Location is the centre of gravity of the symbol.

Colour: black



B 535, B 536 Special man-made features

Special man-made features are shown with symbols 535 and 536. The definition of the symbols in each case must be given in the legend.

Colour: black

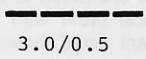
4. FEASIBILITY SYMBOLS

In a competition the ski track network is indicated by green feasibility symbols. These symbols indicate the various speeds which can be obtained on these tracks. When a ski track follows a path, the green is superimposed on the path.

The dimensions given refer to the printed scale.

601 Fast ski track

A track-vehicle made ski track for fast ski-ing. Opened dirt roads (without a good track) suitable for ski-ing are shown only with black.

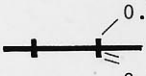


602 Good ski track

Ski track made with ski-doo, good for ski-ing.

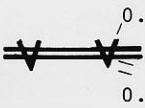
603 Slow ski track

Ski track made by ski-ing or trampling. Ski-ing is slow, because of curves, softness or difficult up- and downhill slopes.



604 Road covered with snow

A road on the map covered with snow during the competition. The symbol is a crossline across the road. The symbol can also be used with green track symbols to show that the track is not opened.



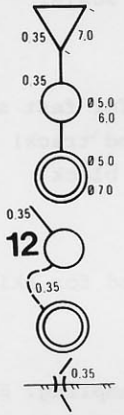
605 Sanded or snowless road

A road on the map which is sanded or snowless during the competition is shown by a series of V-symbols across the road.

5. COURSE SYMBOLS

The printing colour of course symbols is to be a transparent **purple** (PMS). At least for elite classes, courses should be overprinted. For other classes they can be drawn by hand.

The dimensions given refer to the printed scale.



Start or Map Issue Point (if not at start) is shown by an equilateral triangle which points in the direction of the first control.

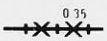
The **control points** are shown with circles. The size of the circles should be chosen to minimize interference with map detail around the controls. Small parts of the circle can be omitted to leave important detail showing.

The **finish** is shown with two concentric circles. The centre of a triangle or circle shows the precise position of the feature but it is not actually marked.

The controls are **numbered** in order with the figures orientated to north. The start, controls and finish are joined in numerical order with **lines.** Sections of the lines can be omitted to leave important detail showing. A **marked route** is shown on the map with a dashed line.

Street- and railway **crossings and tunnel** are to be drawn into the map a double line bent to the outside.

An **out of bounds area** is drawn with diagonal vertical stripes, see also symbol B 523.



A **route** which is **out of bounds** is shown by a series of crosses.

Savion Kirjapaino Oy 1984

SYMBOLS FOR SKI–ORIENTEERING MAPS

- CONTOUR. INDEX CONTOUR
- FORM LINE, SLOPE LINE
- EARTH BANK, EARTH WALL
- KNOLL, DEPRESSION
- IMPASSABLE CLIFF
- BOULDER, BOULDER FIELD
- LAKE, RIVER
- WATERCOURSE, FOOTBRIDGE
- SMALL WATERCOURSE
- MARSH, SPRING
- OPEN LAND
- SEMI-OPEN LAND
- THICKET
- VERY DISTINCT FOREST EDGE
- DISTINCT VEGETATION BOUNDARY
- INDISTINCT VEGETATION BOUNDARY
- MOTORWAY ROAD
- DIRT ROAD TUNNEL
- VEHICLE TRACK, FOOTPATH
- NARROW RIDE, WIDE RIDE
- RAILWAY
- POWER LINE
- HIGH FENCE, CROSSING POINT
- FENCE STONE WALL
- BUILDING, RUIN
- SETTLEMENT, OUT OF BOUNDS
- PARKING AREA
- SPORT TRACK
- FIRING RANGE
- CEMETERY
- HIGH TOWER SHOOTING PLATFORM
- FAST SKI TRACK
- GOOD SKI TRACK
- SLOW SKI TRACK
- ROAD COVERED WITH SNOW
- SANDED OR SNOWLESS ROAD

Ski-orienteering map 1 25000