



# COMPETITION REGULATIONS

## RTC CUP

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### Appendix No. 3: Automatics on the Proving Ground.

#### 1. **General Provisions**

RTC Cup competition shall include autonomous sections on the proving grounds.

Prior to start, it is necessary to notify the judges of actions the robot is to perform automatically. Also, during an attempt, a participant shall loudly announce start and end of the robot's automatic mode.

An automatic action is passing a section without the operator's control input; use of any sensors is obligatory during the passing. A section shall be deemed passed in the automatic mode if the robot entered the cell and left it through another entrance, if any, without the automatic mode interruption.

Motion according to encoders or timer shall not be deemed as such in the automatic mode.

For passing of several sections with the use of a single program (uninterrupted) additional points shall be given: from 30 and +10 for each following section (40, 50, etc.).

Additional points shall be also given for each consequent program where automatic motion is performed.

Training fields similar to some automatic motion sections will be provided in the training area during the competition.

Program and sensors may differ from those recommended below which are given as examples.

#### 2. **Motion along the Line at the Start**

A field with dimensions of 740x1500 mm is located in front of the start.

The field is painted white with marking by means of a black curved 50 mm wide line (see Figure 1). The crossing line width is 30 mm.

This section shall be passed in the automatic mode, according to the program of Motion along the line (by means of illumination sensor/-s, distance sensor).

30 points shall be given for completed motion along the line in the automatic mode, 40 points shall be given if the robot stops after the crossing.

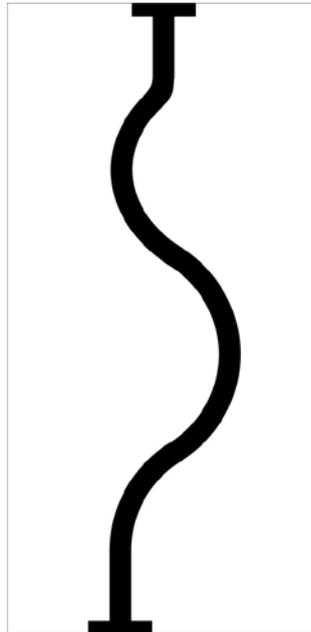


Figure 1. Motion along the Line at the Start

Additional points: the robot shall take a beacon located at the finish after the crossing, turn around and bring the beacon to the crossing at the start. 50 points shall be given for this.

**Three ways to pass the Maze** shall be available for participants: easy, medium and difficult. Accordingly, the easy way is the longest one, and the difficult is the shortest. The way choice shall be made prior to the attempt. Further, 2 options are available:

- 1) If the robot has passed “motion along the line” section:**  
In this case the participant can adjust the route in the course of the attempt at any time so many times it considers reasonable.
- 2) If the robot has NOT passed “motion along the line” section:** In this case the participant can adjust the route in the course of the attempt only **once** and, in addition to that, **against a fine** of 100 points.



### 3. **Automatic Beacon Grip**

From now, points for the beacon grip shall be tripled if the grip is performed in the automatic mode. The beacon grip program shall be calculated in such a way that the automatic mode is switched on at 15 cm min. before the beacon (it shall be marked with a limitation line on the proving grounds).

### 4. **Motion in the Serpentine and Tunnel Sections**

**Motion along the line in the Serpentine section:** An access way to the Tower is the Serpentine section, a winding path with a width of 280 mm, painted white (see Figure 2). In the middle along the path, marking by means of a black 50 mm wide line is applied. The path's height above the floor is 620 mm without banking boards. A polyurethane foam sheet underlays the path.

The robot shall pass along the line from start to finish avoiding fall over the rim.

This section shall be passed in the automatic mode according to the program for motion along the line (using the illumination sensor/-s). When passing this section in the manual control mode, the robot will most probably fall over the path rim.

**Motion along the wall in the Tunnel section:** the Serpentine section is adjacent to the Tunnel section. The Tunnel parameters are similar to those of the Serpentine, excluding several differences. The Tunnel is fenced with walls with a height of 150 mm min., and there is no marking on the path (see Figure 2). There may be discontinuities with a width of 20 to 30 mm (not shown on the Figure).

At the end of this section a line leading to the Tower starts.

The robot shall pass from start to end of the Tunnel not touching its walls.

This section shall be passed in the automatic mode according to the program for motion along the wall (using the distance sensor).

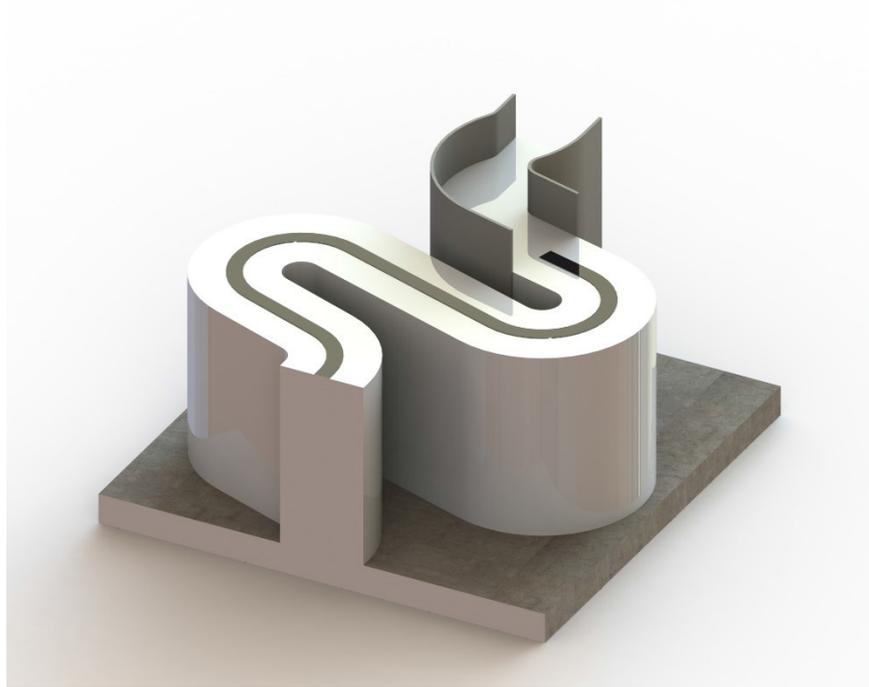


Figure 2. Serpentine and Tunnel Sections

For passing the Serpentine and the Tunnel sections in the manual control mode, 10 and 5 points shall be given correspondingly. In case of the automatic mode, 50 points shall be given for the Serpentine and 30 points for the Tunnel.

#### 5. **Motion along the Line in the Tower**

Along the entire length of spiral passages inside the Tower, marking by means of a black 50 mm wide line is applied (see Figure 3). The line starts at the entrance to the Tower and ends at the last (fourth) level with a crossing. The crossing line width is 30 mm. The spiral ascent's width is 210 mm, the slope angle is  $24^\circ$ .

The robot shall ascend to the top level of the Tower, following the line.

This section shall be passed in the automatic mode according to the program for motion along the line (using the illumination sensor/-s).

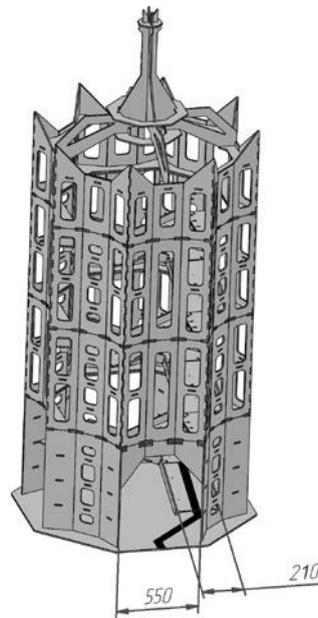


Figure 3. Tower with Marking

## 6. Slalom on the Variable Geometry Bridge

The variable geometry bridge is shown on Figure 4. The bridge's width is 1000 mm, and the height is 620 mm. Marking by means of a black 50 mm wide line is applied along the bridge. Cylinders of plexiglas with a diameter of 100 mm, covered with white paper stand on the line. The bridge's color is gray. Between the obstacles a minimum distance of 400 mm is provided.

The robot shall pass along the black line bypassing the obstacles (knolls) located on the line. The robot shall bypass the first obstacle from the left side, and onward, bypass the knolls alternatively from the left and the right sides (classic slalom principle). For bumping the knolls or cutting the route, points given for the section, shall be reduced.

This section shall be passed in the automatic mode according to the program for motion along the line (using the illumination sensor/-s) which is combined with the program for obstacle bypassing (using the distance sensor) and return to the line.

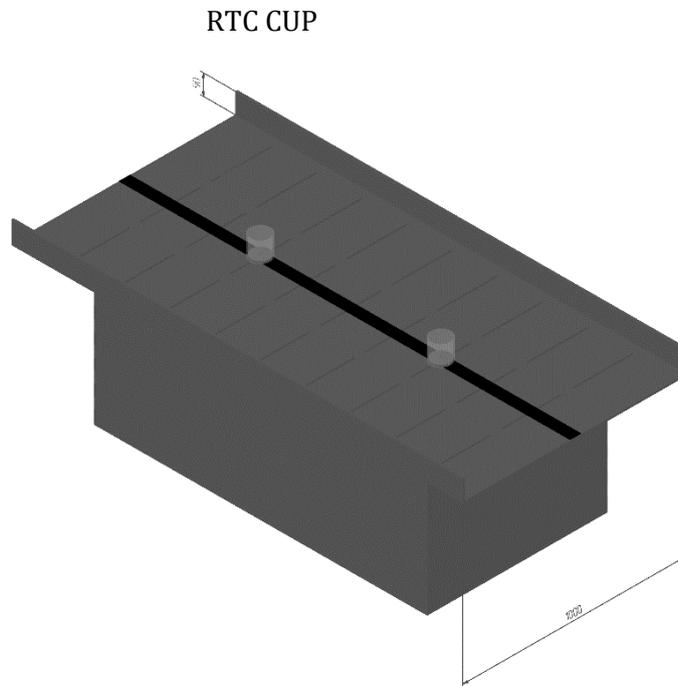


Figure 4. Variable Geometry Bridge

For passing the Slalom on the Bridge section in the manual control mode, 10 points shall be given. In case of the automatic mode, 70 points shall be given for bypassing the knolls from one side and return to the line, or 90 points shall be given for bypassing the knolls from both sides and return to the line.

## 7. **Sections without Marking**

It is possible to pass any section of the proving ground (cells of the Maze, sections of the Field) in the automatic mode and obtain a double amount of points. Use of any sensors shall be allowed according to the automatics definition (see General Provisions).