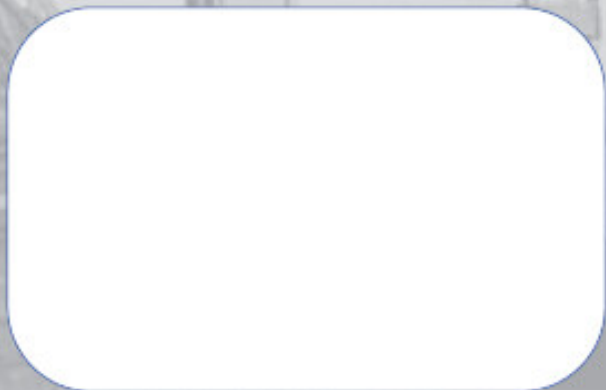


Automobile Service

Quality - Innovation - Safety



German Garage
Equipment Association

Working party
Exhaust extraction systems
Guidelines



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1. Introduction

You hardly ever notice them by sight: exhaust gases, welding smoke and welding dust. Substances which endanger the health of staff are produced during a lot of the work carried out in the workshop. Exhaust gases contain sulphur impurities, lead, carbon monoxide, water vapour, hydrocarbon, nitrogen oxides, carbon dioxide and nitrogen. The individual substances may lead to permanent health complications in people.

The exhaust extraction systems working party of the ASA association has produced this brochure. It is intended to serve as guidelines on current legislation for operators. The brochure provides tips to be noted when planning and purchasing an exhaust extraction system. Since the right system depends on what work is undertaken and what vehicles you work on.

To ensure a fully functioning system, you should contact specialists in the planning phase.

Only an individual exhaust extraction system designed correctly by a specialist will protect you from these health hazards,

stress the members of the exhaust extraction system working party

2. Statutory rulings for EU and special German market

The following statutory rulings provide information about exhaust extraction systems: [BGI](#) (information provided by the Accident Prevention and Insurance Association), [BGR](#) (rules issued by the Accident Prevention and Insurance Association), TRGS (technical rules for hazardous substances)

BGI

According to the accident prevention ruling of BGI § 45 Paragraph 2, health endangering gases, vapours, mists or dusts should be extracted in a safe way from the point at which they are produced or emitted.

BGR

Extracts from the safety rulings for vehicle maintenance.

According to BGR 157, Paragraph 5.14.1: workplaces must be set up so that the air inhaled by the insured parties is kept free of combustible and health endangering gases, vapours, dusts and smoke by means of:

- extraction in the areas where they are produced
 - technical ventilation
 - natural ventilation
 - or a combination of the above
- (also refer to TRGS 900, TRGS 554 and BGR 121)

TRGS

Extract from TRGS 554 (diesel engine emissions)

The latest version of this technical guideline for diesel engine emissions calls for special protective measures at the workplace.

4.2.5 Exhaust extraction systems

- (1) Exhaust extraction systems must function in a vacuum and must be designed so that they capture all the exhaust gases and discharge them so they do not reach working areas.

3. Layout of exhaust systems

The following are key to the layout:

- type and number of workplaces
- vehicle type
- utilisation factor
- structural circumstances

This results in the principles for the system concept.

A formula for the dimensions needed for exhaust extraction systems can be found in TRGS 554 under 4.7.4.3, Paragraph 2.

$$V = V_h \times n \times 0,0363 \times 1,2$$

V = volumetric extraction flow required in m³/h

V_h = cubic capacity of the vehicle to be tested in litres

n = test speed of vehicle in rpm.

0,0363 = physical conversion factor

1,2 = 20 percent proportion of fresh air

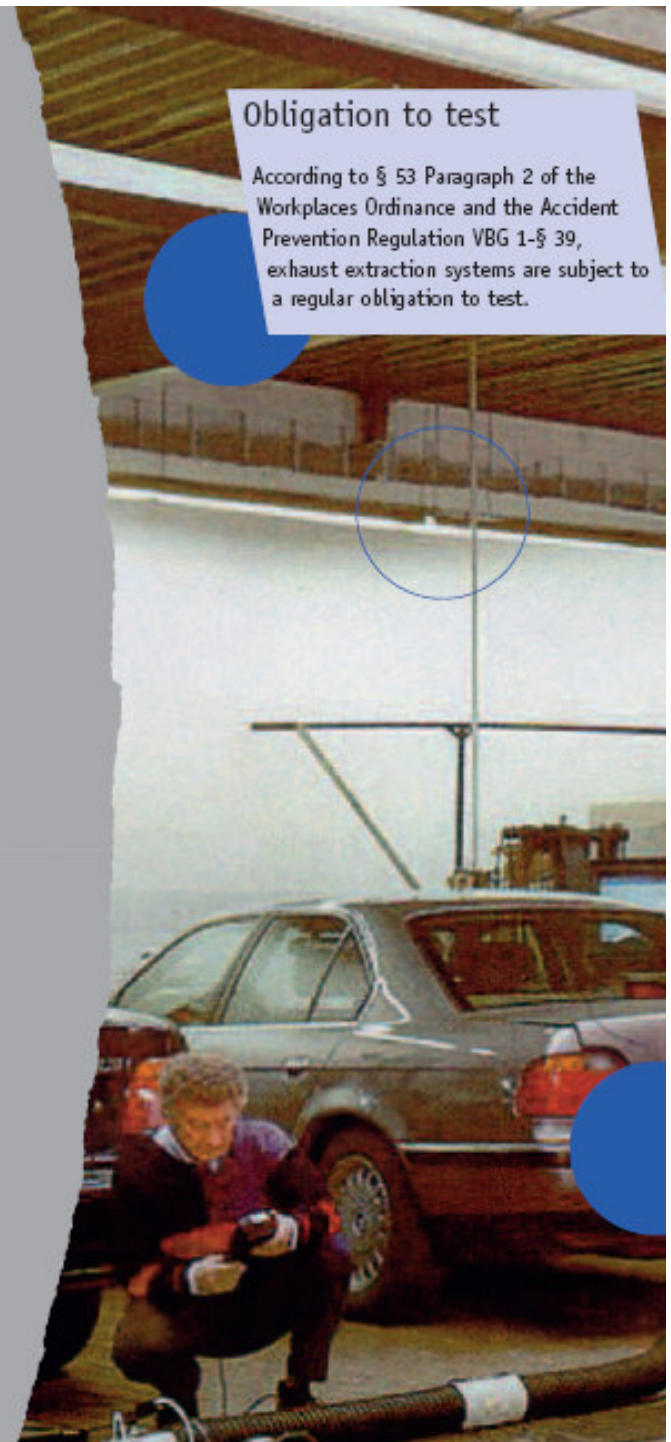


$$V = V_h \times n \times 0,0363 \times 1,2$$



Obligation to test



According to § 53 Paragraph 2 of the Workplaces Ordinance and the Accident Prevention Regulation VBG 1-§ 39, exhaust extraction systems are subject to a regular obligation to test.




4. Approximate values for extraction volumes

Recommendations for extraction volumes at the capturing element

Measuring point: hose/funnel interface



Type of extraction	Car	Truck	Motorbike
	Extraction volumes in m ³ /h	Extraction volumes in m ³ /h	Extraction volumes in m ³ /h
Extraction in service area (Chapters 5.1 + 5.7)	350–450	700–1.200	100–350 (with upright funnels approx. 450–700)
Extraction in the exhaust investigation area (Chapter 5.2)	700–1.200	1.700–2.800	–
Extraction in acceptance area (Chapter 5.3)	350–450	–	–
Extraction on brakes test rig (Chapter 5.4)	350–450	700–1.200 (if this is an exhaust investigation workplace integrated: 1700–2800)	–
Extraction on performance test rig (Chapter 5.5)	2.000–4.500	5.000–8.000	1.000–1.500
Extraction during body repairs via extraction arms (welding smoke) (Chapter 5.6)	700–1.200	700–1.200	–





5. Applications and systems

5.1 Exhaust extraction in the service area

Underground exhaust systems, single-site exhaust units, exhaust hose reels or exhaust rail systems are possible forms of exhaust extraction in the car service area.



Slotted intake duct systems

These are the most effective solution when there are several workplaces positioned next to one another. This form of workplace arrangement is commonly found in car workshops. Vehicle manufacturers are increasingly offering dual flow exhaust systems which allows for effective extraction when you have at least two intake units – without using additional double adapter connections. The utilisation factor of such a system depends on the level of workshop utilisation and if necessary the manufacturer's GV0 rulings. The specialist consultant of ASA member companies or their contractual partners should be contacted.

Planning recommendation:

In car workshops, the exhaust gas rail system should be fitted lengthwise along the road, 0.5 m behind the rear of the vehicle, at a height of 3.8–4.5 m and its length should be sufficient for all workplaces.

In truck workshops, the exhaust gas rail system should be fitted lengthwise along the workplace track, 0.5 m to the side of the vehicle, at a height of 3.8–4.5 m and its length should be sufficient for the entire workplace.

When positioning the exhaust extraction system, co-ordination with other sections will be required. Simple complete systems are controlled by an engine safety switch which is also used as an On/Off switch. Larger systems may be controlled using a central control unit with activation by means of individual remote control panels extending right up to remote radio controlled On/Off switches.





Single site extraction

This is understood to mean exhaust extraction systems for individual workplaces which consist of a fan, exhaust hose and extraction funnel. These are usually fitted under or directly to the wall/ceiling.

Exhaust hose reels

Hose reels with spring action or electric motor driven are one way of removing the hose fully from the working area when it is not being used there. Hose reels are available as compact systems with fans fitted directly or as central systems with collective piping made from galvanised folded spiral-type tube – folded spiral-seam tube. Manual actuation is used to control the spring hose reels. The hoses may also be controlled using suspended lamps or wall-mounted panels extending to radio remote controlled operations.

Hose reels are virtually the only above-ground form of extraction available in workshops in which a crane way is fitted. A crane way failsafe mechanism may then also have to be fitted. The assembly height is between approx. 3.80 m and 10 m.

Underground extraction systems

Underground extraction systems have to be included at an early stage of planning since the individual components have to be fitted during the body shell stage. This includes the piping routed through the ground with inclines and condensate collection shaft. Hose mountings and a ground cover are fitted in a second stage. Finally, the fan is fitted with an intake and blow-out piping as well as the plug-in exhaust gas hoses and capturing element which can be driven over. Another solution is plug-in elbows, exhaust gas hoses and capturing elements. The specialist consultant of ASA member companies must be consulted on such issues since planning errors cannot be corrected at a later date.





Handling

Exhaust extraction systems should always be designed and installed so that the exhaust hoses can be easily accessed by the vehicle mechanics. It is also important to ensure that universal capturing elements are used (exhaust sleeves/exhaust funnels) which allow for the very different exhaust pipe shapes and which fully capture the exhaust gases. Capturing elements with clamping tongues which are clamped to the exhaust pipe are very suitable for this. Corresponding tables and information on the individual exhaust types can be obtained from the ASA member companies.

Fans and noise protection

Since nowadays more and more emphasis is being placed on low noise levels, when acquiring an exhaust extraction system, you should take the characteristics of the fan into careful consideration. There are very large differences in the noise levels of these fans but also in their intake capacity. It is important to ensure that the entire intake capacity is not affected by a loss of pressure which may occur in any system. You should therefore note the operating point – i.e. the effective intake capacity if pressure is lost – which is shown in the fan characteristics curves. Once captured, the exhaust air is discharged via appropriate piping systems, for example a folded spiral-type tube – folded spiral-seam tube, to the fan and then out via the roof. Regional building rulings MUST be noted.



5.2 Exhaust extraction at the exhaust investigation test-station

A series of tests conducted by the ASA association in conjunction with the testing organisations, the Accident Prevention and Insurance Association and the BG Institute for Occupational Safety and Health (BIA) has shown that the first priority is the design of the capturing elements and their position behind the final pipe of the exhaust system. If errors are made at this stage, far too large a fan will not produce a satisfactory result.

The clear information provided in TRGS 554 MUST be noted. Anyone satisfying this criterion must also take into consideration the layout of the fan and structural circumstances.

The measurement procedure recommended by the ASA association should be used for the measurement since this is the only procedure with which precise and reproducible measurements can be easily obtained.

Three key factors are important for capturing the exhaust gases perfectly:

- The correct capturing element must be present.
- Attention must be paid to correctly positioning the capturing element on the exhaust pipe.
- Correct layout of the system components must be ensured.



5.3 Exhaust extraction in the acceptance area

Usually, the vehicle's engine has to run during an after-sales service meeting, even if this is sometimes only for a short period of time. Faultless discharge of the engine exhaust is a very important element of your sales efforts.

In addition to the correct positioning of the capturing element (this is the only way in which the extraction system can function one hundred percent), you must therefore ensure that the noise it produces does not interfere with conversations with the customer.

The local circumstances basically determine the design and positioning of the exhaust systems.

The system structure is predominantly determined by one of three designs:

- Extraction system with piping and a short hose with exhaust sleeve or exhaust funnel.
- Extraction system via exhaust hose reel
If the ceiling is high enough, this solution has the added benefit of the exhaust hose only being unrolled when the system is needed. When the engine is not running, the hose is therefore rolled up and is no longer in the work area (not an obstacle and no risk of accident).
- Extraction system via rail system
If several acceptance points are positioned next to one another, we would recommend the solution using a rail system in which several mobile extraction units are fitted.

With this structure, the idle position of the extraction units is then usually in the shadow of the door pillar or a wall so that the extraction hoses do not get in the way.





5.4 Exhaust extraction on the brakes test line

The brakes test line in the car area is often integrated as part of the test line. The workplace is sometimes also outdoors. Thought should be given to ensuring that the hose length selected is long enough since the position of the exhaust will differ depending on vehicle type.

The exhaust extraction system on roller units on car brakes test lines should preferably be placed centrally above the vehicle or to the side next to the vehicle at a max. distance of 0.50 m.

Truck brakes test line

In the truck area, the brakes test line is often designed as a separate test track in combination with an exhaust investigation point. Whereas in older workshops it has usually been set up as a head test line, the test track in new workshops usually set up as a drive-through unit. Again here, ensure that the hose length is sufficient. You should also note that the exhaust gases in roller-type units can only be captured centrally in exhaust systems ending under the vehicle when using test pits or towing machines.

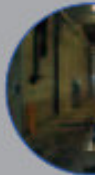
At the end of the brakes test rig track, an exhaust gas investigation test is usually carried out in drive-through units in the truck sector.

When using a truck brakes test line track in combination with an exhaust investigation test, ensure co-ordination of the capturing elements for the upper exhaust. The changeover unit for vertical funnels is also important in this context.

In the area around the truck brakes test rig track in particular, the workshop must note display elements and co-ordinate these with the test line supplier. Roller units furthermore often have to be guided under sectional gates in the incoming and outgoing area and therefore require co-ordination with the planners.

System components

What are commonly referred to as exhaust rail systems, which allow the exhaust hose to trail over the test line and therefore allow the exhaust gases to be extracted during the entire test process have proven themselves in the brakes test line and exhaust investigation test sector. Depending on structural circumstances, the hose length should be adapted to the assembly height of the system. Depending on the number of cycles and the frequency of testing, systems which automatically disconnect from the exhaust are available – as are semi-automatic and fully-automatic return systems. Once captured, the exhaust air is discharged via appropriate piping systems, for example a folded spiral-seam tubes, to the fan and then out via the roof. Regional building regulations must be noted.



Recommendation

When using truck units on brakes test lines, we would recommend installing the system to the side to the vehicle at a distance of approx. 0.50 m from the vehicle. The extraction must be paid attention to the entrance height, usually assume a height of approx. 3.80 m. The extraction arm should extend over the entire test track.



5.5 Exhaust extraction on the dynamo test line

More stringent requirements are placed on the exhaust extraction systems for performance test rigs. The difference between this and the standard application is most especially the increased exhaust gas temperature and volume.

Depending on whether you are using diesel or petrol engines, exhaust temperatures of 300 or 650 degrees Celsius may occur. Please refer to the table on page 8 for the exhaust volumes produced.

There are single-flow, dual-flow and vertical (e.g. for heavy-duty trucks) exhaust systems.

The exhaust system must be adapted to the relevant requirement. Where and how the vehicle's exhaust is positioned are important factors. In other words, the capturing process plays an important role alongside ensuring sufficient extraction. Ensure that the capturing elements can be set to an optimum height and angle.

A performance test may take between 10 and 20 minutes or longer. This results in the development of a considerable amount of heat. Room temperatures in excess of 50 degrees Celsius are thereby rapidly reached.





To prevent this, it is not only the size of the test room but also the incoming and outgoing air which are of importance. You should ensure that the air in the room is changed 20 to 40 times. Ensure that the air brought in is expelled again from the room. This is made possible by exhaust air grids which wherever possible should be fitted opposite the cool air fan at the highest point in the room. Additional air conditioning units are used in warm regions.

The cool air fans, which take the place of the air stream, are usually designed and supplied by the test line manufacturer. The air output of such a fan is more than 10 000 m³/h. The air speed plays an important role alongside the air volume.

The increased noise emission from a performance test requires not only personal protective equipment but also noise-insulating and noise-damping structural measures.

To ensure a fully functioning system, you should contact specialist in the planning phase.



5.6 Welding dust extraction during body maintenance

A check of the space available is indispensable for the correct planning of an extraction system in the body area. An individual working room should be provided for body work on cars due to the considerable levels of noise and dirt produced. The working area for car repairs should be approx. four metres by seven. A separate track or header stand should be available for body work on trucks. A drive through unit is usually included in new workshops these days. Such a workspace should be six metres wide.

Interface co-ordination with suppliers of lifting platforms and sectional gates is also of great importance when planning the extraction systems. Since the extraction of welding smoke must be co-ordinated depending on the type of lifting technology. The same applies to body work areas in the direct gate area where sectional gates are fitted.

System components

What are commonly referred to as slotted suction duct systems or exhaust rails for the extraction of exhaust gases have proven themselves as system components in the area of body maintenance. When positioned perfectly, the hose length should be no more than five metres. In rare cases, halls with a height of more than five metres are however encountered. The assembly height should then be adapted and a hose length of six to 7.5 metres provided.

Extraction arms with a range of four to nine metres are recommended for welding gas extraction.



Combinations of extraction arms with slotted suction duct systems or exhaust rails are also possible.

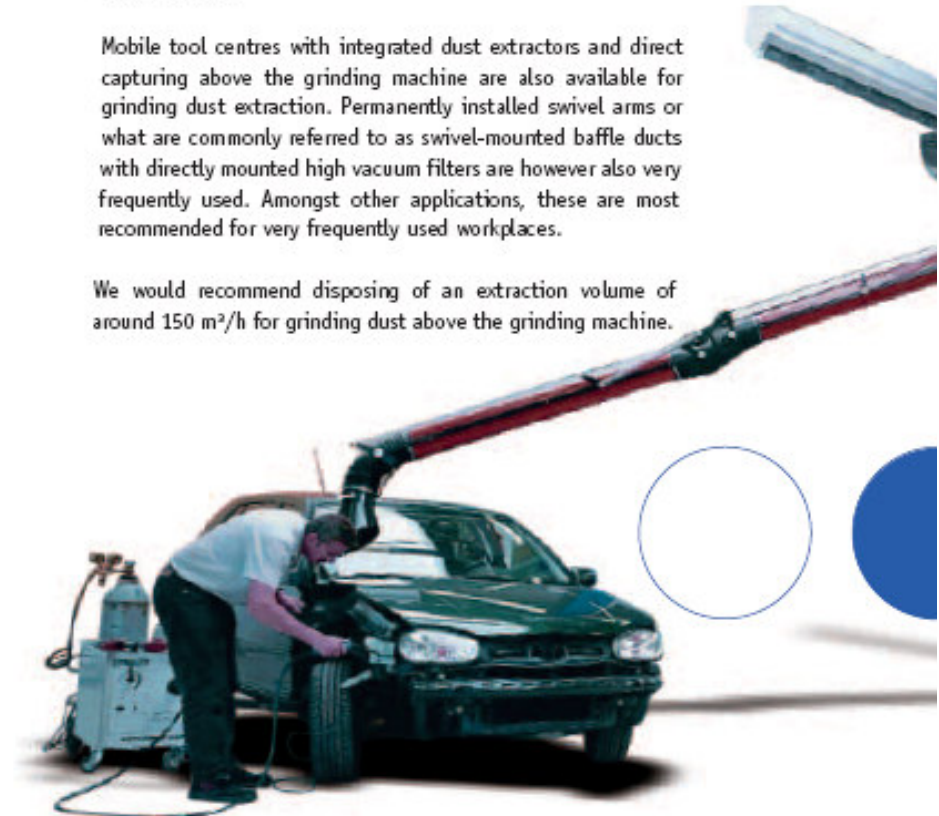
Once captured, the exhaust air is discharged via appropriate piping systems to the fan and then out via the roof. The relevant rulings should be noted here.

Depending on the type and concentration of pollutants, you can use suitable filter technology

Mobile systems with extraction arms and filter technology installed can also be used as alternative for the extraction of welding smoke.

Mobile tool centres with integrated dust extractors and direct capturing above the grinding machine are also available for grinding dust extraction. Permanently installed swivel arms or what are commonly referred to as swivel-mounted baffle ducts with directly mounted high vacuum filters are however also very frequently used. Amongst other applications, these are most recommended for very frequently used workplaces.

We would recommend disposing of an extraction volume of around 150 m³/h for grinding dust above the grinding machine.



5.7 Exhaust extraction for motorbikes

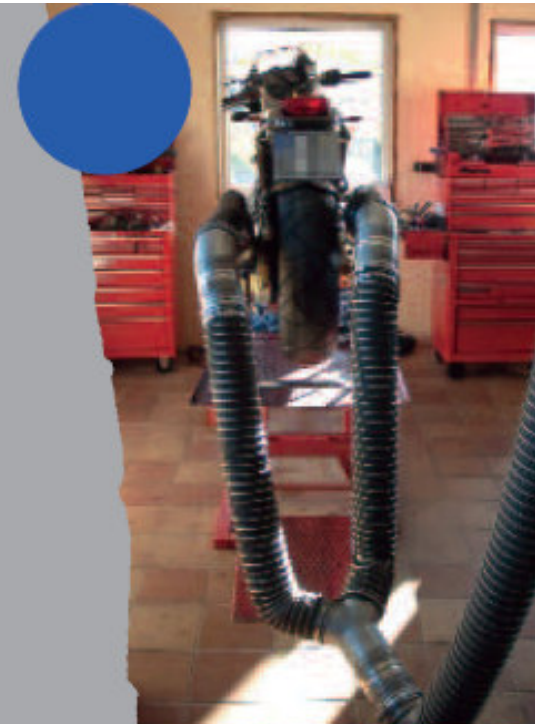
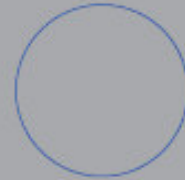
All exhaust extraction system designs which can be fitted in a car workshop can also be recommended for use in a workshop for motorbikes – and therefore also their components (rail systems, hose reels, funnels, hoses, fans etc.).

Individual and twin exhaust systems at different heights and sometimes concealed systems (motorised rollers) as well as dual-flow exhaust systems are used in motorbikes.

For system configuration, we would recommend the BG/BIA/ASA recommendation for the dimensions of exhaust extraction systems for motorbikes.

A separate room is usually provided for the performance test rig in motorbike repair workshops with two to six workplaces.

When designing an exhaust extraction system for a performance test rig for motorbikes, various components are of crucial importance. Consideration should be given to the safety equipment, especially near the motorbike performance test rig track and/or this should be co-ordinated with the test line supplier.





6. The ASA association

The Bundesverband der Hersteller und Importeure von Automobil-Service Ausrüstungen e.V. (ASA) (Manufacturing and Importers Association for Workshop Equipment) is a body representing the interests of the companies involved.

The range of member companies spans many disciplines: From world-wide concerns to medium-sized niche suppliers. More than 85 percent of the active suppliers of workshop equipment in Germany are represented by the ASA association. The exchange of interdisciplinary work is promoted by the very wide range of product areas represented in the association and their numerous technical standards and quality specifications. The approx. 100 member companies and their products are synonymous with quality. They hold their ground on the market through innovative ideas and concepts. Again and again, they concern themselves with safety in workshops and road traffic.

Through its committed and varied involvement in the EGEA (European Garage Equipment Association), the association is continually present at European level and is involved therefore not only in national, but also international legislation. The ASA association, founded in 1972, is an important dialogue partner and adviser for political decision-makers.

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Quality, innovation, safety

The federal ASA association sits on national and international bodies and is thereby involved in the development of **quality** standards for the entire automotive sector. Members of the seven working parties are informed of and discuss futuristic developments.

Important bases for the continued existence of the entire automotive sector are therefore set and find their expression in the **innovative** products of the ASA members.

The federal ASA association is always undertaking studies and investigations on a whole range of issues in collaboration with authorities, associations, accident prevention and insurance associations and other organisations. They are all pursuing the same goal: safety for drivers whose vehicles are reliably tested and checked on modern systems. Safety for workshop owners who are investing in futuristic and innovative technologies. Safety for all road users through the falling number of accidents as a result of modern test technology.

The development of safety and quality standards for workshop equipment and working out appropriate test concepts and procedures for new vehicle technologies are amongst the key skills of the ASA association. This association work is undertaken in the working parties. They form the heart of the association. Networking is experienced here on a practical basis and work on technical issues is undertaken in a solution-focused manner.

7. The exhaust extraction systems working party

Installing exhaust extraction systems in workshops protects the health of the staff working there. By regularly exchanging information on new technologies, the ASA working party on exhaust extraction systems, this issue is always the focal point of their work. Current technical guidelines for diesel engine emissions and the protective measures required at the workplace as a result of these are also discussed here as are the consequences of new diesel filter systems on the function of existing systems.

Self-imposed obligation

The members of the ASA exhaust systems working party are obliged to meet the criteria of this exhaust handbook.

You will find more information at www.asa-verband.de

