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

FIA SPORT
11 AVR. 2003

101. **Constructeur** / *Manufacturer* — Kidde Deugra *Brandschutzsysteme GmbH*

102. **Adresse** / *Address* — *Halskestraße 30 D-40880 Ratingen*

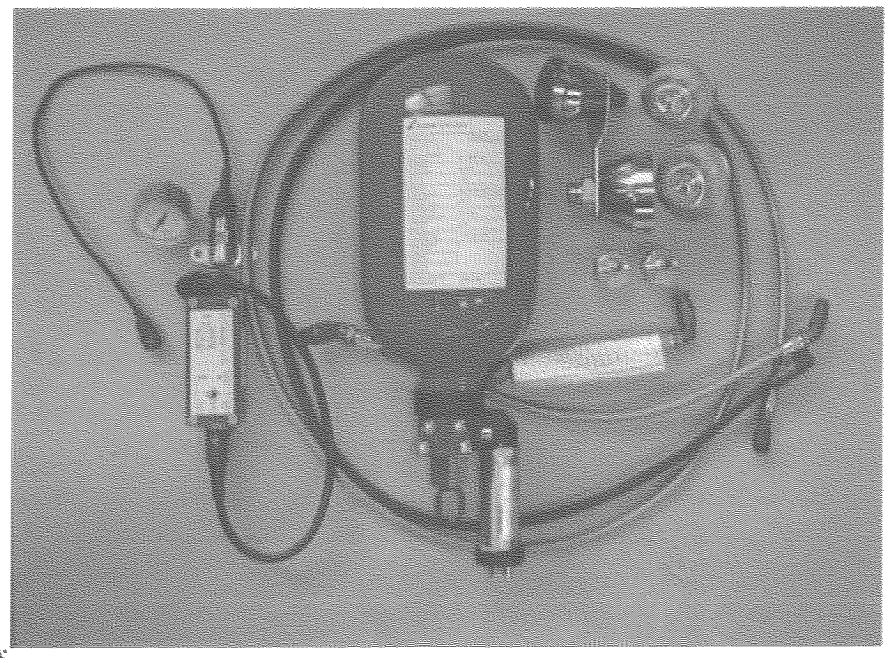
103. **Nom du système** / *System name* — *KD-596*

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)**
Vehicule 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 sytème 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** / *Extinguishant* *Pulver – Powder (Aerosol)*

202. **Capacité totale du système** / *Complete Capacity of the system* *2,00 l / 0,50 kg Liter / Kg* *2,00 l / 0,50 kg Litres / Kg*

203. **Norme à partir de laquelle a été approuvé l'agent d'extincteur** / *Standard from which the extinguishant has been approved* *Bundes Länder Vereinbarung der BRD Agreement between the federal states of Germany*

204. **Couleur de l'étiquette indiquant le type d'extincteur utilisé** / *Colour of the label showing the type of extinguishant used* *schwarze Schrift auf weißem Label black letters on white background*

205. **Pression d'utilisation** / *Fill pressure* *41,50 Bar (+60°C)*

206. **Pression minimale** / *Min Pressure* *32,50 Bar (-10°C)*

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** / *Size of the bottle* **Diamètre** / *Diameter* *Ø 120 mm* **Hauteur** / *Height* *254 mm*

209. **Poids de la bonbonne** / *Weight of the bottle* *2,4 Kg - inkl. Anbauteile; - with all conveniences*

210. **Système de déclenchement** / *Activation system*

Manuel / *Manual*	Electrique / *Electric*	Automatique / *Automatic*
☒	☒	☐

Cocher la mention utile
Tick off as applicable

211. **Gamme de température d'utilisation** / *Operating temperature range* *-10°C bis +60°C ; -10°C to +60°C*

212. **Nombre d'ajutage minimum dans le compartiment moteur** / *Minimum number of nozzles in the engine compartment* *2 -nur für Motorschutz,- only for engine safety*

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

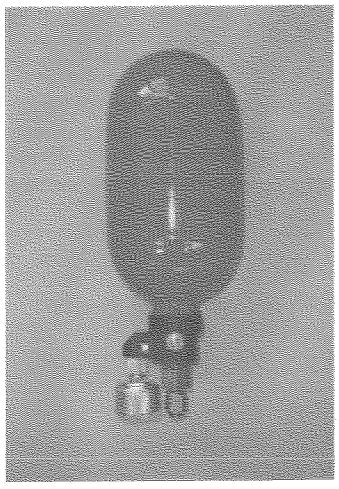


Abb. 1: Löschmittelbehälter mit Manometer

Fig. 1: extinguisher with pressure gage

Abb. 2: Löschmittelbehälter mit spezial Druckaufnehmer

Fig. 2: extinguisher with spez. pressure detektor

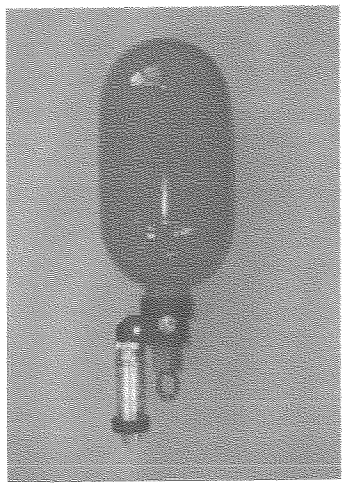


Abb. 3: Löschmittelbehälter mit konv. Druckaufnehmer

Fig. 3: extinguisher with conv. pressure detektor

214. **Photo d'un ajutage**
Photo of a nozzle

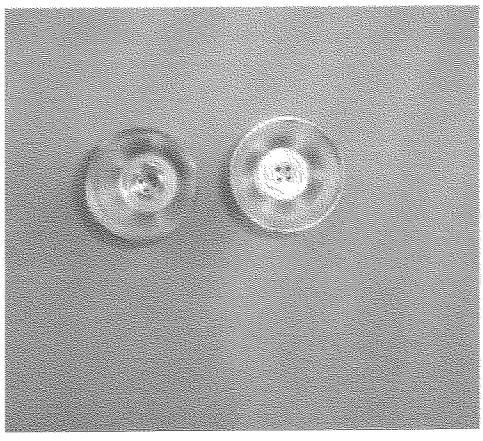


Abb. 1:
Düsenanzahl für Monoposto Fahrzeuge
Fig. 1:
number of nozzles for single seater cars

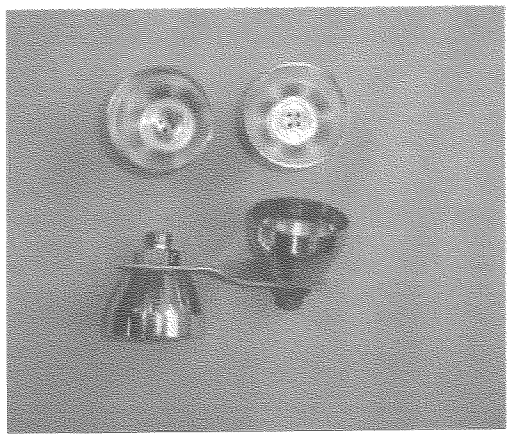


Abb. 2:
Düsenanzahl für Sportwagen
Fig. 2:
number of nozzle for sport cars

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	i.V.	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*

FEDERATION INTERNATIONALE DE L'AUTOMOBILE

Extension No. : 1

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

FIA SPORT
22 DEC. 2003

valid as from :

1. GENERALITES / GENERAL

101. Constructeur
Manufacturer Kidde Deugra *Brandschutzsysteme GmbH*

102. Adresse
Address *Halskestraße 30 D-40880 Ratingen*

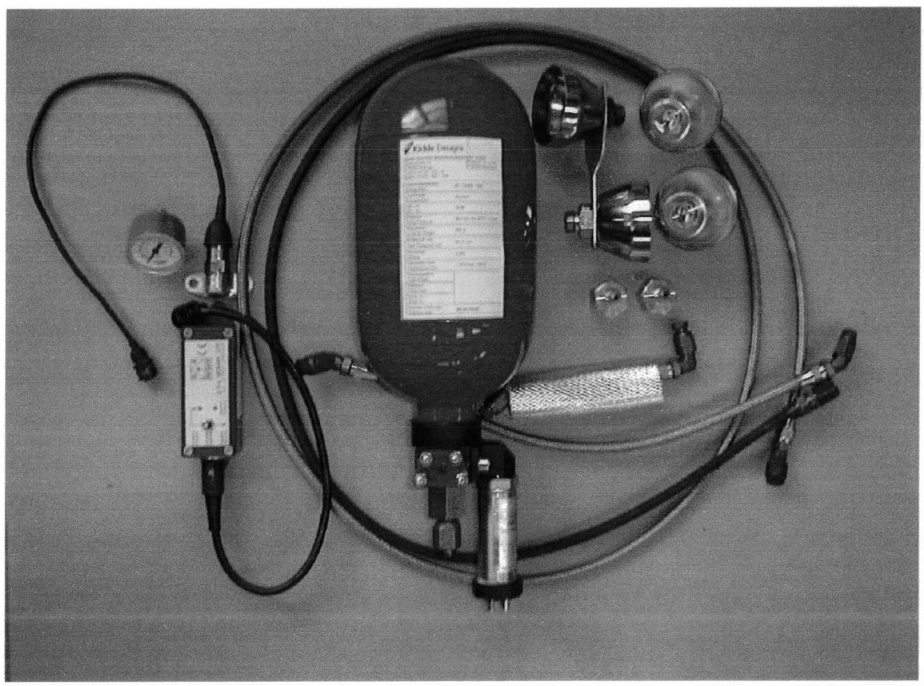
103. Nom du système
System name *KD-596*

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)
Vehicule for which the system may be used (Indicate if the system is valid for all groups):

- **Tourenwagen** **touring cars**

106. Photo du sytème complet
Photo of the complete system



Variante C:
Anwendung mit 6 Düsen für Tourenwagen – Application with six nozzle for touring-cars

2. DESCRIPTION DU SYSTEME / SYSTEM DESCRIPTION

201. Agent extincteur *unchanged*
Extinguishant *unchanged*

202. Capacité totale du système *unchanged*
Complete Capacity of the system *unchanged*

203. Norme à partir de laquelle a été approuvé l'agent d'extincteur *unchanged*
Standard from which the extinguishant has been approved *unchanged*

204. Couleur de l'étiquette indiquant le type d'extincteur utilisé *unchanged*
Colour of the label showing the type of extinguishant used *unchanged*

205. Pression d'utilisation
Fill pressure *unchanged*

206. Pression minimale
Min Pressure *unchanged)*

207. Si le système est normalement non pressurisé, définir le type de pressurisation *unchanged*
If system is normally unpressurised define type of pressurisation : *unchanged*

208. Taille de la bonbonne **Diamètre** *unchanged*
Size of the bottle *Diameter* *unchanged*

209. Poids de la bonbonne
Weight of the bottle *unchanged*

210. Système de déclenchement
Activation system *unchanged*

211. Gamme de température d'utilisation
Operating temperature range *unchanged*

212. Nombre d'ajutage minimum dans le compartiment moteur
Minimum number of nozzles in the engine compartment *unchanged*

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

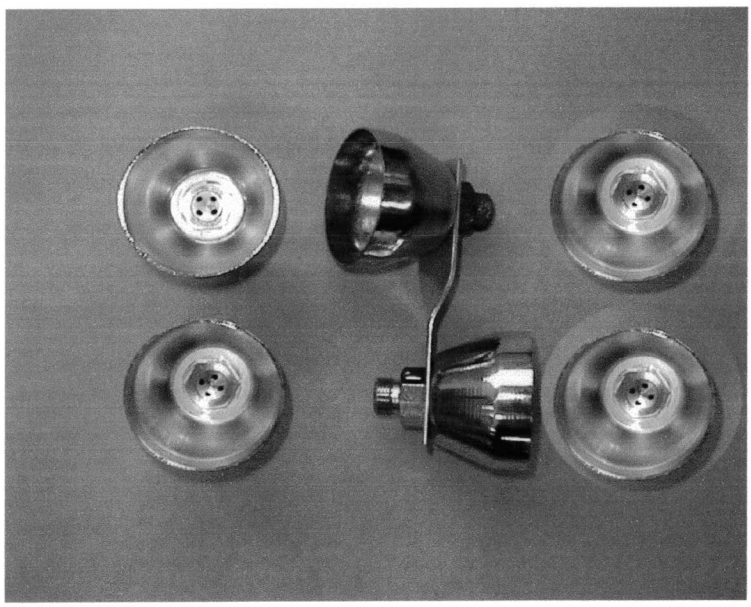


Abb. 1:
Düsenanzahl (6) für Tourenfahrzeuge

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

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 2003	i.V.	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*

Constructeur / Manufacturer: Kidde Deugra — Nom du système / System name: KD-596 — **EX . 014 . 03**

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	Non / No
☐	X

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**

Nom et Visa de l'ASN Name and ASN Stamp	**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 relized the tests)*
D. Fürst	Obering. Dipl.-Ing. Knut Wartenberg

Kidde Deugra

KD-A96

Aerosol Extinguishing System

Kidde Deugra	KD-A96 Aerosol Extinguishing System			Bereich / Department: COV	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: 2 / 5

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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 ($KHCO_3$) - 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 $KHCO_3$ is based on two different factors. Firstly, the flames are cooled by various endothermic reactions whilst their $KHCO_3$ is consumed.

$$2\,KHCO_3 \rightarrow K_2CO_3 + H_2O + CO_2 \qquad (1)$$

$$K_2CO_3 \rightarrow K_2O + CO_2 \qquad (2)$$

$$K_2O \rightarrow 2\,K + O \qquad (3)$$

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.

$$K + H + M \rightarrow KH + M \quad (4)$$

$$KH + O \rightarrow KOH \quad (5)$$

$$KH + OH \rightarrow K + H_2O \quad (6)$$

$$KOH + H \rightarrow K + H_2O \quad (7)$$

$$KOH + OH \rightarrow KO + H_2O \quad (8)$$

$$KO + H \rightarrow KOH \quad (9)$$

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_2) by the extinguishant is verifiable.

3. Manufacture and discharge

For manufacturing purposes, the so-called spray drying method is used, where an aqueous $KHCO_3$ solution is forced through a nozzle, to finally expand in an evacuated space. As a result, the water suddenly evaporates and the $KHCO_3$ 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_2 is subsequently added, as with standard powders. This mixture is then filled into a compressed gas cylinder and pressurised with nitrogen.

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 $KHCO_3$.

4. Toxicology

The aerosol consists of non-toxic potassium bicarbonate ($KHCO_3$). $KHCO_3$ 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. $KHCO_3$ 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.

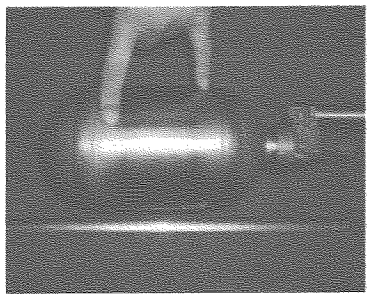
Fire extinguishing systems for motor sport vehicles

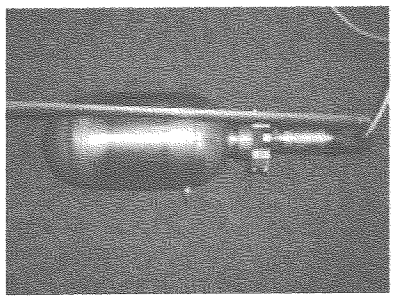
To protect driver and vehicle in the event of a fire, a powder (aerosol) extinguishing system is used as a safety facility. This extinguishing system, designed for activation via a manual switch – *integrated into the control box* – serves for extinguishing an engine or vehicle fire appropriate to the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

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.

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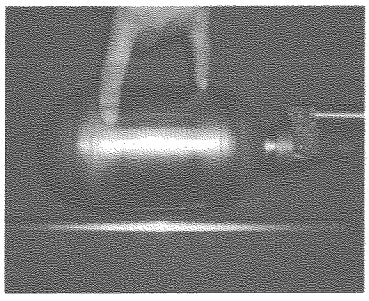

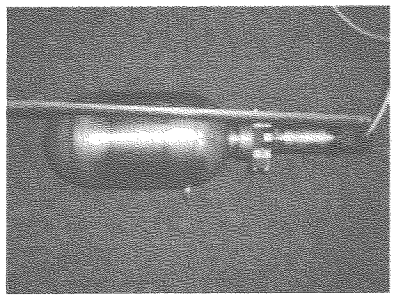

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The valve head is made similarly of high-strength aluminium and is externally screwed to the extinguishant container with a specific tightening torque. This is a safety component to be used in conjunction with the following components.

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.

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 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 g/m^3.