第二十三届

全国大学生机器人大赛 ROBOTAC

23rd China University Robot Contest ROBOTAC

2024 主题：十年铸剑

Theme： A Decade of Dedication

比赛规则

Game Rules

（V1.0）

规则编制：全国大学生机器人大赛ROBOTAC组委会

Prepared by ROBOTAC Organizing Committee of China University Robot Contest

2023 年 10 月

October, 2023

Catalog

1. Introduction

The ROBOTAC（short for ROBOt and TACtic) is an annual international robot contest for students in university, college and polytechnic. This competition fuses the fun from both sports and technology. It aims to enhance interest in robotics and to nourish young engineers' skills as well as to promote culture exchange.

The first ROBOTAC was launched in 2015. Over the years, thousands of talented college students participated in this game, lived up to the technical challenges, and most importantly, enjoyed their spent time on this game. In 2024, ROBOTAC will be celebrating its 10 year anniversary. The theme for the 2024 ROBOTAC is A Decade of Dedication.

In ancient China, it was a tradition for gentlemen to carry chinese swords, Therefore, the word "forging a sword" in chinese also has the imagery of cultivating talents. This year, robots will be divided into red and blue sides, simulating the process of forging swords during the competition while facing each other

1.1. Terminologies

No	Name	Description
1	**Mine**	located on **Upland**, holds **Ores**
2	**Ore**	**Ores** are uniquely owned by each team. A team earns points when the robot removes **Ores** form the **Ore Zone or Mine**. **Ores** can be deposited into the **Furnace** to earn points or get quick wins.
3	**Gold Ore**	The **Gold Ore** can be fetched by either team. The team with a “alive” robot that holds the **Gold Ore** at the end of the team will earn 30 points.
4	**Furnace**	The **Ores** can be deposited into the **Furnace** pan located at the center of the game field. The outlet of the **Furnace** and detect hits by either team.
5	**Upland**	The **Upland** is where the **Mine** is located at. It has an **autonomous/bionic robot Start Zone**. A **Transfer Platform** is located out of the **Upland**.0
6	**Defense Zone**	A **Defense Zone** is designated for each team
7	**Start Zone**	**Start Zone** for autonomous/bionic and manual robots

8	**Canyon Zone**	Corridor to enter the opponent **Defense Zone**. The **Furnace** is located at the center of the **Canyon Zone**
9	**Rehab Zone**	The health of the robot can be replenished when the robot gets within 600 mm of the center of the **Mine** of their team. The health status will increase one tier for every two seconds. A killed robot can be revived. A robot will not lose health within 5 seconds of a revival
10	**Health Bar**	Senses attack and shows the health status of a manual robot. It cuts the control power of a manual robot and uploads data when it is killed
11	**Marker Display**	Displays team color for autonomous robot
12	**Cannonball**	Glowing rubber balls, shot by robots
13	**Kill**	When the **Health Bar** shows empty on a robot, and robot power is cut automatically
14	**Revive**	The health of the robot can be replenished when the robot get within 600 mm of the center of the **Mine** of their team

1.2. Rule Highlights

（1）Formality

The game is between Red and Blue teams. Robots cross obstacles and attack the opponent robots and fort. A team can win either with a quick win or with a higher score when the game ends.

（2）Earning Points

Remove own ore from mine or the lift platform.

Place an own ore into the corresponding pan on the furnace.

A live robot holding the gold ore by the end of the game.

（3）Quick Win

A quick win happens when a team has three ores in the corresponding furnace pan, and hits the furnace outlet.

（4）Game Time

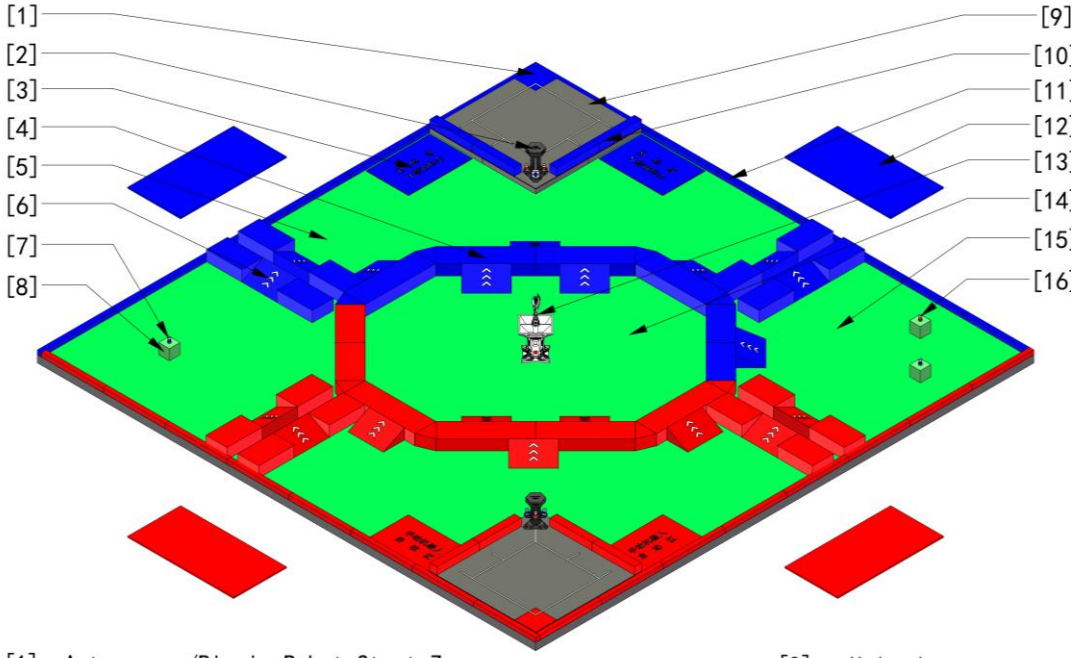
The game time is 3 minutes.

2.Game Field

2.1. Overview

The game field is illustrated in Fig 2-1. It has dimensions of 14000 mm × 14000 mm. The game field is covered by foam tiles of 600 mm × 600 mm × 15 mm. The game field is

surrounded by fence segments with a height of at least 120mm. Field overview is illustrated in Fig 1 in the Appendix. The fence design is illustrated in Fig 2 in the Appendix



[1] Autonomous/Bionic Robot Start Zone
[2] Mine and Rehab Zone
[3] Manual Robot Start Zone
[4] Crater
[5] Defense Zone
[6] Slope
[7] Gold Ore
[8] Lift
[9] Upland
[10] Transfer Platform
[11] Fence
[12] Operation Zone
[13] Furnace
[14] Canyon
[15] Ore Zone
[16] Ore

Fig 2-1 Game Field

2.2. Uplands

Two uplands, with dimensions of 3000 mm * 3000 mm * 135 mm each, are located at the two corners of the game field that share the same diagonal, as illustrated in Fig 2-2. The upland surface is covered by green foam tiles of 600 mm * 600 mm * 15 mm. On each upland, there is a 600 mm * 600 mm autonomous/bionic robot start zone. The upland is marked by 30mm wide white tape. One ore of the own team and two ores of the opponent team are located on the mine of each team. Details of the upland is illustrated in Fig 3 in the Appendix.

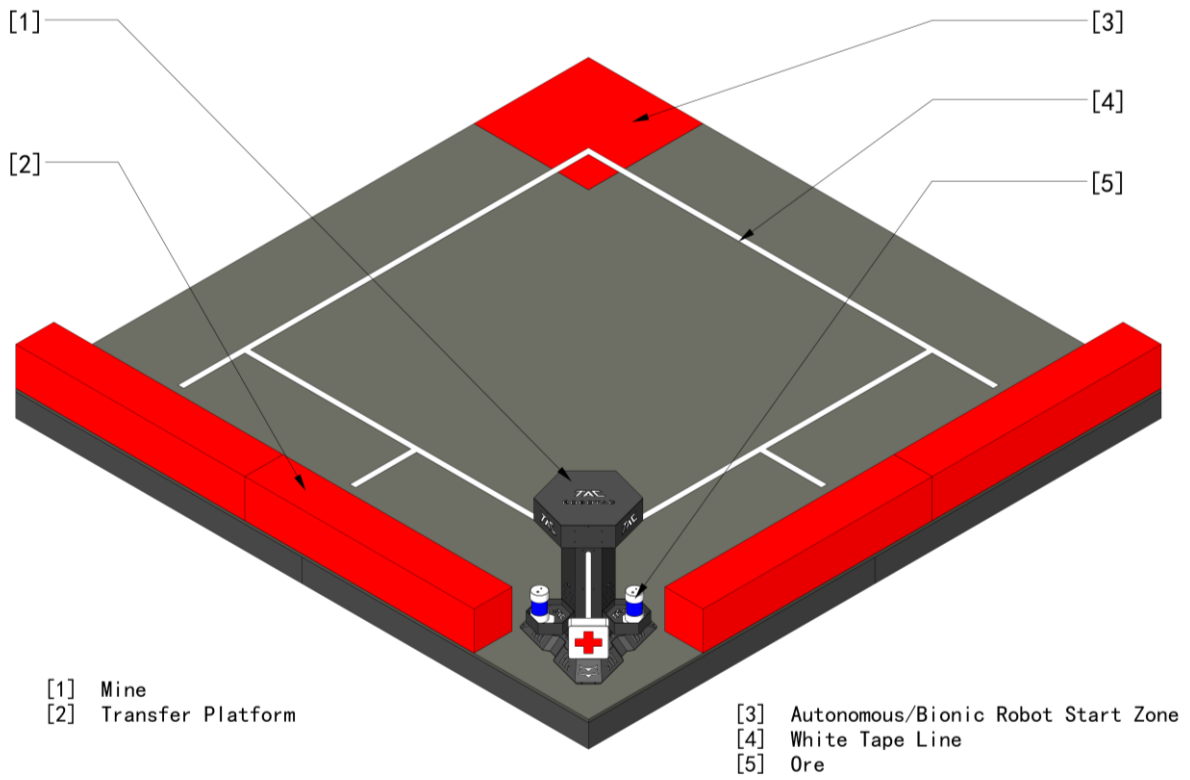


Fig 2-2 uplands

2.3. Zones in game field

2.3.1. Defense Zone

The game field is divided into two defense zones, for RED and BLUE teams respectively, as illustrated in Fig 2-1.

2.3.2. Manual Robot Start Zone

In each defense zone, there are two manual robot start zones of 1200 mm * 1800 mm each, as illustrated in Fig 1 in the Appendix.

2.3.3. Rehab Zone

The health of the robot can be replenished when the robot gets within 600 mm of the center of the ore zone of their team. The health status will increase one tier for every two seconds. A killed robot can be revived. A robot will not lose health within 5 seconds of a revival.

2.3.4. Ore Zone

As illustrated in Fig 2-3, a regular ore zone and a gold ore zone are located in the defense zone. There are two lifts located in the regular ore zone, each holding an ore for each team, with red and blue color. On the diagonal side of the defense zone, there is a lift holding a

gold ore. The ore zone is separated from the rest of the game field by broken bridges, as shown in Fig 4 in the Appendix.

When the game starts, the lift in the ore zone is elevated at 750 mm from the ground. The lift in the regular ore zone starts to descend 30 seconds into the game, and stops 55 seconds after the initial descent. The lift in the gold ore zone starts to descend 90 seconds after the game starts, and stops 55 seconds after the initial descent. All lifts stop at 300 mm above the ground. More details of the lift are illustrated in Fig 6 in the Appendix.

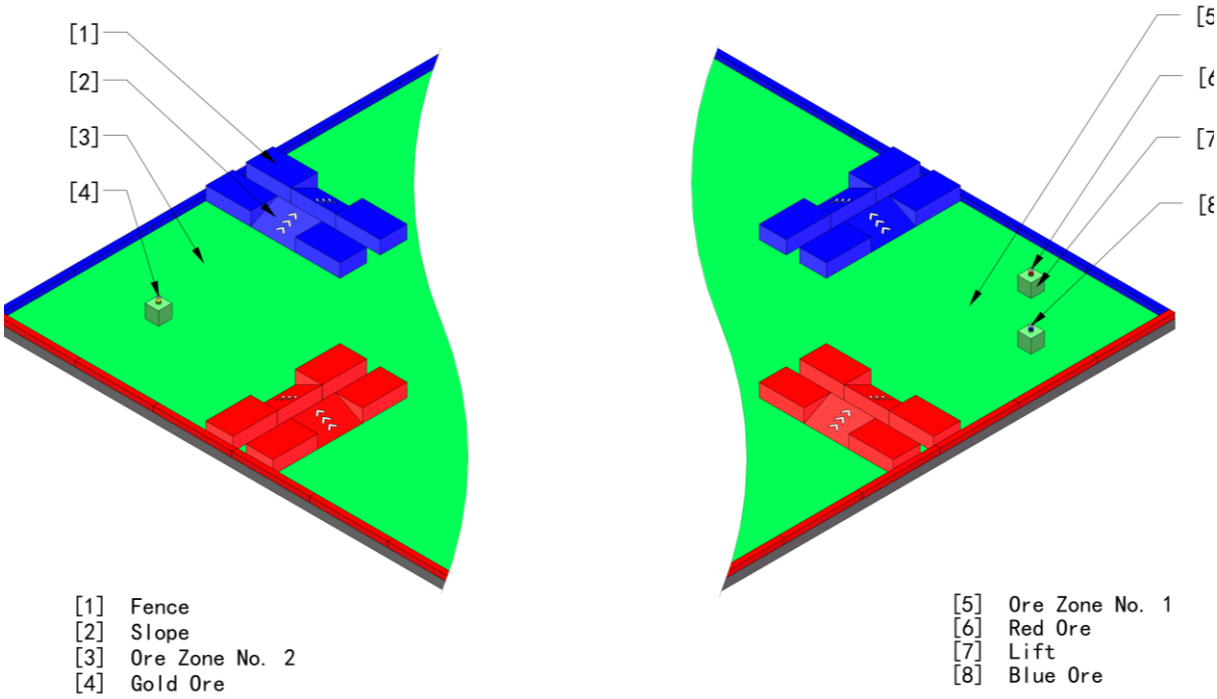


Fig 2-3 Ore Zone

2.3.5. Canyon

As illustrated in Fig 2-4, the canyon zone is surrounded by a crater. The crater consists of 8 cuboids with dimensions of 2000mm*600mm*300mm, two cuboids with dimensions of 2520mm* 600mm*300mm and 8 triangular prisms with triangle side length of 600 mm, height of 300 mm, and vertex angle of 45 degrees.

10 ramps with dimensions of 300mm*1000mm*600mm connect the inside and outside of the crater. Details of ramp positions are illustrated in Fig 7 in the Appendix.

The furnace is located at the center of the crater. A team scores by placing ores into the corresponding furnace pan. A quick win happens when a team has three ores in the corresponding furnace pan, and hits the furnace outlet.

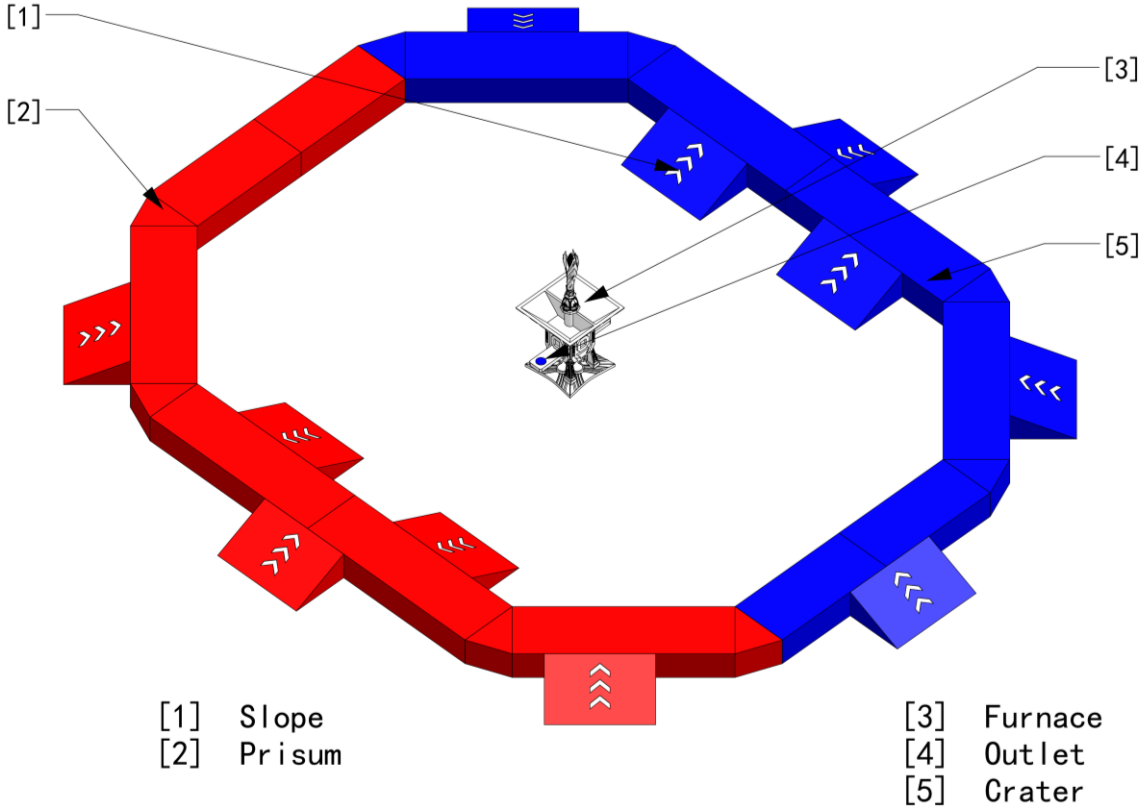


Fig 2-4 Canyon

3. Props

3.1Mine

An ore of the own team is placed on the inner side of the mine, and two ores of the opponent team are placed on the outer side of the mine, as illustrated in Fig 3-1(The appearance of the mine may be redesigned. Participants are advised to pay attention).

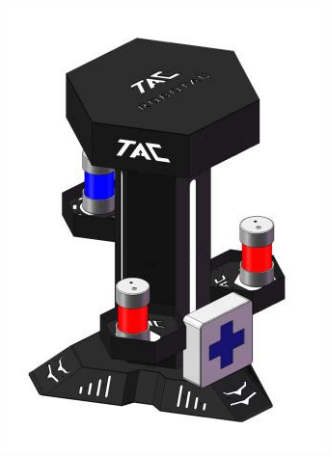


Fig 3-1 Mine

3.2furnace

The furnace is illustrated in Fig 3-2. It has a height of 1550 mm. The furnace pan is located 750 mm above the ground. The ore can be poured into furnace pan. There is an outlet for each team for quick win. The outlets are located 325 mm above the ground and the square of each outlet is about 100mm2. The outlets are equipped with a sensor to detect attack. Sensitivity of the sensor is tuned so that it is triggered when attacked by a cannonball that free falls from 450 mm above, and a 350 mm free fall will not trigger the sensor

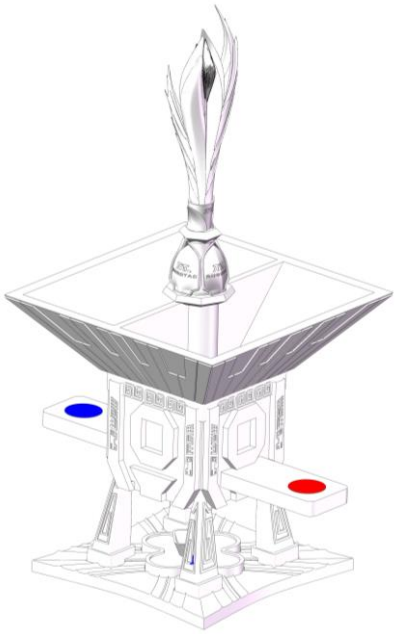


Fig 3-2 furnace

3.3Ores

The ores are illustrated in Fig 3-3. The ore has a cylindrical shape with lighting feature. The surface of the ore is covered by a layer of silicone. It is about 125 mm tall, with a diameter of 65 mm at the center, and 70 mm at the ends. It weighs about 280 grams. At the beginning of the game, one ore and two opponent ores are placed in mine of each team. There is another regular ore in the ore zone. The lift in the ore zone starts to descend 90 seconds after the game starts, and stops 55 seconds after the initial descent. A autonomous/bionic robot can carry one regular ore at the beginning of the game. Regular ores are exclusive, and are color marked by red and blue paint. Details of ore are illustrated in Fig 10 int he Appendix.

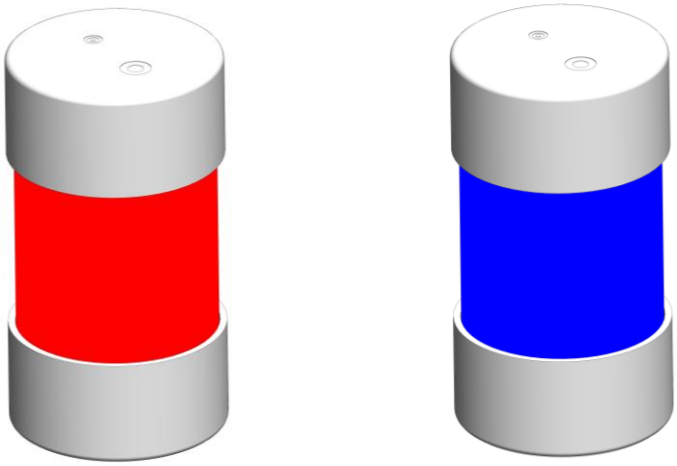


Fig 3-3 Ores

3.4 gold ore

There is a gold ore in the ore zone, which can be used by either team. As illustrated in Fig 3-4, a gold ore has same specifications as a regular ore, except that it is marked by yellow paint. The gold ore lift starts to descend 90 seconds after the game starts, and stops 55 seconds after the initial descent. The team that possesses the gold ore by the end of the game gets 30 points. The gold ore can also be placed in the furnace pan to facilitate a quick win.

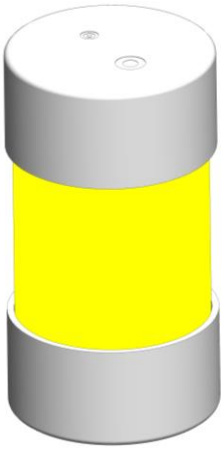


Fig 3-4 gold ore

3.5 Health Bar

A health bar has dimensions of 134 mm * 230 mm * 15 mm. It is shown in Fig 3-5. Details of the health bar are illustrated in Fig 11 in the Appendix. The health bar has a XT60 plug which connects between the robot power inlet and power supply. Under valid attack, the indicated health level will drop one tier. The health bar uses accelerometers to sense the attack, and the sensitivity is calibrated by the

organizing committee. Additional attacks within 5 seconds after the initial valid attack are invalid and will NOT be counted. After the robot loses all 3 tiers of health level, the robot is killed and will be automatically powered off.

The health bar caps the current at 30A for 12V or less voltage, and 15A for 12V to 24V voltage. It cuts the power for three seconds when overcurrent occurs.

Each team must install the health bar to designated locations on their Manual Robots following instructions of the organizing committee, and ensure the robot is powered through the heath bar. Any modifications of the health bar are strictly prohibited. The installation and performance of the health bar will be inspected by the organizing committee prior to the game.

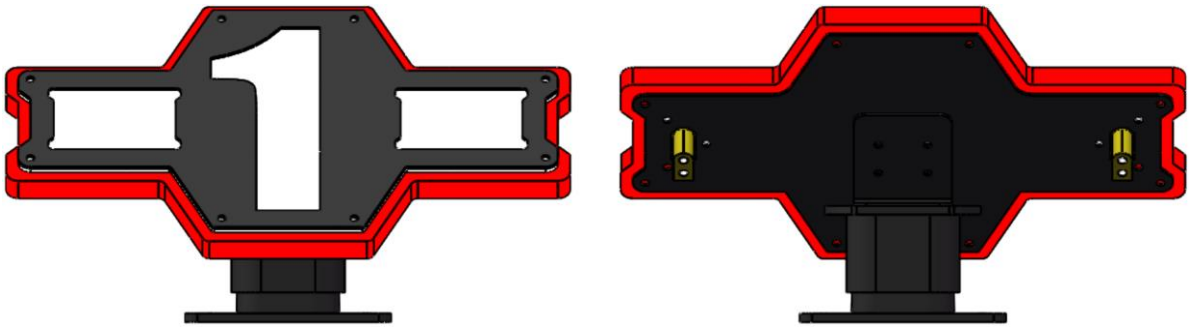


Fig 3-5 Health Bar

Two different types of health bars are provided: Base angled 45 degrees to the horizontal plane (4 provided, No 1-4, Fig 3-6(1)), and base parallel to the horizontal plane (1 provided, for bionic robot only, No 5, Fig 3-6(2)). Details of the health bar are illustrated in Fig 11 in the Appendix.

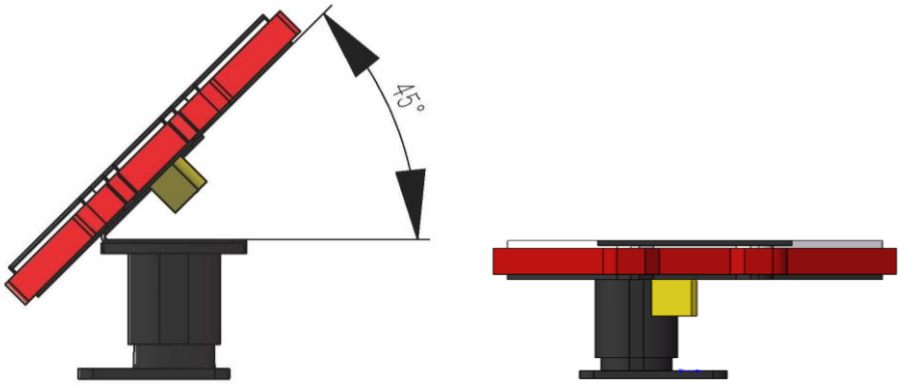


Fig 3-6(1) 45 degrees Fig 3-6(2) 180 degrees

Fig 3-6 Health Bar

3.6Marker Display

The marker display has similar dimensions to the health bar, as illustrated in Fig 3-7. One marker display will be provided to each team with the No 0. The marker display will be installed on the

autonomous robot, with similar installation to the health bar. A marker display only displays color, and does not sense attack.

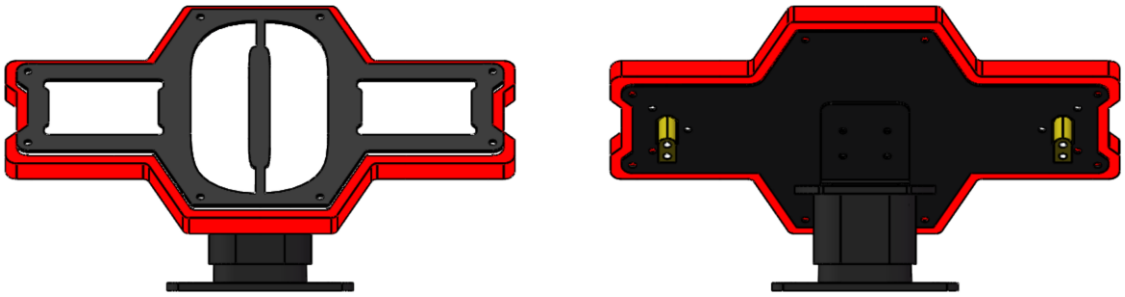


Fig 3-7 Marker Display

3.7Cannonball

A cannonball is made of rubber. It has a diameter of 54 mm and a weight of 44 grams, as shown in Fig 3-8. 30 cannonballs are provided to each team. Before the game starts, cannonballs can be loaded to the manual robot. Manual reload is prohibited during the game. Unused cannonballs can be stored in the cannonball storage or the manual robot start zone.

Fig 3-8 Cannonball

The cannonballs are not exclusive for either teams and robots can pick up cannonballs on the ground and shoot them during the game. Cannonballs can be transferred between robots. For safety, the effective range of the cannonball must not exceed 10 meters. Prior to the game, the shooting mechanism must be inspected and approved by the organizing committee.

4.Robots

Each team can have up to five manual robot and multiple autonomous/bionic robots. The total weight of the robots for each team must not exceed 60 kg. The total weight includes power source and all parts of robots (including the base of health bar, and video transmission devices not provided by the organizing committee). The total weight does not include remote controllers, spare batteries and parts.

The organizing committee will inspect each robot prior to the game. Any robot that deemed not compliant with the game rules will be disqualified.

Aerial robots are prohibited.

4.1 Autonomous/Bionic Robots

An autonomous/bionic robot must start from the autonomous/bionic robot start zone. Before and after the game starts, the dimensions of an autonomous/bionic robot must not exceed 600 mm * 600 mm * 500 mm (height). Autonomous/bionic robots do not carry any health bars or cannonball launching mechanisms. Autonomous/bionic Robots must carry marker display No. 0, which shows the color of the team. The autonomous/bionic robots can

a. Pass the ore it carries at the beginning of the game;

b. Fetch ores from the mine;

Communication between autonomous robots and manual robots are prohibited. However, an autonomous robot can recognize and respond to the motion or status of a manual robot. Prior to the game, autonomous robots will be inspected by the organizing committee. Autonomous robots must demonstrate all pre-programmed motions. Motions not demonstrated during inspection are not allowed in the game.

A bionic robot can be radio controlled. A bionic robot must be legged with higher than 2 degrees of freedom on each leg.

4.2Manual Robots

4.2.1. Dimensions

All manual robots must fit into the manual robot start zone and start from there. At any time during the game, each manual robot must not exceed the dimensions of 600 mm * 600 mm * 750 mm. Manual robots can be equipped with cannonball launching mechanisms or other attacking mechanisms which are used to attack opponent robots or the furnace outlet. An attacking mechanism is considered part of a robot, and must meet the dimension criteria. Attacking mechanisms cannot be separated from robots.

4.2.2. Motion Mechanism

For each team, all manual robots participating in the game must have different motion mechanisms, such as wheel/continuous track, non-bionic legged, bionic, etc. Types of motion mechanism are listed in table 4-1. In each game, the maximum number of robots for the wheel/continuous track type is three.

4.2.3. Health Bar Installation

The health bar must be installed in a designated location：

a. Mounting bases for health bars will be provided by the organizing committee. The base must be rigidly connected to the robot body. Any modification to the base or health bar is prohibited. The base must be mounted at the center of the Manual Robot's rear edge, with a height of 60 mm~160 mm to ground. Wheels cannot be higher than the lowest point of health bar. Details of the installation are illustrated in Fig 4-1.

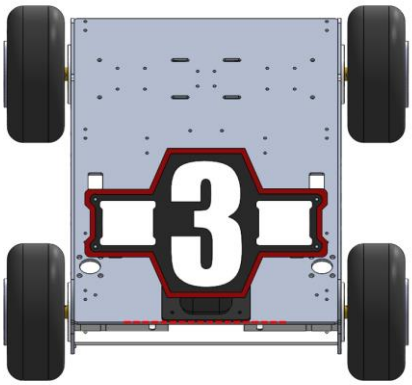


Fig 4-1 Health Bar Installation

b. Blocking the health bar: During the match, attacking mechanism, wheel, or other mechanisms must not block the health bar in any way, as shown in Fig 4-2。

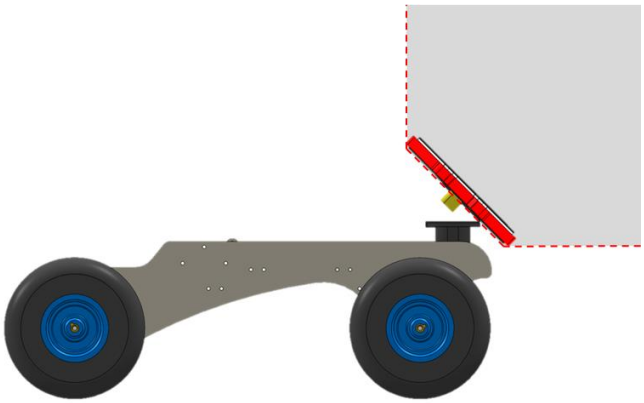


Fig 4-2 Health Bar Installation

Health bar installation requirements are shown in table 4-1.

table 4-1

Type	Motion Mechanisms	Health Bar Installation
Wheel/Continuous track (Up to 3)	Direct wheel drive, omni-wheel, Mecanum wheel, etc. mixed wheel count as one type.	Standard
Non-bionic legged	discrete step landing point, but non-bionic. The walking mechanism of the robot adopts continuous circular motion and the contour arc of the walking mechanism is greater than 180 °	Horizontal installation

4.2.4. Remote Controller and Video Transmission Module

A manual robot is controlled by a remote controller. Radio control interferences should be mitigated.

Prior to the game, each team must designate a manual robot to mount a video transmission module provided by the organizing committee for live video transmission. The module weight does not count against the robot weight.

The dimensions of the video transmitter provide by the organizing committee do not exceed 120mm*85mm*50mm, excluding the antenna, as illustrated in Fig 4-3.

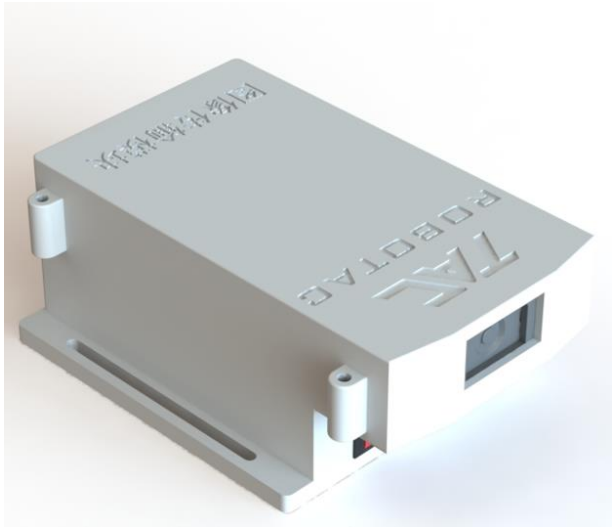


Fig 4-3 Remote Controller and Video Transmission Module

Additional video transmission modules can be installed on Manual Robots, and the modules will count against the weight and size limit for robots. It is responsibility of each team to avoid interferences resulting from the modules.

4.3 Power

a. The power supply voltage must not exceed 24VDC for autonomous robots and bionic robots. For other robots, it must not exceed 12VDC.

b. Compressed air can be used. The air pressure must not exceed 0.8MPa, and the volume of air container must not exceed 5 L. Protection to the container must be provided.

5. Teams

a. All team members must be registered college students. Each team has a team captain.

b. Undergraduate, vocational colleges, high schools, and vocational schools in China are allowed to form teams to participate in the competition. The proportion of international students among the team members should not be less than 60%, and cross school teams are allowed;

c. Overseas universities can form teams to participate in the competition, and cross school teams are allowed.

d. Each team can have one international graduate student.

e. Only one faculty advisor and six students can participate in the match. The faculty advisor cannot operate the robots

f. During the match, all operators must stay in the designated operator zone.

g. The number of registered student team members should be reasonable. Faculty advisor to student ratio should not exceed 1:4.

6. Game

6.1 Proceedings

6.1.1. Preparation

Prior to start, both teams have one minute to prepare their robots in respective start zones. The robots may be powered on. Manual robots are not allowed out of the start zone.

6.1.2. Start

The referee system starts the by whistle, and robots start from their respective start zones. Robot start must be completed within 10 seconds after the match starts. Start the autonomous/bionic robot before the whistle, or start the manual robot before the light signal is prohibited.

6.1.3. Scoring

a. Removing an ore of the own team earns 5 points.

b. Placing an ore of the own team to the corresponding furnace pan earns 15 points.

c. Placing the only gold ore to the corresponding furnace pan earns 15 points. At the end of the game, a live robot that holds the gold ore earns 30 points.

6.1.4. Quick Win

A team achieves quick win when at least three own side ores or the gold ore are placed in the corresponding furnace pan, and a robot hits the furnace outlet. The game ends immediately with 100 points win.

6.1.5. Violations

During the game, when the robot moves outside the fence of the competition site, and when the non-bionic robot moves to the protected area, it will be punished and will not be allowed to re-enter the field.

6.1.6. Retry and Power Off

After the game starts, retry is absolutely prohibited. If a robot malfunctions, it will be disqualified immediately. The referee has full authority to order the malfunctioning robot to be powered off and removed from the game field.

6.1.7. Determination of Game Outcomes

If no team achieves a quick win, the team with the higher score wins. A tie is possible for a qualifier game. In a elimination game, if the game ends with a tie, the winner of the game is determined in the following order:

Team that earns more points on ore placement.

Team that holds the gold ore at the end of the game.

If it is still a tie, a two-minute overtime will be played between the two teams. Each team will select one robot to participate. Battery and compressed air change or recharge are prohibited. The team that first places an ore in the corresponding furnace pan wins.

If neither team was able to win the overtime, the team with a lighter total weight at the end of the game wins.

6.1.8. Technical Timeout

Before the game starts, a team can request technical timeout in the staging area. Each team has one timeout of up to two minutes in the qualifier game phase, and two timeouts of up to three minutes in the elimination game phase. A team has one additional timeout of up to two

minutes in the elimination game phase if it is not used in the qualification game phase. For each game, only one team can request timeout.

A team is considered No Show if it does not arrive at the staging area in time before the game, and may result in disqualification.

6.2 Violations and Disqualifications

6.2.1. 1 Point Penalty(Can be accumulated)

a) First time false start.

b) A robot fails to start 10 seconds after the game starts, and it is touched by an operator.

c) An operator touches a robot after it starts.

d) An operator leaves the operator zone.

e) Other operator behaviors that deemed inappropriate by the referee.

6.2.2. Robot Disqualification

a) Duplicating designs of other teams.

b) A second false start in the game, regardless of which team has the first false start.

c) A robot touches ground outside of the game field; a non-bionic robot enters or reaches over the bionic robot protection zone.

d) Intentionally damaging the game field or props.

e) Shooting cannonballs to over 10 meters.

A disqualified robot does not stop moving. 10 points will be taken each time, and this can be accumulated.

6.2.3. Team Disqualification

a) Manual Robots not powered through the health bar or tempering with the health bar.

b) Dangerous actions to operators, referees, or audience.

c) Duplicating designs of other teams.

d) Any actions of disobedience against warning or ruling of referees.

e) Any other actions against the spirit of fair play.

When a team is disqualified, the team loses with 0 points, and the opponent team earns a quick win.

7. Safety

Safety is the most important consideration for ROBOTAC. All teams and participants must pay special attention to safety and take utmost precautions.

1) The faculty advisor of each team is responsible for safety supervision of each team.

2) Use of hydraulics, internal combustion engines, explosives, high pressure air (>0.8MPa), and energetic chemical materials that deemed dangerous or improper by the organizing committee is prohibited.

3) Maloperation, control system malfunction, and damaged parts can cause sudden stop, accelerate, or turns, which can cause collision and injuries. Accidental firing of launch or attack mechanism can also cause injuries. Necessary precautions should be taken to prevent these incidents from happening, including but not limited to: training with companions present, wearing safety goggles and helmets, use disarm function for firing systems, etc.

4) The participating robots shall not cause damage to the team members, judges, staff, spectators, equipment and the venue. If the judge believes that the robot's behavior is potentially dangerous to personnel or equipment, he can prohibit the robot from participating in the competition or terminate the competition at any time.

8. Others

1) Please check the official website http://www.robotac.cn for the latest version of game rules.

2) The dimensions of the game field and objects described in this document may have a tolerance of ±5% unless otherwise stated. However, the robot dimensions and weight are absolute maxima. The organizing committee reserves the right to add decorative materials or change the materials in the game field.

3) FAQs are available at http://ask.robotac.cn (You need to obtain the login account from the organizing committee)

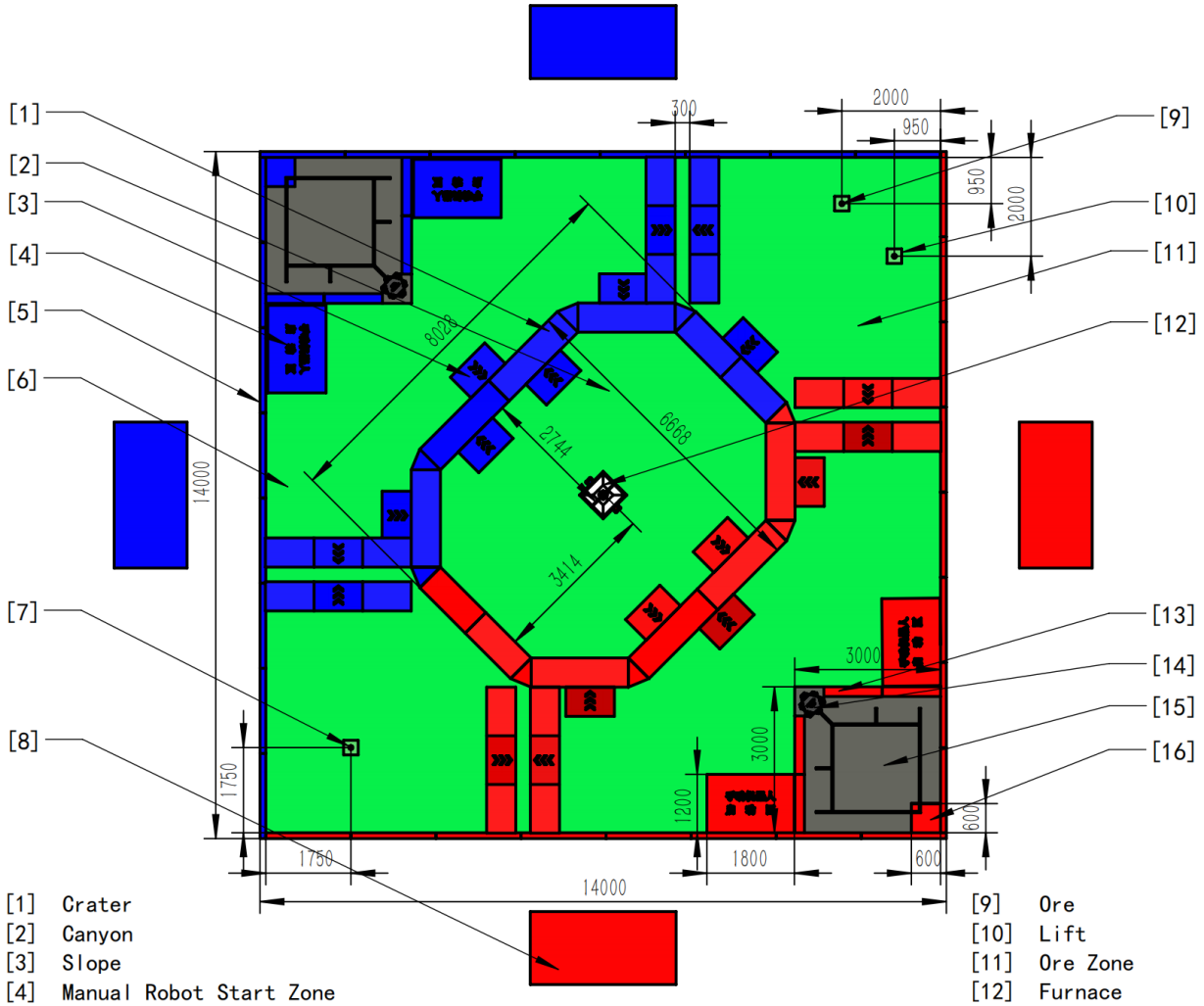
4) A team can appeal referee rulings following the Referee Ruling Book.

5) Referees have the right to make rulings for any action not specified in the rules. In case of a dispute, the decision of the chief referee is final.

6) The organizing committee reserves the right for final explanation to the rules.

7) Players should face all problems encountered in the competition with a positive attitude. Respect teammates, opponents, volunteers, referees and all people who have worked hard for the competition

Appendix



[1] Crater
[2] Canyon
[3] Slope
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[9] Ore
[10] Lift
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[12] Furnace
[13] Transfer Platform
[14] Mine and Rehab Zone
[15] Upland
[16] Autonomous/Bionic Robot

Fig 1 game field

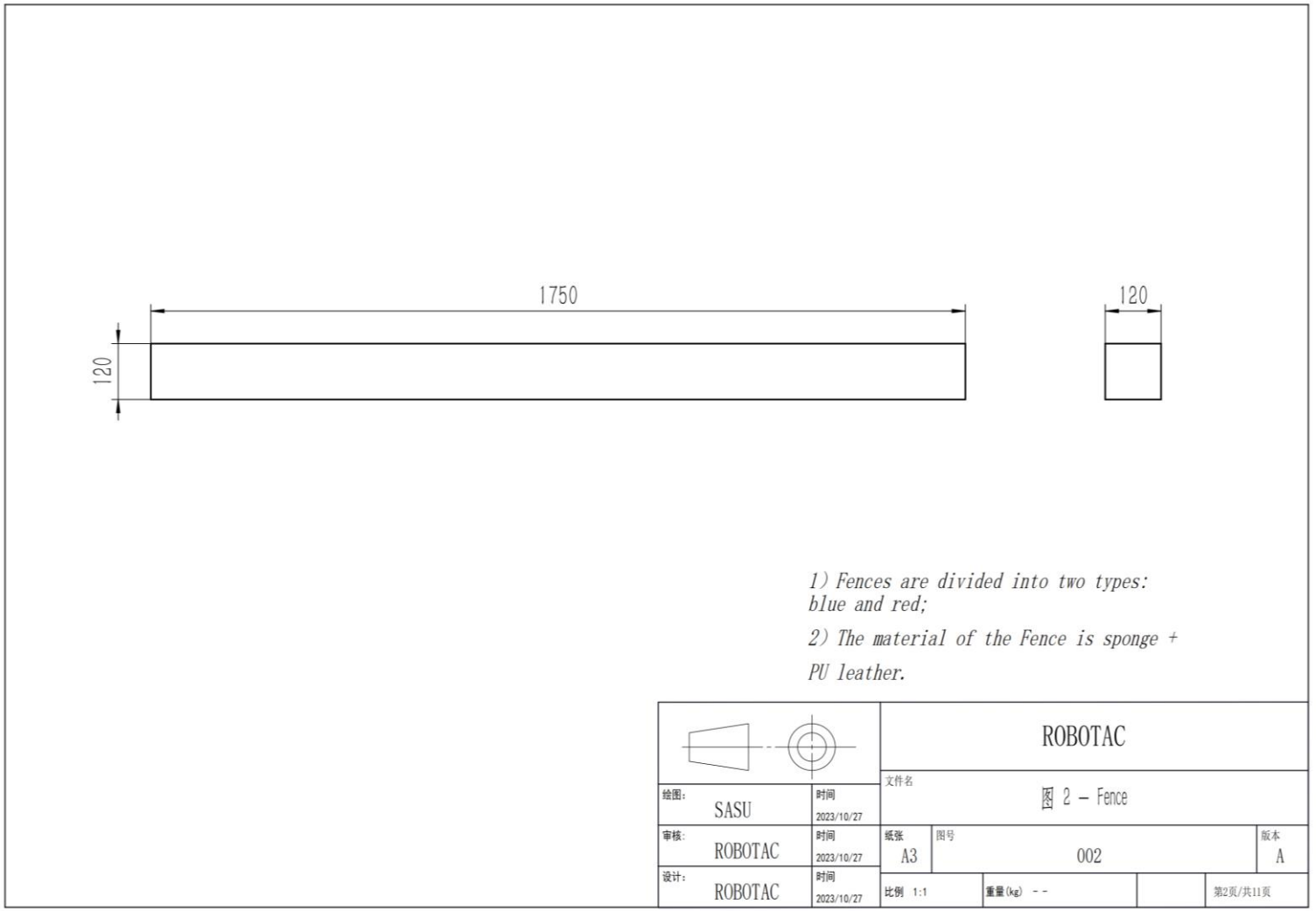
1750
120
120
1) Fences are divided into two types: blue and red;
2) The material of the Fence is sponge + PU leather.
ROBOTAC
文件名
图 2 – Fence
绘图: SASU
时间 2023/10/27
审核: ROBOTAC
时间 2023/10/27
设计: ROBOTAC
时间 2023/10/27
纸张 A3
图号 002
版本 A
比例 1:1
重量(kg) - -
第2页/共11页

Fig2 fence

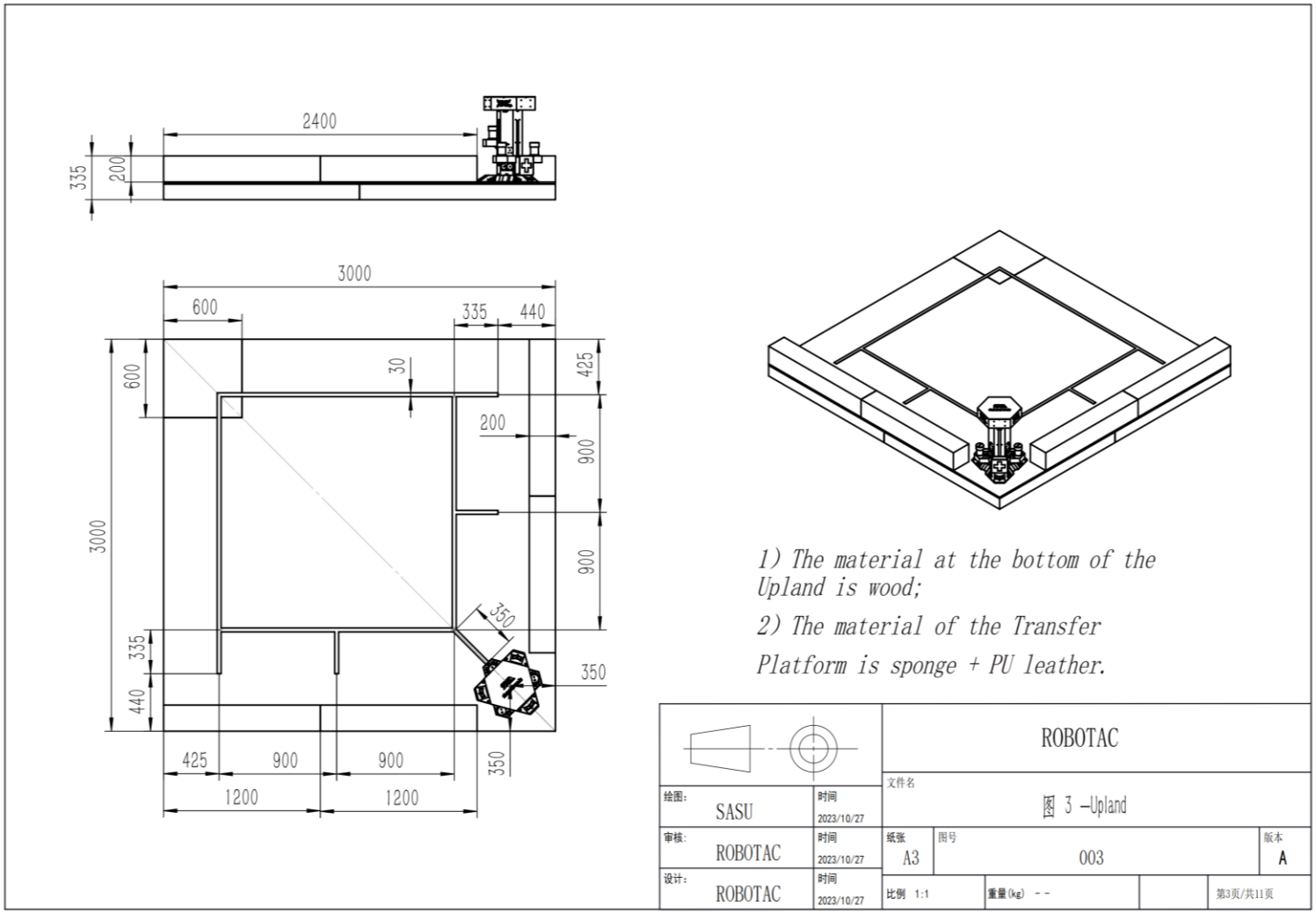
2400
335
200
3000
600
335
440
600
30
425
200
900
900
3000
350
335
350
440
425
900
900
350
1200
1200
1) The material at the bottom of the Upland is wood;
2) The material of the Transfer Platform is sponge + PU leather.
ROBOTAC
绘图: SASU
时间 2023/10/27
文件名
图 3 –Upland
审核: ROBOTAC
时间 2023/10/27
纸张 A3
图号 003
版本 A
设计: ROBOTAC
时间 2023/10/27
比例 1:1
重量(kg) - -
第3页/共11页

Fig3 upland

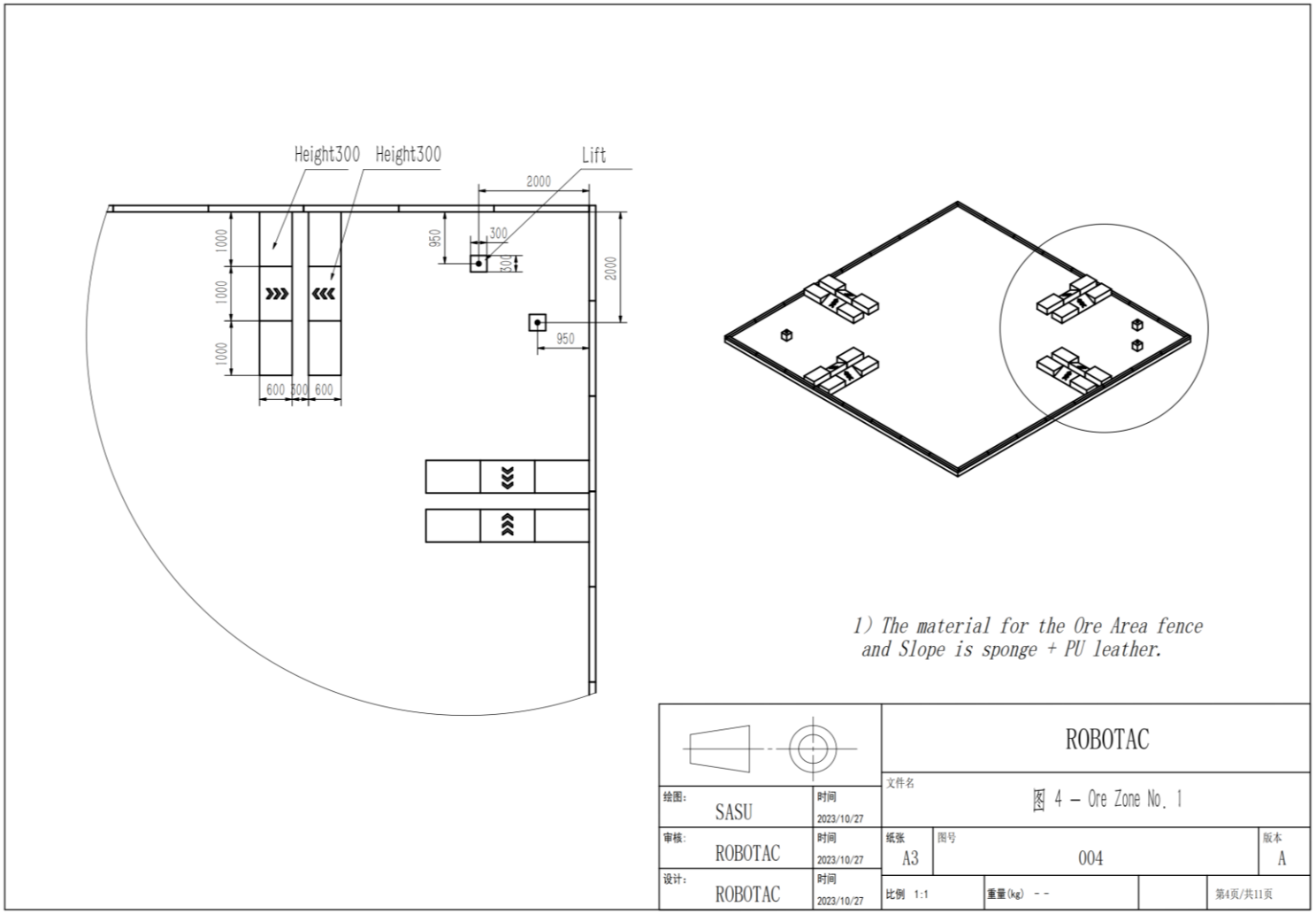

Fig 4 ore zone No.1

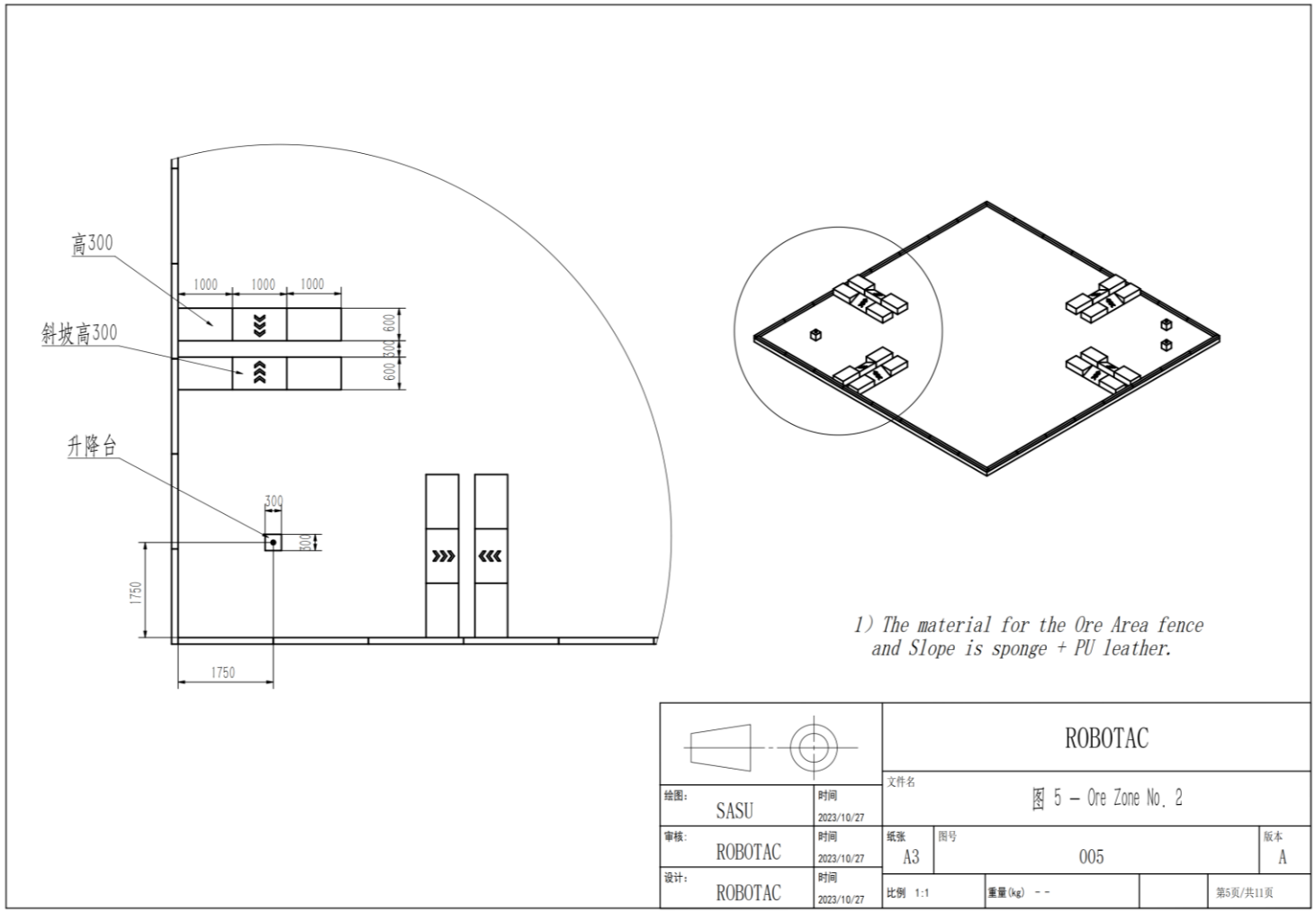

fig5 ore zone No.2

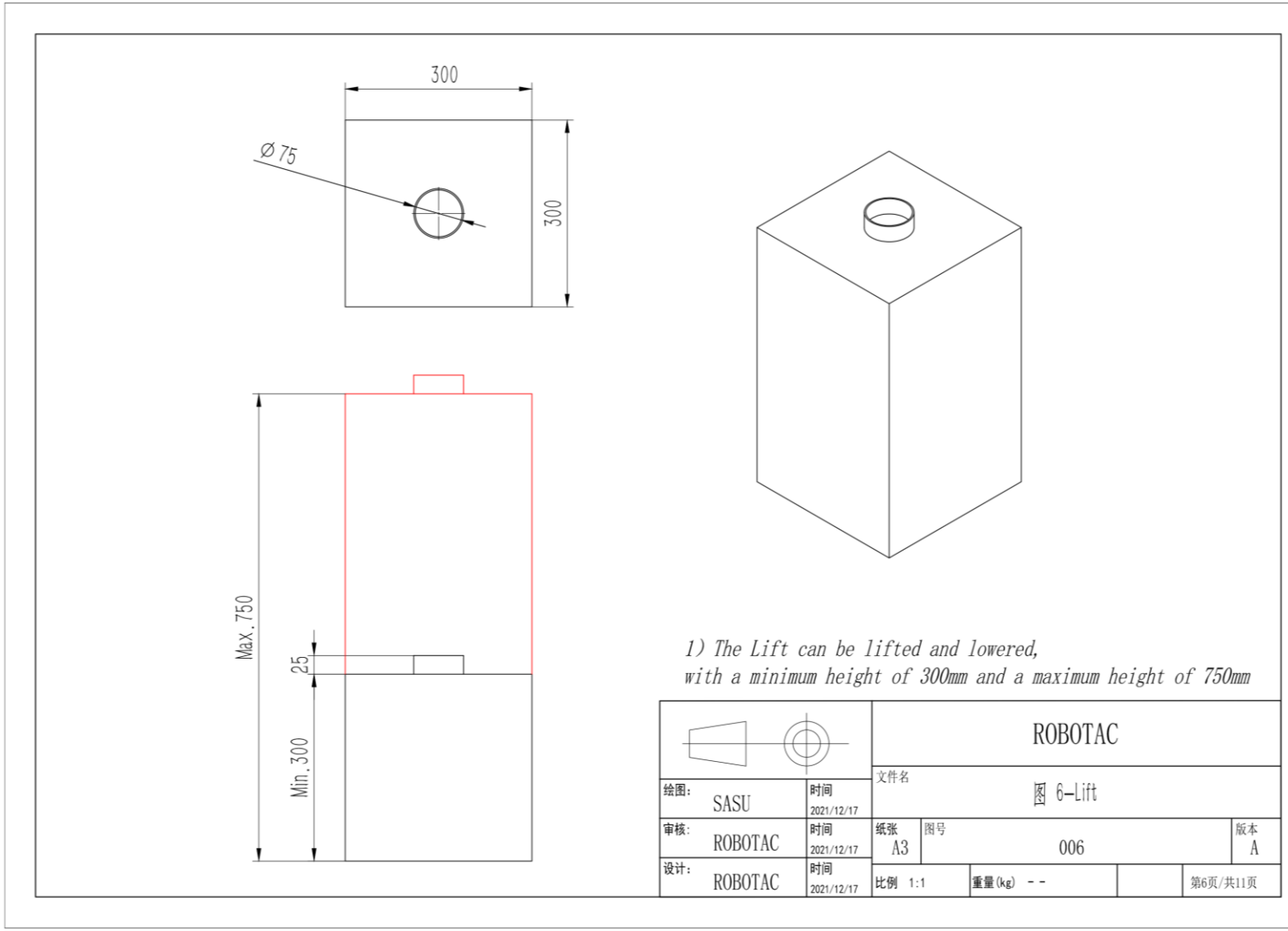
300
Ø 75
300
Max.750
25
Min.300
1) The Lift can be lifted and lowered,
with a minimum height of 300mm and a maximum height of 750mm
ROBOTAC
文件名
图 6-Lift
绘图: SASU
时间 2021/12/17
审核: ROBOTAC
时间 2021/12/17
设计: ROBOTAC
时间 2021/12/17
纸张 A3
图号 006
版本 A
比例 1:1
重量(kg) - -
第6页/共11页

Fig6 lift

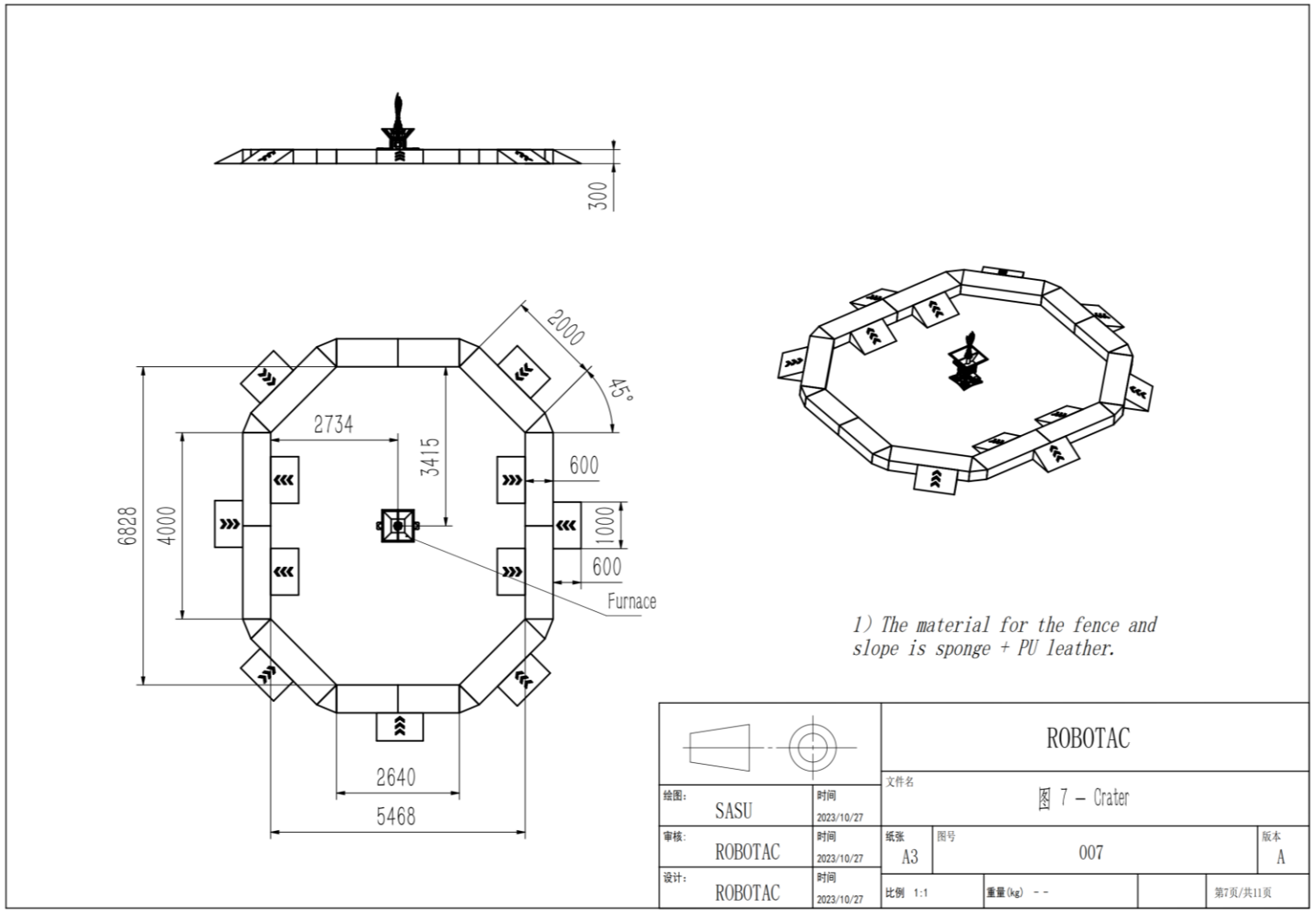
300
2000
45°
2734
3415
600
1000
600
6828
4000
Furnace
2640
5468
1) The material for the fence and slope is sponge + PU leather.
ROBOTAC
文件名
图 7 – Crater
绘图: SASU
时间 2023/10/27
审核: ROBOTAC
时间 2023/10/27
设计: ROBOTAC
时间 2023/10/27
纸张 A3
图号 007
版本 A
比例 1:1
重量(kg) - -
第7页/共11页

fig7 canyon

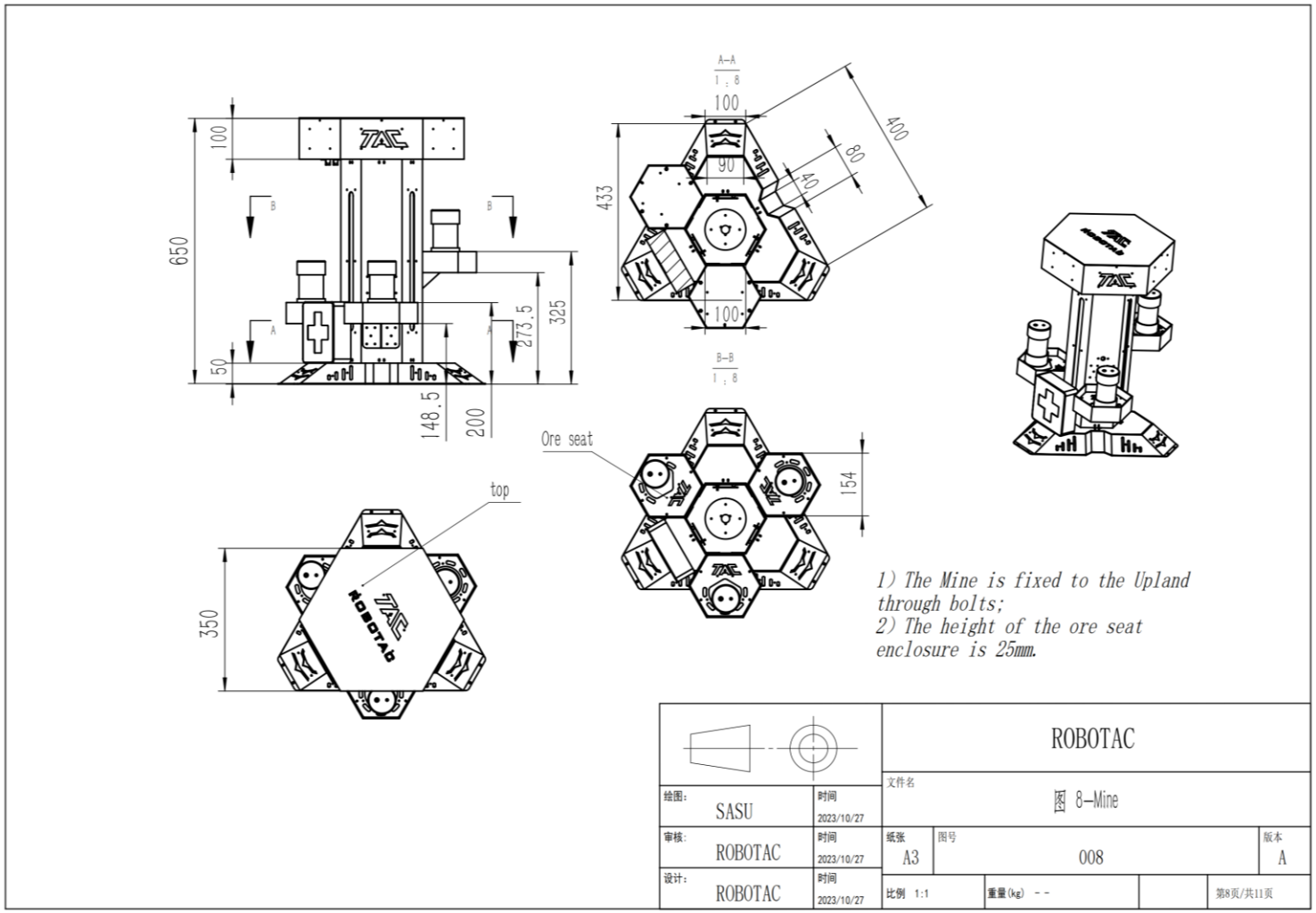
A–A
1 : 8
100
400
80
40
90
433
100
B–B
1 : 8
650
100
50
325
273.5
148.5
200
Ore seat
154
top
350
1) The Mine is fixed to the Upland through bolts;
2) The height of the ore seat enclosure is 25mm.
ROBOTAC
文件名
图 8–Mine
绘图: SASU 时间 2023/10/27
审核: ROBOTAC 时间 2023/10/27
设计: ROBOTAC 时间 2023/10/27
纸张 A3
图号 008
版本 A
比例 1:1
重量(kg) --
第8页/共11页

fig8 mine

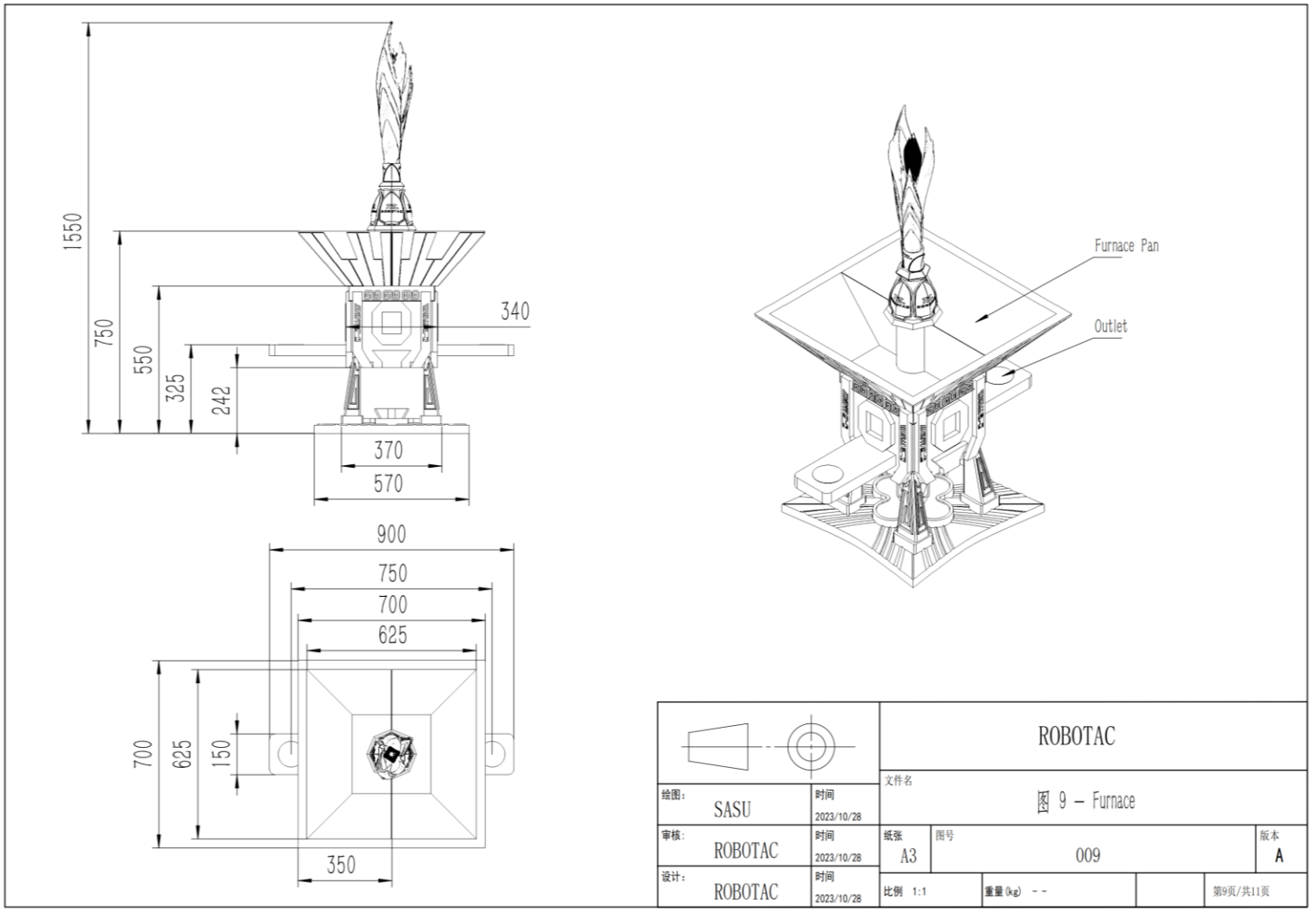

fig9 furnace

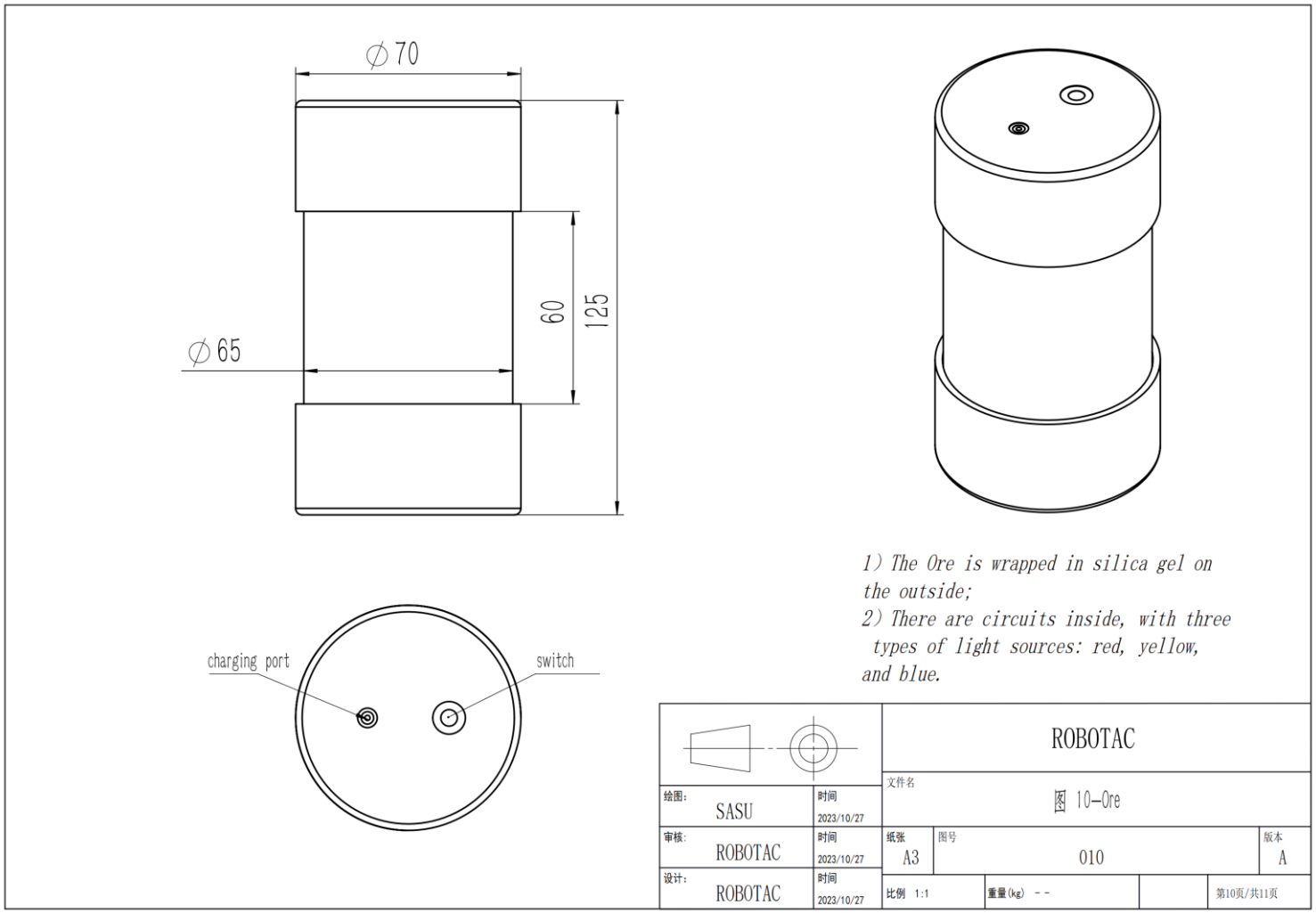
∅70
∅65
60
125
charging port
switch
1) The Ore is wrapped in silica gel on the outside;
2) There are circuits inside, with three types of light sources: red, yellow, and blue.
ROBOTAC
文件名
图 10-Ore
绘图: SASU 时间 2023/10/27
审核: ROBOTAC 时间 2023/10/27
设计: ROBOTAC 时间 2023/10/27
纸张 A3
图号 010
版本 A
比例 1:1
重量(kg) --
第10页/共11页

fig10 ore

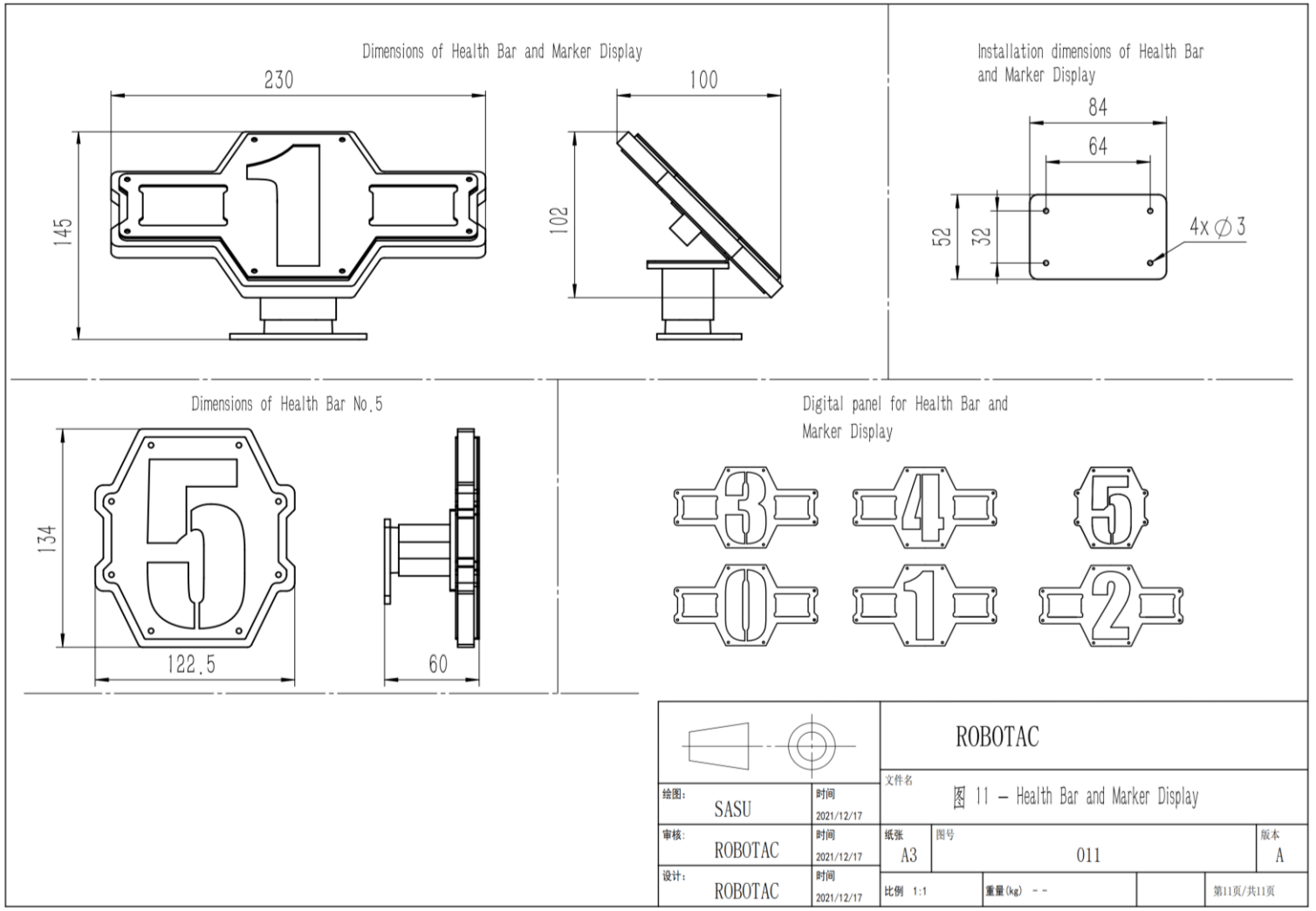

fig11 health bar