




FEDERATION INTERNATIONALE  
DE L'AUTOMOBILE

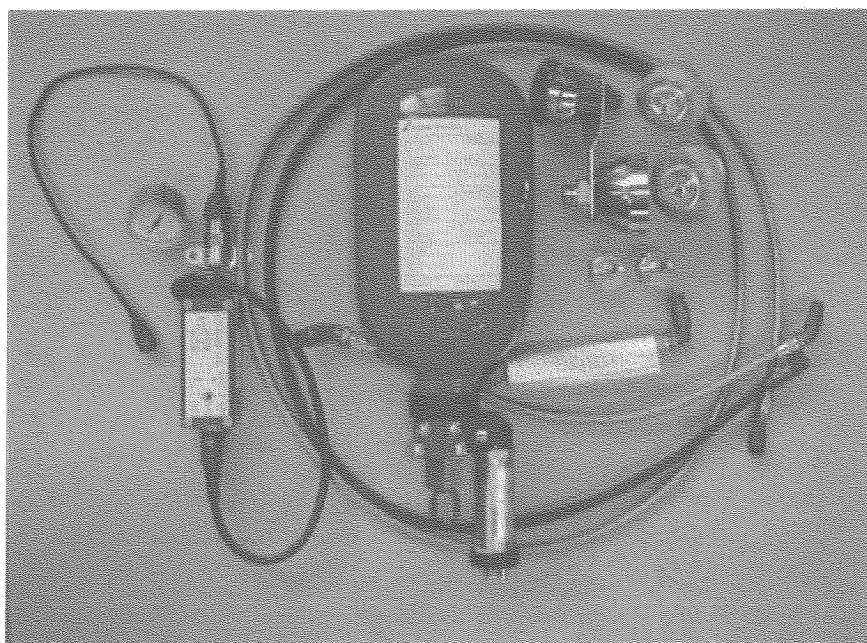
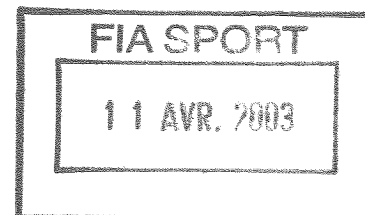
Homologation N°

EX.014.03

CERTIFICAT D'HOMOLOGATION POUR LES SYSTEMES D'EXTINCTION PLOMBES DANS LES VOITURES DE COURSE  
HOMOLOGATION CERTIFICATE FOR MOTOR SPORT FIRE EXTINGUISHER SYSTEMS

1. GENERALITES / GENERAL

101. Constructeur  
Manufacturer  **Kidde Deugra**  
*Brandschutzsysteme GmbH*
102. Adresse  
Address *Halskestraße 30 D-40880 Ratingen*
103. Nom du système  
System name *KD-596*
104. Dénomination commerciale  
Commercial name *Feuerlöschanlage – Fire Extinguishing System*
105. Véhicules pouvant être équipés de ce système (Le cas échéant, indiquez si ce système est valide pour tous les groupes)  
Vehicle for which the system may be used (Indicate if the system is valid for all groups):
- Formel Fahrzeuge      - Formula cars
  - Sportwagen            - Sport cars
  - GT-Fahrzeuge         - GT cars
106. Photo du système complet  
Photo of the complete system



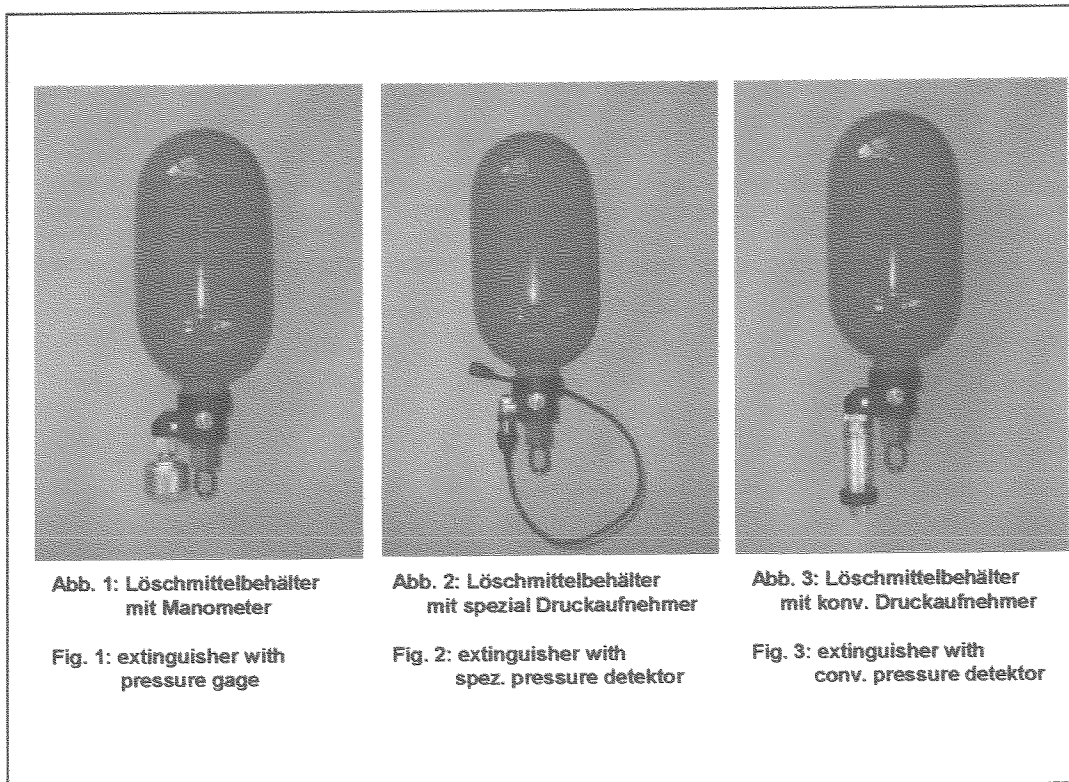
Variante A:  
Anwendung mit 2 Düsen für Monoposto Fahrzeuge – Application with two nozzle for single seater cars

Variante B:  
Anwendung mit 4 Düsen für Sportwagen – Application with four nozzle for sport-cars

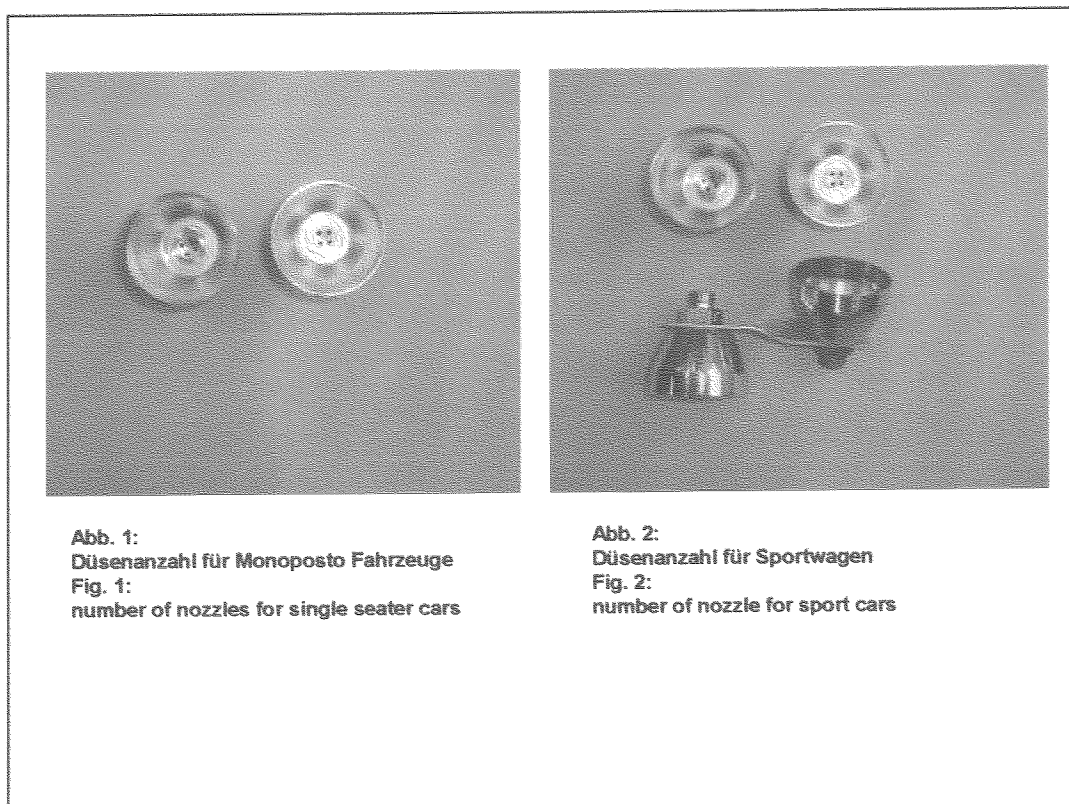
## 2. DESCRIPTION DU SYSTEME / SYSTEM DESCRIPTION

201. Agent extincteur Pulver – Powder  
Extinguishant (Aerosol)
202. Capacité totale du système 2,00 l / 0,50 kg Liter / Kg  
Complete Capacity of the system 2,00 l / 0,50 kg Litres / Kg
203. Norme à partir de laquelle a été approuvé l'agent d'extincteur Bundes Länder Vereinbarung der BRD  
Standard from which the extinguishant has been approved Agreement between the federal states of Germany
204. Couleur de l'étiquette indiquant le type d'extincteur utilisé schwarze Schrift auf weißem Label  
Colour of the label showing the type of extinguishant used black letters on white background
205. Pression d'utilisation 41,50 Bar (+60°C)  
Fill pressure
206. Pression minimale 32,50 Bar (-10°C)  
Min Pressure
207. Si le système est normalement non pressurisé, définir le type de pressurisation  
If system is normally unpressurised define type of pressurisation :  
- nur der Löschmittelbehälter  
- only the extinguisher
208. Taille de la bonbonne Diamètre Hauteur  
Size of the bottle Diameter Ø 120 mm Height 254 mm
209. Poids de la bonbonne 2,4 Kg - inkl. Anbauteile; - with all conveniences  
Weight of the bottle
210. Système de déclenchement Manuel / Manual Electrique / Electric Automatique / Automatic  
Activation system
- Cocher la mention utile  
Tick off as applicable
211. Gamme de température d'utilisation -10°C bis +60°C ; -10°C to +60°C  
Operating temperature range
212. Nombre d'ajutage minimum dans le compartiment moteur 2 -nur für Motorschutz,- only for engine safety  
Minimum number of nozzles in the engine compartment

213. Photo d'une bonbonne montrant l'étiquette indiquant l'agent d'extincteur utilisé  
Photo of one bottle showing the label of the extinguishant used



214. Photo d'un ajutage  
Photo of a nozzle



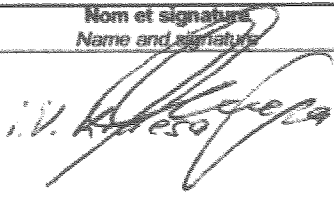
### 3. ENGAGEMENT DU FABRICANT / MANUFACTURER'S RECOGNITION

Je déclare que le système décrit ci-dessus :

- est conforme à la norme FIA sur les systèmes d'extinction plombés dans les voitures de courses
- a passé, sous ma supervision, avec succès l'ensemble des tests décrit dans la norme FIA

I declare that the system described above :

- is in conformity with the FIA standard for motor sport fire extinguisher systems
- has passed, under my supervision, all the tests described in the standard

Date	Nom et signature Name and signature	Visa d'approbation Endorsement stamp
03 December 2002		KIDDE-DEUGRA Brandschutzsysteme GmbH Halskestrasse 30 40880 Ratingen

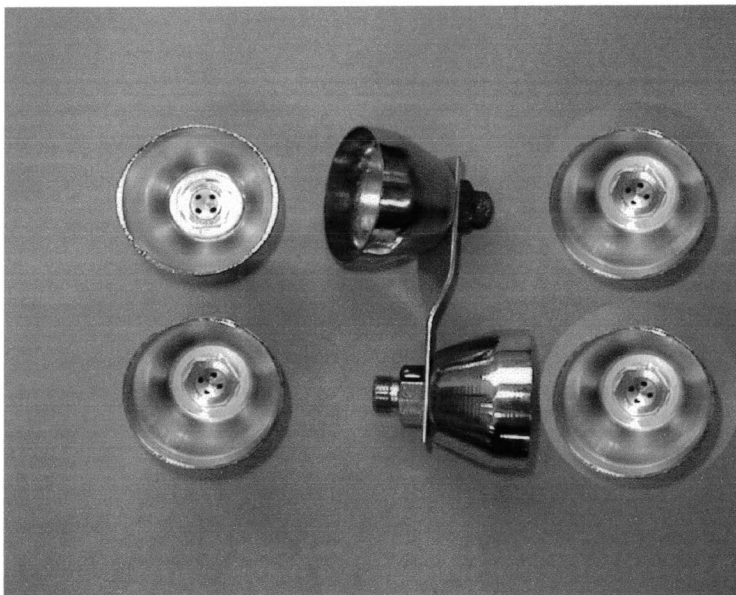
#### ANNEXES / APPENDICES :

- Rapport de test / Tests report
- Instruction d'installation / Installation instructions
- Instruction de maintenance / Maintenance instructions



## 2. DESCRIPTION DU SYSTEME / SYSTEM DESCRIPTION

- |   |                                      |  |                                      |
|---|--------------------------------------|--|--------------------------------------|
| <b>201. Agent extincteur</b><br><i>Extinguishant</i>  | <i>unchanged</i><br><i>unchanged</i> | <b>202. Capacité totale du système</b><br><i>Complete Capacity of the system</i> | <i>unchanged</i><br><i>unchanged</i> |
| <b>203. Norme à partir de laquelle a été approuvé l'agent d'extincteur</b><br><i>Standard from which the extinguishant has been approved</i>                              | <i>unchanged</i><br><i>unchanged</i> |  |                                      |
| <b>204. Couleur de l'étiquette indiquant le type d'extincteur utilisé</b><br><i>Colour of the label showing the type of extinguishant used</i>                            | <i>unchanged</i><br><i>unchanged</i> |  |                                      |
| <b>205. Pression d'utilisation</b><br><i>Fill pressure</i>  | <i>unchanged</i>                     | <b>206. Pression minimale</b><br><i>Min Pressure</i>                             | <i>unchanged</i><br><i>unchanged</i> |
| <b>207. Si le système est normalement non pressurisé, définir le type de pressurisation</b><br><i>If system is normally unpressurised define type of pressurisation :</i> |                                      |  | <i>unchanged</i><br><i>unchanged</i> |
| <b>208. Taille de la bonbonne</b><br><i>Size of the bottle</i>  | <b>Diamètre</b><br><i>Diameter</i>   | <i>unchanged</i><br><i>unchanged</i>   |                                      |
| <b>209. Poids de la bonbonne</b><br><i>Weight of the bottle</i>   |                                      | <i>unchanged</i>   |                                      |
| <b>210. Système de déclenchement</b><br><i>Activation system</i>  |                                      | <i>unchanged</i>   |                                      |
| <b>211. Gamme de température d'utilisation</b><br><i>Operating temperature range</i>  |                                      | <i>unchanged</i>   |                                      |
| <b>212. Nombre d'ajutage minimum dans le compartiment moteur</b><br><i>Minimum number of nozzles in the engine compartment</i>  |                                      | <i>unchanged</i>   |                                      |
| <b>213. Photo d'une bonbonne montrant l'étiquette indiquant l'agent d'extincteur utilisé</b><br><i>Photo of one bottle showing the label of the extinguishant used</i>    |                                      |  |                                      |
| <b>214. Photo d'un ajutage</b><br><i>Photo of a nozzle</i>  |                                      |  |                                      |



**Abb. 1:**  
Düsenanzahl (6) für Tourenfahrzeuge

**Fig. 1:**  
number of nozzles (6) for touring cars

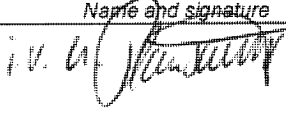
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I declare that the system described above :

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- has passed, under my supervision, all the tests described in the standard

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03 December 2003		<b>KIDDE-DEUGRA</b> Brandenschutzsysteme GmbH Halskestrasse 30 40880 Ratingen

### ANNEXES / APPENDICES :

- Rapport de test / Tests report
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**RAPPORT DE TESTS / TESTS REPORT**

**1. TESTS REALISE DANS LE COMPARTIMENT MOTEUR / TESTS REALISED IN THE ENGINE**  
COMPARTMENT (Point 1.1 de la norme / Point 1.1 of the standard)

Capacité de la bonbonne d'extinction utilisée / Capacity of the extinguishant bottle : 2 \* Litres

Quantité de carburant utilisé / Quantity of fuel used : 2,5 Litres

Résultats / Results :

Temps mis pour la maîtrise et l'extinction total du feu / Time taken to bring the fire under control and extinguish it completely  
5 Secondes / Seconds

**2. TEST DE L'HABITACLE / COCKPIT TEST** (Point 1.2 de la norme / Point 1.2 of the standard)

Capacité de la bonbonne d'extinction utilisée / Capacity of the extinguishant bottle : 2\* Litres

Quantité de carburant utilisé / Quantity of fuel used : 2,5 Litres

Résultats / Results :

Temps mis pour la maîtrise et l'extinction total du feu / time taken to bring the fire under control and extinguish it completely  
5 Secondes / Seconds

**3. TEST DE ROTATION / ROTATION TEST** (Point 1.3 de la norme / Point 1.3 of the standard)

Temps minimal de décharge du système / System's minimum discharge time  
5\*\* Secondes / Seconds

Temps de décharge mesuré lors du test / Discharge time measured during the test  
5\*\* Secondes / Seconds

**4. SYSTEME DE DECLENCHEMENT / ACTIVATING SYSTEM** (Point 2 de la norme / Point 2 of the standard)

Démonstration d'une décharge automatique / Demonstration of an automatic discharge

Oui / yes <input type="checkbox"/>	Non / No <input checked="" type="checkbox"/>
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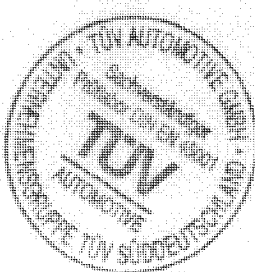
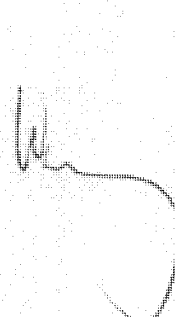
Cocher la mention utile  
Tick off as applicable

**5. TESTS / TESTS**

\*) le test 1.1 et 1.2. était fait avec une 2 litres bouteille /  
the test 1.1. and 1.2. was carried out with one 2 litres bottle


\*\*\*) le test était fait deux fois aux positions 0° et 180° manifestant le cas le plus mauvais /  
the tests were carried out 2 times in 0° and 180° position, demonstrating worst case

Date des tests / Date of the tests : 16.10.2002

<p>Nom et Visa de l'ASN Name and ASN Stamp</p> <p> (D. Forst)</p> <p></p>	<p>Visa du centre de test (Nom et signature du centre de test et de la personne ayant réalisé les tests) Test center visa (Name and signature of the test center and of the person who has realized the tests)</p> <p></p> <p></p> <p>Obering. Dipl.-Ing. Knut Wartenberg</p>
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**KD-A96**


**Aerosol Extinguishing  
System**

 Kidde Deugra		KD-A96 Aerosol Extinguishing System		Bereich Department COV	Dokument. Nr. Document No
Ereitet (Name, Datum) Prepared (name/date) U. Planstedt 22. Jan. 2003	Geprüft (Name, Datum) Checked (name/date) K. Kniesa 22. Jan. 2003	Bestätigt (Name, Datum) Confirmed (name/date)	Freigegeben (Name, Datum) Approved (name/date) R. Gall 22. Jan. 2003	Rev Nr Rev No 1	Seite/Anzahl Page/Total 2 / 5

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		<b>KD-A96 Aerosol Extinguishing System</b>		Bereich Department <b>COV</b>	Dokument. Nr. Document No
Erstellt (Name, Datum) Prepared (name/date) U. Planstedt 22. Jan. 2003	Geprüft (Name, Datum) Checked (name/date) K. Kniesa 22. Jan. 2003	Bestätigt (Name, Datum) Confirmed (name/date)	Freigegeben (Name, Datum) Approved (name/date) R. Gall 22. Jan. 2003	Rev Nr Rev No 1	Seite/Anzahl Page/Total 3 / 5

## 1. Introduction

It is a well-known fact that potassium salts are suitable for fire fighting purposes. Moreover, the anti-correlation between the particle size and the effectiveness of powder extinguishants has been known for the past 40 years. It is therefore surprising to see that the majority of commercial powder extinguishers contain comparatively coarse-grained particles with sizes between 10 and 50 µm.


This is mainly due to the difficulties of producing small particle sizes by traditional grinding and screening methods. By using newer manufacturing methods, it is now possible to produce particle sizes of 10 µm and below with less size variation.

These so-called aerosols not only have the advantage of extinguishing more effectively, but are also highly mobile due to their small size. The mobility results in the aerosols not settling rapidly like conventional powders, but filling out the whole room like a gas. This ensures reliable extinguishing also in corners of rooms and maintenance of the extinguishing action over an extended period of time. By using potassium bicarbonate (KHCO<sub>3</sub>) - in solution an easily water-soluble, neutral and non-toxic salt - any danger to humans during the extinguishing process can be virtually excluded, as tests carried out at the Hygiene Institute in Gelsenkirchen have verified.

## 2. Extinguishing action

The extinguishing action of KHCO<sub>3</sub> is based on two different factors. Firstly, the flames are cooled by various endothermic reactions whilst their KHCO<sub>3</sub> is consumed.



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Secondly, the chain reactions that take place during combustion are interrupted by various potassium compounds by trapping the radicals H, O and OH decisive for this chain reaction and initially occurring in sufficient number at a temperature of 1600 K necessary for combustion.




As can be seen, potassium for its part initiates a chain reaction by the radicals being converted into stable compounds (mainly water).

These two effects are sufficient to extinguish a fire also with a relatively low potassium bicarbonate concentration. In tests carried out by Kidde-Deugra, the oxygen concentration after extinguishing was between 18 and 19%; this is attributed solely to the oxygen consumption of the flames and nitrogen supplied from the pressurised gas cylinder. No increase in the toxic gases (CO, CO<sub>2</sub>) by the extinguishant is verifiable.

### 3. Manufacture and discharge

For manufacturing purposes, the so-called spray drying method is used, where an aqueous KHCO<sub>3</sub> solution is forced through a nozzle, to finally expand in an evacuated space. As a result, the water suddenly evaporates and the KHCO<sub>3</sub> molecules combine as particles, the size of which can be varied by the manufacturing conditions.

To improve and maintain the discharge behaviour of the powder, a certain amount of SiO<sub>2</sub> is subsequently added, as with standard powders. This mixture is then filled into a compressed gas cylinder and pressurised with nitrogen.


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Opening of the pressurised cylinder takes place in the same way as conventional powder extinguishers.

To achieve optimal distribution, special nozzle systems are used for aerosol discharge. Within seconds, the aerosols are distributed evenly within the room and produce an atmosphere in which fire cannot develop, despite an oxygen content of 19%. After several minutes, the aerosols begin to settle to a noticeable degree. Subsequent cleaning of the room presents no difficulty due to the easy water solubility of  $\text{KHCO}_3$ .

#### 4. Toxicology

The aerosol consists of non-toxic potassium bicarbonate ( $\text{KHCO}_3$ ).  $\text{KHCO}_3$  is found in e.g. baking powder, mineral water and heartburn tablets. A theoretically existing problem of the aerosol is the high risk of its entering the lungs through inhalation due to particles of such small size.  $\text{KHCO}_3$  is easily water-soluble however and sediments on surfaces, as previously mentioned. The way to the lungs is characterised by a high surface/volume ratio and extreme humidity. When using the aerosol as an extinguishant therefore, any risk to humans is excluded.

		<b>Fire extinguishing system for motor sport vehicles</b>		Bereich Department <b>COV</b>	Dokument. Nr. Document No
Erstellt (Name, Datum) Prepared (name/date) <b>U. Planstedt</b> <b>04. Apr. 2003</b>	Geprüft (Name, Datum) Checked (name/date) <b>K. Kniesa</b> <b>04. Apr. 2003</b>	Bestätigt (Name, Datum) Confirmed (name/date)	Freigegeben (Name, Datum) Approved (name/date)	Rev Nr Rev No <b>1</b>	Seite/Anzahl Page/Total <b>1 / 2</b>

## Fire extinguishing systems for motor sport vehicles

To protect driver and vehicle in the event of a fire, a powder (aerosol) extinguishing system is used as a safety facility. This extinguishing system, designed for activation via a manual switch – *integrated into the control box* – serves for extinguishing an engine or vehicle fire appropriate to the vehicle class.

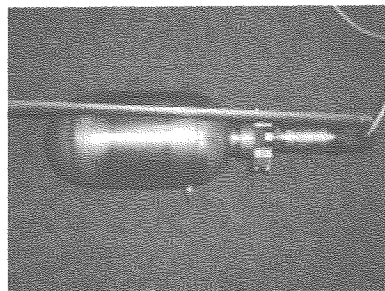
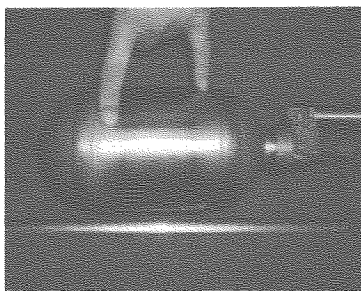
In addition to activation, the manual switch also serves for testing the extinguishing system electronics. Electronic faults are indicated visually via an LED when the manual switch is actuated.

Operational monitoring takes place via an installed pressure sensor that visually informs the vehicle driver about the performance (pure pressure drop) of the safety system. The filling and operating pressure at 20°C is 36.50 bar.

Arranged next to the extinguishant container in the engine compartment are two extinguishing nozzles with an optional four extinguishing nozzles being provided inside the vehicle. The nozzles are connected to the extinguishant container via a metal hose system or stainless steel pipes.


### **Article description:**

The extinguishant container is a welded cylinder of stainless steel X6CrNiMoTi17 12 2 1.4571. It consists of two half shells with a seamless cylindrical centre section. The volume is specified at 1.95 litres according to APZ DIN 50049. One half shell (cylinder head) has an open neck with internal and external thread.



The internal thread serves for receiving the necessary ascending pipe, whilst the external thread serves for connection of the valve head.

The ascending pipe is in a two-piece design and made of high-strength aluminium, whereby the upper part is connected rigidly and the lower part movable via a ball-and-socket joint. This arrangement allows up to 95% of the necessary dry powder to be used with the extinguishant container lying horizontal.

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The valve head is made similarly of high-strength aluminium and is externally screwed to the extinguishant container with a specific tightening torque. This is a safety component to be used in conjunction with the following components.

The bursting disc unit – *consisting of two bursting discs  $p_{Burst}=100$  bar welded with a spacer ring and sealing plug* –, a lateral-mounting high-pressure fill valve, optional pressure sensor and pyrotechnic igniter to be used for opening.

All components are provided with appropriate seals and tightened with calculated torque. This ensures the tightness of the container.


The mentioned bursting discs are also regarded as a safety facility for the thin-walled container, as the bursting disc facing the container serves as a predetermined breaking point in the event of an acute pressure increase and the pressure is released in a controlled manner.

#### **Mode of operation of the extinguishing system:**

In the event of fire, the system is electrically ignited via the manual trip device of the control box; i.e. via an electrical pulse, the pyrotechnic igniter ignites a *black powder charge of 0.6 g* and develops a vapour pressure of about 950 bar. This pressure is forced into an ignition channel milled in the shape of a ring around the bursting disc unit in the valve head. Via six holes in the spacer ring of the bursting disc unit, the pressure is passed between the two aforementioned bursting discs causing both to burst. When both discs have burst, the dry powder is able to discharge freely from the extinguishant container and rendered active as a fire extinguishant.

The pressure causes the extinguishant to flow to the positioned extinguishing nozzles via a pipe system and used for active fire-fighting purposes. The nozzles ensure the necessary distribution.

Following a release, the container can be repaired to a limited extent and reused as a replacement container.

		<b>Fire extinguishing system for motor sport vehicles</b>		Bereich Department <b>COV</b>	Dokument. Nr. Document No
Erstellt (Name, Datum) Prepared (name/date) U. Planstedt 20. Nov. 2002	Geprüft (Name, Datum) Checked (name/date) K. Kniesa 20. Nov. 2002	Bestätigt (Name, Datum) Confirmed (name/date)	Freigegeben (Name, Datum) Approved (name/date)	Rev Nr Rev No 1	Seite/Anzahl Page/Total 1 / 2

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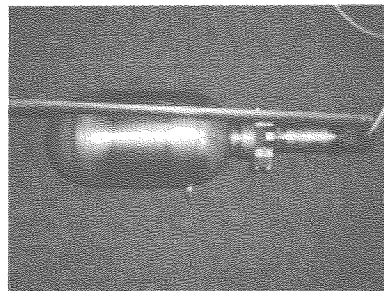
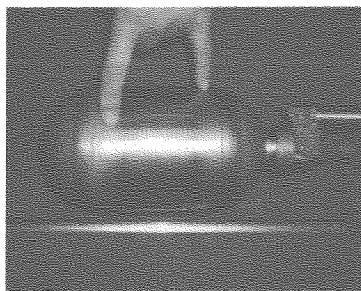
In addition to activation, the manual switch also serves for testing the extinguishing system electronics. Electronic faults are indicated visually via an LED when the manual switch is actuated.

Operational monitoring takes place via an installed pressure sensor that visually informs the vehicle driver about the performance (pure pressure drop) of the safety system. The filling and operating pressure at 20°C is 36.50 bar.

Arranged next to the extinguishant container in the engine compartment are two extinguishing nozzles with an optional four extinguishing nozzles being provided inside the vehicle. The nozzles are connected to the extinguishant container via a metal hose system or stainless steel pipes.


### **Article description:**

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The internal thread serves for receiving the necessary ascending pipe, whilst the external thread serves for connection of the valve head.

The ascending pipe is in a two-piece design and made of high-strength aluminium, whereby the upper part is connected rigidly and the lower part movable via a ball-and-socket joint. This arrangement allows up to 95% of the necessary dry powder to be used with the extinguishant container lying horizontal.

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The valve head is made similarly of high-strength aluminium and is externally screwed to the extinguishant container with a specific tightening torque. This is a safety component to be used in conjunction with the following components.

The bursting disc unit – *consisting of two bursting discs  $p_{Burst}=100$  bar welded with a spacer ring and sealing plug* –, a lateral-mounting high-pressure fill valve, optional pressure sensor and pyrotechnic igniter to be used for opening.

All components are provided with appropriate seals and tightened with calculated torque. This ensures the tightness of the container.


The mentioned bursting discs are also regarded as a safety facility for the thin-walled container, as the bursting disc facing the container serves as a predetermined breaking point in the event of an acute pressure increase and the pressure is released in a controlled manner.

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The pressure causes the extinguishant to flow to the positioned extinguishing nozzles via a pipe system and used for active fire-fighting purposes. The nozzles ensure the necessary distribution.

Following a release, the container can be repaired to a limited extent and reused as a replacement container.

		<b>Hazard observation</b> <b>Aerosol extinguishant</b>		Bereich Department <b>COV</b>	Dokument. Nr. Document No
Erstellt (Name, Datum) Prepared (name/date) U. Planstedt 04. Apr. 2003	Geprüft (Name, Datum) Checked (name/date/) K. Kniesä 04. Apr. 2003	Bestätigt (Name, Datum) Confirmed (name/date)	Freigegeben (Name, Datum) Approved (name/date)	Rev Nr Rev No 1	Seite/Anzahl Page/Total 1 / 1

## ***Extinguishing system KD-596 with aerosol for motor sports***

In 1995, hygienic fire extinguishing tests were carried out using aerosol as an extinguishant. In addition to the extinguishing efficiency, the aim was to determine whether aerosol as an extinguishant is dangerous to health. The results are contained in the report of the Hygiene Institut des Ruhrgebietes in Gelsenkirchen of January 1995.

Determined as a safe concentration was  $40 \text{ g/m}^3$ , whereby the concentration exposure time was about 10 minutes.

When using the aerosol in an extinguishing system for motor sports, a higher concentration, but a shorter exposure time (extinguishing time about 5 seconds) was produced or tested.

Furthermore, the extinguishant nozzles for the interior space were arranged behind the driver, so that the driver is seated in the direction of discharge, but is not exposed to the maximum concentration. The discharge time is about 5 seconds in which the dry powder is evenly distributed within the interior space. This is generally not totally enclosed, so that part of the extinguishant is able to escape.

In the event that the driver is wearing a helmet and a fire protective lens, he will not inhale any aerosol.

If an incident should occur during test-drives, where the driver wears neither helmet nor fire protective lens, inhalation occurs, but it can be assumed that the concentration is  $\leq 40 \text{ g/m}^3$ .