Technical specification

The technical specification of task:

1) General conditions

The object is the design and construction of a „pneumatic vehicle" – **PNEUMOBILE** – which is driven by compressed air. The transmission of torque onto the wheels shall be performed by pneumatic control and drive elements.

2) Composition

The driver has to sit on the vehicle (remote control is not permitted). Number of wheels: minimum 3, - arranged at least in 2 wheel-tracks, for safety reasons

3) Mass and dimensions

No limit to the mass is defined (try to reach the lowest possible mass). The maximum admitted length of the vehicle is 3 m, the maximum admitted width is 2 m. It is going to be checked at the machine reception with a rectangular stuck on the ground, which mass will be 3x2 m. The clearance between the bottom of the vehicle and the ground surface should be at least 100 mm, which will be checked with a 100 mm high bumper on the ground.

4) Framework, car-body

The chassis shall be made of metal, carrying the pressure-bottle, the driving system and the driven wheels. The pressure (air) bottle and the pressure-reducer must be protected by the framework of vehicle, so they should be placed inside the framework. The (air) bottle is not allowed to be mounted with suspension under the framework, directly above the road surface. Material and design of other components are not limited. Closed chassis is not required, but the driver must be separated from moving parts of drive system by a protection shield.

Safety framework:

- In case of a vehicle with car character (the framework encloses the driver's seat), safety framework higher than the driver's head is compulsory.
- In case of a vehicle with bike character (the driver should sit on the vehicle), safety framework is not compulsory.

5) Engine

The conversion of energy of compressed air to mechanical energy should be performed by pneumatic cylinders and valves of Rexroth. Number of applicable cylinders: maximum 4 (with max. diameter Ø100 mm, and standard strokes according to the catalogue). The available pneumatic components for engine construction can be found on the home page of competition. The racer teams, participating in the competition in 2008 or 2009 are requested to use the existing pneumatic components for construction of vehicles, and using only the missing, or additional parts, as required for the assembly. On request we can provide spare parts to the pneumatic cylinders used at the race in 2009. The control system can be electro pneumatic as well. In this case the promoted voltage is 24V DC. Only one engine can be used in the vehicle, which makes up one mechanical unit. Every cylinder of the engine shall be in moving, in every run (category) of competition. The engine must be visible by the jury, or transparent cover can be used. The engine may be started already before the run.

6) Input of extern energy

Air in the system can be heated with external environmental heat via heat-exchanger or by absorbing and mixing of environmental air. Heating is allowed before the races, after the mounting of the bottle. The heat-exchanger can be free or forced flow. In case of forced flow “ventilator” can only be driven by the energy of the bottle. In case of air absorbing the exhauster-compressive part can only work with the energy of the bottle. For driving the vehicle during the race it is not allowed to use other energy resource or heat energy in other form (except the directions at chapter 6a), or using human force (except the battery used for the control system).

7) Puffer container:

After the bottle-change, rest air in the bottle can be deflated into a puffer container (compulsory exhausting will be checked).

8) Drive chain

The drive chain can be optionally built with geared or direct transmission. The application of free-wheel is mandatory, clutch is permitted. The drive chain shall permit to move the vehicle by hand force. (forwards and backwards)

9) Suspension

Any kind of wheel suspension principle is applicable. The diameter of wheels is optional. The pavement of runway is bitumen.

10) Steering-gear

The vehicle can be equipped with any kind of steering gear. The vehicle must be easily steered, the driver must be able to drive easily straight and take a bend, by normal force. The vehicle should be able to turn around on the 8 m wide speedway.

11) Brake

The vehicle shall be equipped with two independent brakes, capable for efficient reduction of velocity of vehicle, and to stop the vehicle. One of the brakes shall be able to fix the vehicle in standing position.

12) Compressed air bottle:

The source of energy is a 10 litre pressure-bottle filled with air, nominal pressure of 200 bar. The air bottle is equipped with a pressure-reducer. The bottle shall be fixed to the chassis, and locked against slipping. The pressure-reducer shall be protected against damage, in case of collision, accident or external objects (e.g. with protection cover).

Technical data of pressure-bottle:

- Dimensions: **The exact properties will be later before the nomination given!**
- Type of pressure-reducer: Messer FC-2000
- Connection of pressure-reducer: Plastic pipe: Ø 10 mm
- Maximal air flow of reducer: see on the home page of Pneumobil (download)

13) Safety prescriptions

The driver must have a safe place in the vehicle. In case of a vehicle with car character the use of minimum two-point safety belt over the seat is obligatory (across the burst). In case of a vehicle with (motor)bike character there is no requirement for a safety belt, but the use of knee- and elbow-pads is obligatory, as well as wearing protective clothing for motorcycling. In case of a vehicle with (motor)bike character the "gas-pedal" should be always pressed down. When released the "gas-pedal" should go back to the start position. Goal: in case of an accident with the driver, the vehicle should not run longer. An emergency stop circle shall be used in the pneumatic system, for exhausting the air from drive chain. The operating lever or button shall be easily accessible by the driver or by other helping person. The circuit diagrams of compulsory emergency stop system are available on the home page of „Pneumobil". Only the specified circles and pneumatic elements can be used for this purpose. The optional source of current (battery) shall be safely fixed, and the vehicle equipped with a main switch which should be easily accessible, similar to the emergency stop lever. Wearing motorcycle crash-helmet by the drivers and the passengers (if any) is compulsory during the events of competition. Use of other crash-helmet (e.g. helmet used at cycling) is not permitted.

14) Pneumatic elements

The conversion of energy of compressed air to mechanical energy should be performed by pneumatic cylinders and control valves of firm Rexroth. The applicable Rexroth pneumatic components can be selected from the list on the home page of the competition. Besides the driving system the vehicle can have other pneumatically operated functions as well.

15) Documentation

The competing teams have to prepare the documentation of technical design considering the following points (evaluation of the documentation will be based on these points):

- Structure of the documentation should follow the structure of the technical specifications
- It should contain the plans of the framework of chapter nr. 4 (3D-CAD, load calculation is favourable)
- It should contain the circuit plan of the pneumatic system of chapter nr. 5 (CAD is favourable)
- It should contain the kinetic calculation of chapter nr. 8
- It should contain the kinetic sketch of chapter nr. 8 (3D-CAD is favourable)
- It should contain the list of needed pneumatic elements on the last page.
- At other chapters a description is sufficient, but a support with calculation and visualization is favourable.

Deadlines:

- Term of submitting of documentation 15.12.2009
- Reply (acceptance, further requirements) until **15.01.2010**
- Deadline for correction or supplement 31.01.2010
- Reply and decision about the acceptance until 10.02.2010
  (only for teams which had to correct the documentation)

In case of insufficient, perfunctory documentation the team will be disqualified from the competition. That will be communicated to the team according to "Deadlines" point nr. 4. Photos of the ready vehicles equipped with the safety appliances, certifying the compliance with the technical and safety requirements shall be submitted. The incoming photos will be treated with absolute secrecy by Rexroth until the day of competition. Term of sending in the photos: **15.04.2010.** Aim of this: discovery of occasional shortcomings of safety before the competition! Accepted languages of documentation: Hungarian or English

16) **Start plates and publicity surfaces**

Two separated even surfaces with size of A3 shall be provided on the front and back, or on the right and left side of the vehicle for the start plates. These surfaces can be directly on the chassis or on extra boards made for this purpose. Without these surfaces the vehicle cannot be approved for the competition. Sponsor advertisements can be also placed on the vehicle, in a maximum size of A4 and max. two copies of each advertisement. Advertisements of Rexroth pneumatic competitors are not allowed to place on the vehicle. The members of competing teams **shall wear the T-shirts of Rexroth**, that will be provided in different colours to the team leaders one months before the competition. The logo of sponsors can be placed on the T-shirt.