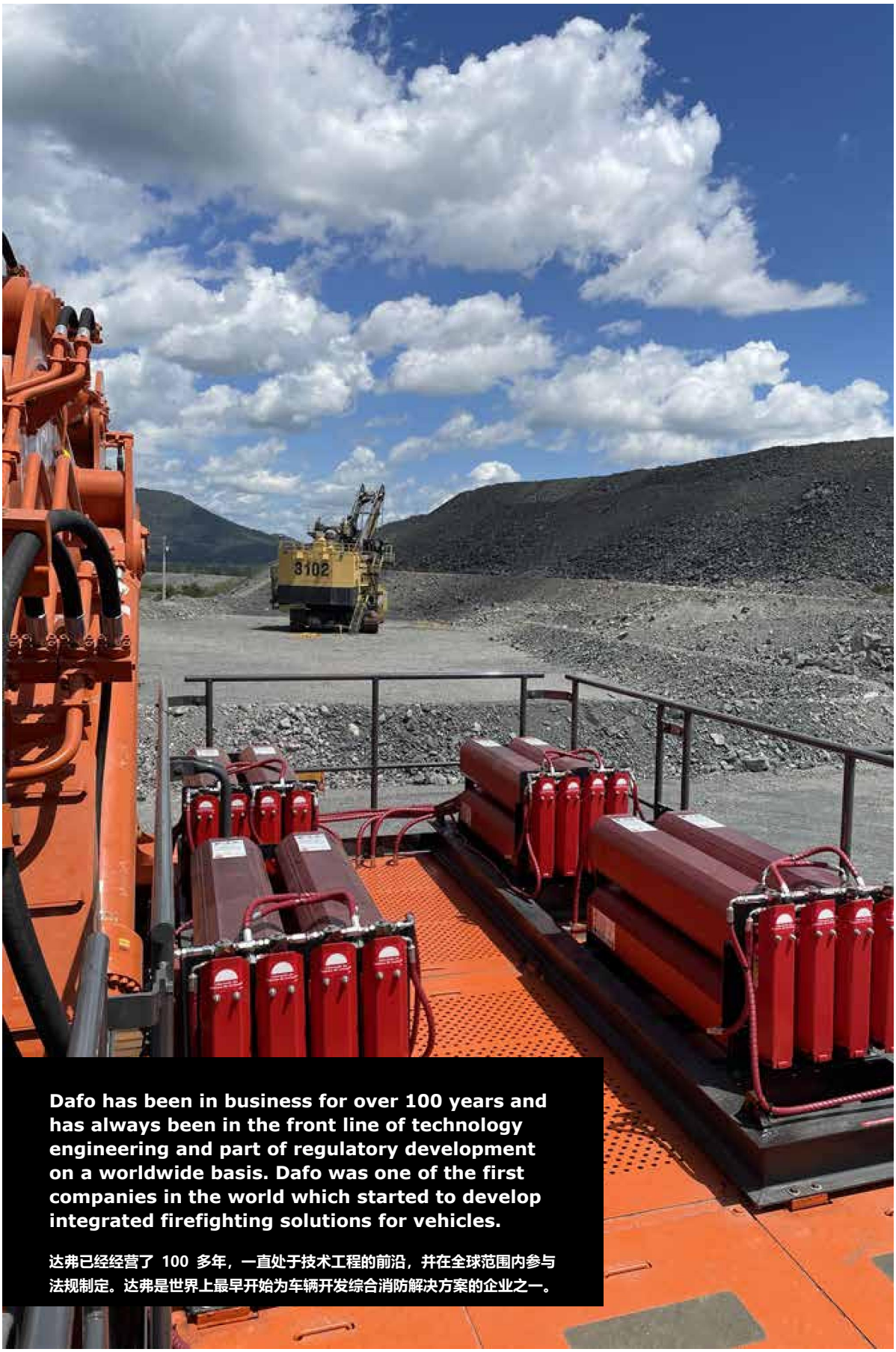
dafo European Technology | 达弗® 消防

FIRE PROTECTION SYSTEMS FOR HEAVY-DUTY MINING VEHICLES

重型采矿车辆火灾防护系统



达弗（北京）消防科技有限公司
Dafu Fire Protection Technology Co.,Ltd.



Dafo has been in business for over 100 years and has always been in the front line of technology engineering and part of regulatory development on a worldwide basis. Dafo was one of the first companies in the world which started to develop integrated firefighting solutions for vehicles.

达弗已经经营了 100 多年，一直处于技术工程的前沿，并在全球范围内参与法规制定。达弗是世界上最早开始为车辆开发综合消防解决方案的企业之一。

Mining, both surface and underground, is a complex operation that needs large off-road vehicles/ heavy duty mobile equipment (HDME) and processing equipment that operate at remote locations 24/7. In addition, these machines operate under challenging and demanding conditions in environments with many potential fire hazards as the HDMEs often carry a lot of flammable liquids in pressurized fuel lines close to hot engines and transmissions.

露天与井下采矿均属于复杂作业，需要大型非公路车辆 / 重型移动设备和破碎设备，这些设备需要在偏远地区全天候（24/7）运行。同时，这些设备面临严苛的条件，设备上的液压管道通常携带大量可燃液体，这些燃油或液压管道非常靠近热发动机和传动装置，有潜在的火灾风险。

When a fire breaks out on a mining vehicle the results can be dramatic. Expensive repair or replacement of valuable equipment are the obvious consequences. Extensive downtime and business interruption can result in even greater expenses as this equipment often takes many months to repair or replace. Further on and most importantly a fire on a mining vehicle can mean serious injuries to the machine operator, miners in some cases, also lead to geological instability, especially in the

采矿车辆一旦起火，后果十分严重。首要损失是贵重设备的高额维修或更换费用；设备维修、更换周期往往长达数月，长时间停机与生产中断会造成更大经济损失。更为关键的是，矿用车辆起火可能造成设备操作人员、矿工重伤，在井下作业场景下，还可能引发地质失稳。

Dafo Vehicle offers the most reliable and effective fire suppression systems for HDME designed to survive challenging working environments and secure safety of operations. The systems are designed to mitigate losses due to fire and reduce the impact on investment, reducing downtime and securing business continuity and increasing the productivity of the end users. Dafo Vehicle’s robust system not only protect individual hazards within the vehicle such as leaking fuel, hydraulic fluid, and/or lubrication, built up flammable deposits, but it is also a system with low life cycle costs.

达弗车载消防可为重型移动设备提供高可靠、高性能灭火系统，产品可适应严苛作业环境，保障作业安全。该系统旨在降低火灾造成的损失、减少资产投资风险，缩短停机时长、保障业务连续运营，提升终端用户生产效率。达弗消防这款坚固耐用的系统，既可防护车辆内部各类风险源，例如燃油、液压油、润滑油泄漏，以及堆积的易燃沉积物；同时整套系统具备较低的全生命周期成本。

In order to secure that Dafo Vehicle’s fire suppression systems are fit for purpose in the challenging environments, the systems are thoroughly tested for fire performance ability and environmental durability such as Electromagnetic Compatibility (EMC), vibration, corrosion and temperature extremes according to international automotive standards to ensure the highest performance.

为确保达弗车载灭火系统可在恶劣环境下可靠适用，产品依据国际车用标准，针对灭火性能与环境耐久度开展全面测试，涵盖电磁兼容（EMC）、振动、腐蚀、极限温变等项目，保障最优性能表现。

Dafo Vehicle fire suppression system fulfill the requirements of NFPA, Australian Standard AS 5062 and SBF 127:17 and among other certifications and approvals of the

达弗车载灭火系统满足美国消防协会标准（NFPA）、澳大利亚标准 AS 5062、SBF 127:17，同时具备行业内其他多项认证与认可。

With more than 300000 vehicle systems sold worldwide knowhow and experience ensure our customers to have the latest technology combined with proven reliability. The current solutions are being used worldwide as integrated solutions at the OEM production lines as well as retrofit installations at the end user in the mining industry.

凭借在全球销售的 30 多万套系统的成功专业知识和经验确保我们的客户拥有最先进的技术和可靠的产品。目前的解决方案正在全球范围内作为 OEM 生产线的集成解决方案以及采矿业最终用户的改造安装。

Dafo Vehicle’s systems are easy to maintain and refill on site which reduce downtime and operational costs when machines many times operate in remote places.

达弗车载灭火系统便于现场维护与药剂重装。很多矿机常在偏远区域作业，该优势能够缩短停机时间、降低运营成本。

Dafo Vehicle continuously work with sustainability, meaning environmental sensitivity without compromising safety. A potential fire in a mining environment would have a significant impact on the working- and public environment. Dafo Vehicle is measuring and mitigating impacts from manufacture to end-of-life and by choosing a Dafo Vehicle system our customers can rest assured that it favorable contributes with added value in their own sustainability work..

达弗车载持续践行可持续发展理念，在严守安全底线的同时兼顾环境友好。采矿环境一旦发生火灾，会对作业区域及周边公共环境造成严重影响。达弗车载对产品从生产制造到报废全生命周期的环境影响开展监测与管控。客户选用达弗车载系统，可放心该产品能够为自身可持续发展工作赋能增值。

Our system

我们的系统

The Dafo Vehicle fire suppression system is a well-integrated and effective solution which is based on thorough Risk Assessment, design, installation, documentation with subsequent, training and related services.

达弗灭火系统是一套完整而有效的解决方案，它基于全面的风险评估、设计和安装指导以及后续培训和相关服务。

The Dafo Vehicle fire suppression system consists of four integrated elements; **Detection, Alarm, Suppression and Control** which work together in a coordinated, fast and efficient way to suppress fires.

达弗灭火系统由四个功能构成；**探测，报警，灭火，控制**，在一个相互协同，快速和有效的方式下扑灭火灾。

Detection: The detection system consists of an ultra-reliable Linear Heat Detection Cable routed throughout all high-risk areas inside the engine compartment to ensure early detection of a fire.

探测：探测系统采用超高可靠性的线型感温电缆，沿发动机舱内所有高危区域布设，实现火情早期预警。

Alarm: The alarm panel placed inside of the operator cabin, will alarm the machine operator upon detection. The machine operator can also release the system manually from the panel. An external alarm, protected but in plain sight, will alarm the machine operator and the staff around the machine by sound and flashlight. If needed, the fire alarm can also be seen from the control room for each machine and the control room operator can release the fire suppression system from this location.

报警：驾驶室内部配有报警面板，探测到火情后立即向设备操作员发出警报；操作员也可通过该面板手动启动灭火系统。 设备外部另设防护型声光报警器，位置醒目，通过声光信号同步提醒操作员及周边人员。必要时，火情信号还可接入对应设备的中控室，中控室操作人员可在远端启动灭火系统。

Suppression: The distribution network is composed of flexible fire resistance hydraulic hoses, stainless steel pipes with direct spray and full cone nozzles that will protect all areas or specifically locations with many potential fire hazards such as turbo charger, catalytic converter, pumps, fuel lines, generators, transmission belts, filters and hydraulic package.

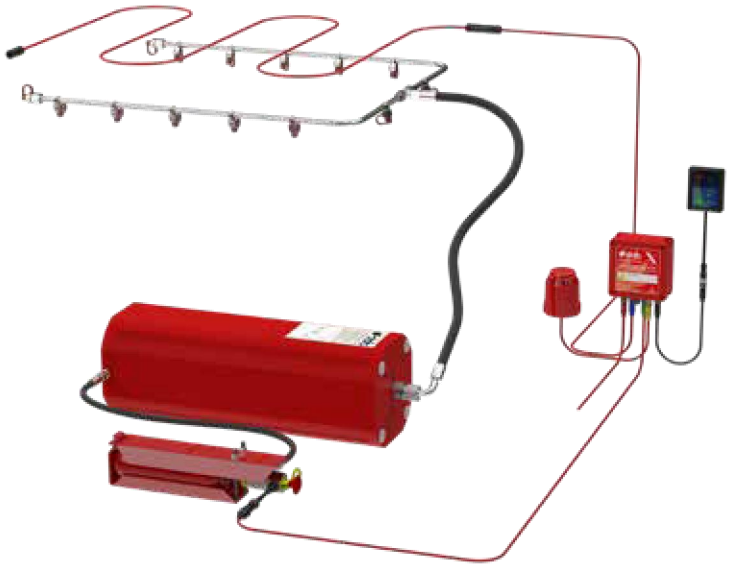
灭火：药剂输送管网由耐火柔性液压软管、不锈钢管路搭配直射型与全锥形喷嘴组成，可对全部防护区域，或是针对涡轮增压器、催化转化器、泵体、燃油管路、发电机、传动皮带、过滤器及液压总成等高火灾风险点位实施专项防护。

Control: freshly released family of Dafo's new generation control units has following key features:

控制单元：达弗全新一代控制装置系列新品，具备以下核心特性：

- Back-up power and no need to replace batteries
  - Real Time Clock and Event Log
- Allows access to full historical data in order to analyze historical events
  - Full compatibility with Dafo's upcoming solutions, including multi-zone CO-detectors
  - Model dependent features include:
- 1, 2 or 3 detections and suppression Zones
- 1 or 2 CANbus networks (SAE J1939)
- Up to 4 analogue inputs and 2 digital outputs
- M12 or MX150 connectors

- 备用电源，无需更换电池
  - 内置实时时钟与事件日志
- 支持调取完整历史数据，用于事件溯源分析
  - 可完全兼容达弗后续新品方案，包括多区域一氧化碳探测器
  - 依型号不同可选配置：
- 有 1、2 或者 3 个探测及灭火区域
- 1 或 2 个 CANbus 总线 (SAE J1939)
- 最多 4 路模拟量输入及 2 路数字量输出
- M12 或 MX150 连接器



Dafo Forrex EVO™ 灭火剂

The basis of Dafo Vehicle's system is the suppression agent Forrex EVO which is 100% flourine free and specially developed to suppress fires in combustible engines. Forrex EVO is highly effective on flammable liquid fires like petrol, diesel and hydraulic oils. The system combines the features of liquid and dry chemical, includes unique and propriety tailormade solutions and offers outstanding flame knockdown and unique protection against re-ignition as it will cool down the overheated engine parts in case of a thermal event.

达弗车载灭火系统的核心灭火剂为 Forrex EVO，全氟无氟配方，专为内燃机火情定制研发。Forrex EVO 对汽油、柴油、液压油等可燃液体火灾具备高效灭火能力。该灭火剂兼具液相与干粉药剂的优势，搭载专属定制化方案，具备卓越的快速控火能力与独特的复燃抑制效果；发生热险情时，可对过热发动机部件持续降温。

- **Proprietary blend** – The Forrex EVO is Dafo's own proprietary blend. The included surfactants improve the fluidity and fire-extinguishing performance of Forrex EVO.

  专利配方：Forrex EVO 为达弗自研专属配方，内含表面活性剂，提升药剂流动性与灭火性能。
- **Effective Flame Knockdown** – Forrex EVO is discharged through overlapping fields of spray which coats all areas of the engine and cutting off the fuels' oxygen

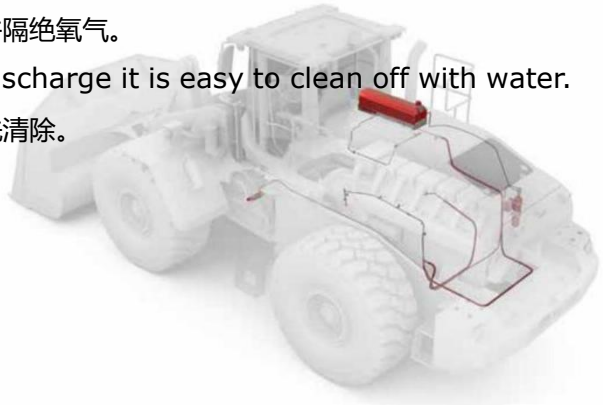
  高效控火：Forrex EVO 通过多层叠加喷雾场释放，包覆发动机所有区域，切断燃料的氧气供给。
- **High penetration capability** – Forrex EVO spray droplets are slightly coarse but still small enough to create area liquid film cooling layer which absorbs the radiant heat. Forrex is also extremely effective at following the outline of the engine components in the risk area to ensure it reaches every part where the fire may be. This is particularly important for flammable liquid fires.

  强渗透性：Forrex EVO 雾滴粒径略粗但尺寸适中，可形成液膜冷却层、吸收辐射热；药剂可沿风险区内发动机构件轮廓充分附着，抵达所有潜在起火点位，对可燃液体火灾尤为关键。
- **Excellent cooling** – Forrex EVO effectively reduces the temperature on any super-heated surfaces below the ignition points of any flammable liquid.

  优异冷却效果：Forrex EVO 可有效将所有过热表面降温，使其低于各类可燃液体的燃点。
- **Prevents reignition** – increased heat absorption with ability to cling on 3-dimensional surfaces and exclude oxygen.

  抑制复燃：吸热能力强，可附着在三维构件表面并隔绝氧气。
- **Clean up after discharge** – In case of discharge it is easy to clean off with water.

  喷射后易清洁：药剂喷射释放后，可直接用水冲洗清除。



The Dafo Vehicle detection system is designed to activate an alarm (sound and flashlight), adjust the vehicle operation (shutting down the cooling and ventilation fans as well as shutting down the fuel line to reduce the spread of fire) and activating the automatic fire suppression system.

达弗车载探测系统可触发声光报警、管控车辆运行（关停冷却与通风风机、切断燃油管路，抑制火势蔓延），并启动自动灭火系统。

The **Linear heat detector** is used in the engine compartments and is a fixed temperature sensor meaning that an alarm signal is triggered when the activation temperature of 180 °C is reached. The sensor cable consists of two steel conductors, each insulated with a heat sensitive polymer. At the activation temperature of 180 °C the heat sensitive polymer will melt and the conductors will short circuit initiating an

线型感温探测器用于发动机舱，属于定温型传感器：温度达到 180℃动作阈值时，即发出报警信号。 该传感线缆内含两根钢质导体，各自包覆热敏聚合物绝缘层；当温度升至 180℃动作温度，热敏聚合物熔化，两根导体短路，从而触发报警。

The insulated conductors are covered by an outer jacket made from flame retardant vinyl fluoropolymer (FR). This ensures good performance for most installations featuring low moisture absorption, good resistance against many common chemicals as well as excellent low temperature flexibility.

绝缘导体外层护套采用阻燃乙烯基氟聚合物（FR）。该护套吸水率低、耐多种常见化学品，且低温柔韧性能优异，可满足绝大多数工况稳定使用。



Steel Conductors 钢制导线

Heat Sensitive Polymer 热敏聚合物

Outer Jacket 外护套





Large heavy-duty mining vehicles have large engine compartments. It is therefore important that the engine compartments are protected with additional suitable detection systems in addition to the linear heat detector which then provides the vehicle

大型重载矿用车辆的发动机舱空间庞大。因此，除线型感温探测器外，发动机舱还需增设适配的探测系统，以此为整车提供最高等级防火保护。

Flame Detectors; for large engine compartments flame detectors are more suitable for detection. Flame detectors operate in the harshest environmental conditions and offer a solution for virtually any application where there is a fire risk to personnel and high value plant and capital equipment. We offer flame detection solutions with fast response times, the best area coverage, the highest immunity to false alarms and all the performance and safety approvals you need.

火焰探测器：针对大型发动机舱，火焰探测器更适合火情探测。火焰探测器可在最严苛工况下工作，适用于所有存在人员、高价值设备与固定资产火灾风险的场景。我们提供的火焰探测方案响应迅速、探测覆盖范围广、抗误报能力强，并具备所需全部性能与安全认证。

Smoke detectors are used for early warning of fires in electrical cabinets. The performance and suitability is good with both black white smoke. The amount of the false alarms is significantly decreased by the stability of the detector which is reliable and customizable to the changes triggered by the surroundings environment. The stability of the detector and low false alarm rate is further ensured by the use of algorithms to decide when the detector should change to alarm state. This removes the likelihood of a detector triggering an alarm as a result of smoke and particles from other

烟感探测器用于电气柜火灾早期预警，对黑烟、白烟均具备良好探测性能与适配性。探测器自身稳定性可大幅降低误报；设备可靠，可根据周边环境变化定制适配参数。探测器搭载判定报警状态的算法，进一步保障稳定性、压低误报率，避免因非火情来源的烟尘、颗粒引发误报警。

Multizone temperature detection for large vehicle coverage – technology that can indicate excess temperature in multiple zones.

多分区温度探测，实现大型车辆全域防护—— 该技术可对多个区域的超温情况进行监测预警。



Electrical cabinets in heavy-duty mining vehicles are a well-known source of fires as it can generate enough energy required for the ignition. It also provides the combustible material needed for spreading of the fire. Fires originating from the electric system account for a relatively large proportion of the total number of fires.

重载矿用车辆的电气柜是常见起火源，其可产生引燃所需的足够能量，同时具备维持火势蔓延的可燃物料。电气系统引发的火灾在火灾总数中占比相对较高。

Causes of Fire:

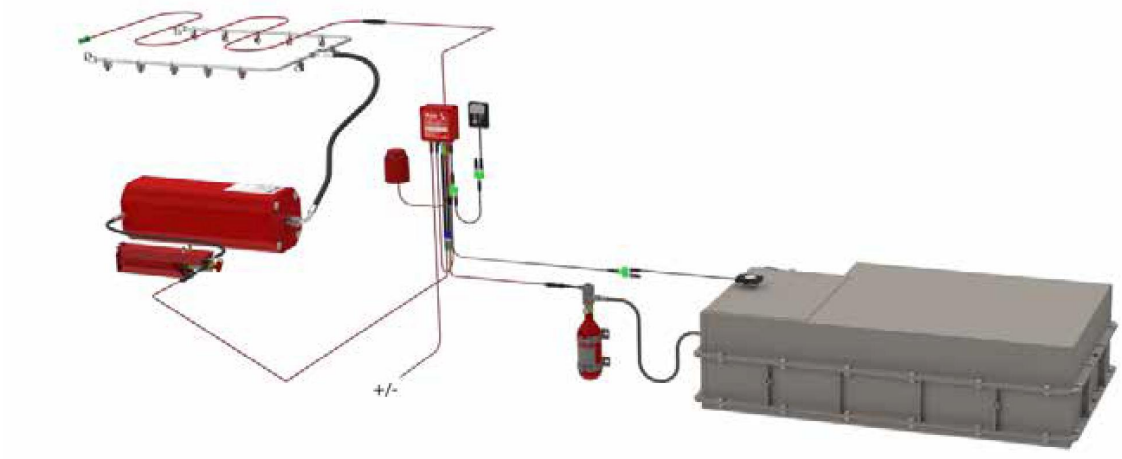
- Short circuit – This is a rare occurrence in an electric installation conforming to international standards since the safety devices (circuit breakers or fuses) will immediately be triggered.
- Surcharge – In this instance the conductors heat up without safety devices being triggered.
- A contact resistance – Heating occurring between two elements causing electric

起火原因:

- 短路 – 在符合国际标准的电气装置中，短路并不常见，因为安全装置（断路器或熔断器）会立即触发。
- 过载 – 该工况下导体发热，但安全保护器件未触发。
- 接触电阻 – 两个部件接触面处发热，进而产生电弧。

PFK system – The PFK system combines fire suppression abilities with environmental sustainability. The PFK system agent FK-5-1-12 is pressurized in the agent tank with nitrogen. The FK-5-1-12 which is a colorless and odorless gas suppresses fires through cooling and suffocation by removing the heat energy and interrupting the combustion process. The clean agent leaves no residue, requires no cleanup is non-conductive and non-corrosive. FK-5-1-12 agent quickly evaporates without harming any valuable assets.

PFK 系统 — PFK 系统兼具灭火能力与环境可持续性。 PFK 系统灭火剂 FK-5-1-12 在药剂瓶内由氮气增压。FK-5-1-12 为无色无味气体，通过吸热降温、窒息作用消除热能、中断燃烧链式反应，从而实现灭火。该洁净灭火剂无残留、无需事后清理，不导电、无腐蚀性。FK-5-1-12 药剂可快速汽化，不会对贵重设备资产造成损害。



Advantages

- Fast and reliable fire protection.
- Suppresses a fire in seconds, reducing equipment damage and downtime.
- Penetrate even complex environments quickly.
- Easy to install in any electrical cabinet onboard on HDME.
- Clean suppression agent requires no post-discharge cleanup.
- Harmless for people, equipment and the environment.
- Does not interfere with installation or maintenance of equipment.
- Clean agent which will not damage electronic equipment even when energized.

优势

- 快速可靠的火灾防护。
- 数秒内扑灭火灾，降低设备损害和停机时间。
- 可快速渗透至复杂空间内部。
- 便于安装在重型矿用设备车载各类电气柜内。
- 洁净灭火剂，喷放后无需清理。
- 对人员、设备及环境无害。
- 不影响设备安装与维保作业。
- 洁净药剂，带电状态下也不会损伤电子设备。





Dafo^{CLOUD}

达弗云

The Dafo^{CLOUD} is a cloud-based risk management system to provide full overview of lifecycle of Fire Detection and Suppression System (FDSS).

达弗云是一个基于云端的风险管理系统，提供火灾探测和灭火系统（FDSS）的生命周期进行总览管控。

The Dafo^{CLOUD} provides access to the full history and genealogy of sub-systems of the FDSS and the complete information is seamlessly accessible and updatable by relevant stakeholders.

达弗云可调取火灾探测及灭火系统各子系统的完整历史记录与溯源信息，相关权责方可无缝查阅、更新全部资料。

The restricted access database contains information about the whole life cycle of each

这套权限管控数据库，收录每一套火灾探测及灭火系统的全生命周期信息：

Manufacturing

- The electrical sub-systems of FDSS are always individually tested, programmed and configured by using equipment connected to Dafo^{CLOUD} which enables full control and visibility about detailed test reports but also firmware files, settings and configurations used over the time.

Installation

- The FDSS-specific installation documentation is accessible for technicians via Dafo^{CLOUD}.

Maintenance

- Both planned and unplanned maintenance activities, including associated time-stamped reports, photos/videos and reminders for next actions will be stored and handled by Dafo^{CLOUD}.
- Historical event logs of Control Units can be accessed from Dafo^{CLOUD} for in-depth

制造

- 火灾探测及灭火系统的电气子系统均单独测试、编程与配置；相关设备接入达弗云，可完整管控并查看详细测试报告，以及历史使用的固件文件、参数设定与配置方案。

安装

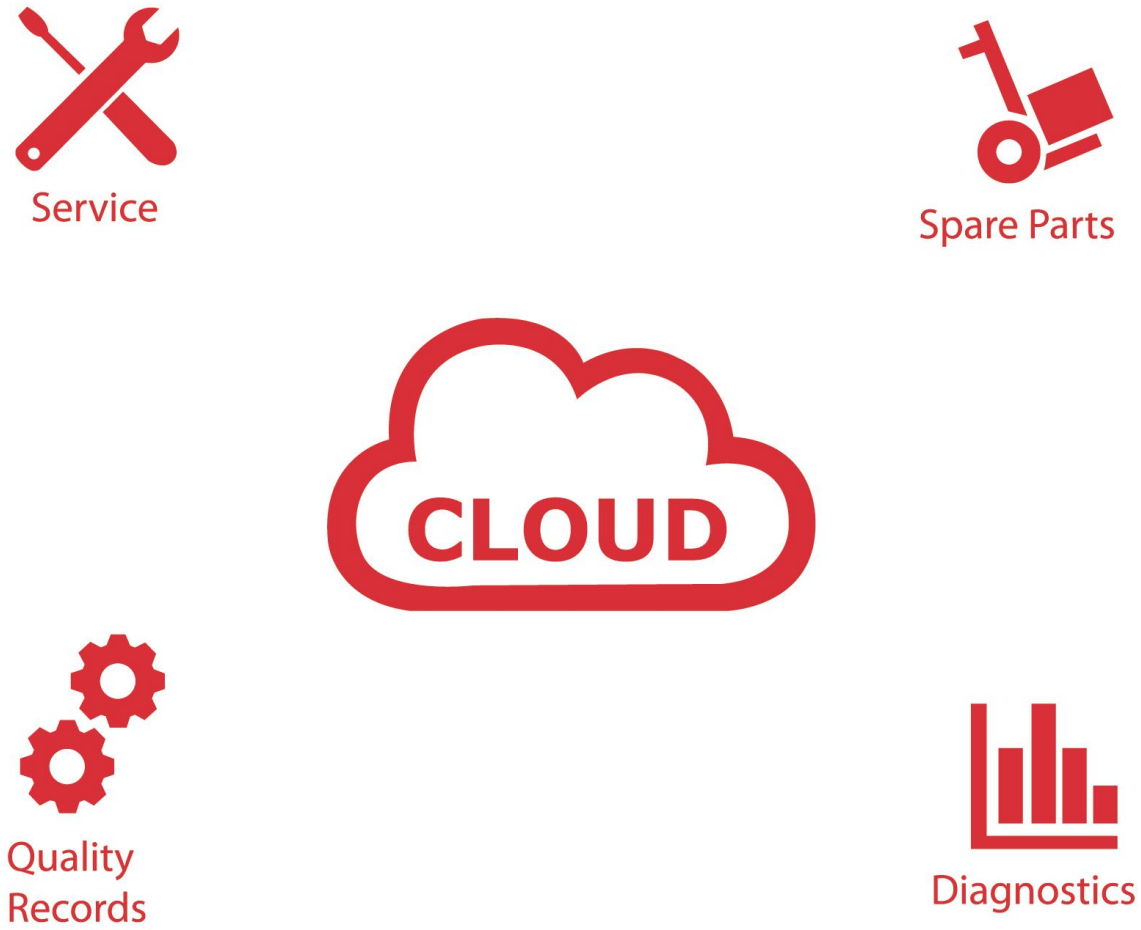
- 技术员可通过达弗云查阅对应火灾探测及灭火系统专属安装文档。

维护

- 计划性与非计划性维护工作，含带时间戳的相关报告、照片 / 视频、后续任务提醒，均由达弗云存储与管理。
- 可在达弗云调取控制单元历史事件日志，用于深度分析。

The Dafo^{CLOUD} is the basis for reducing and controlling the total cost of ownership with keeping maximized safety in focus.

达弗云以安全保障优先，为管控、降低设备全生命周期持有成本提供支撑。



Safe with Dafo Vehicle

达弗车载，安全随行



Active fire protection is an integral part of systematic and effective fire prevention. Together with Dafo Vehicle Fire Protection, you'll always get the most effective solution so that you can limit fire damage, reduce downtime and increase productivity.

主动防火是系统化、高效火灾预防不可或缺的一环。依托达弗车载消防方案，您将获得最优解决方案，以此控制火灾损失、缩短停机时间、提升生产效率。

Since the start back in 1919, Dafo has developed into a modern, high-tech company committed to offer the very best solutions to our customers.

达弗始创于 1919 年，现已发展为现代化高科技企业，致力于为客户提供顶尖消防解决方案。

Dafo Vehicle has three main business areas: Integration (Fire suppression systems integration into OEM production line, Retrofit (Fire suppression systems installed at final customer) as well as Service & Maintenance.

达弗车载业务包含三大核心板块：配套集成（将灭火系统集成至主机厂 OEM 产线）、改造加装（为终端客户现场加装灭火系统）以及维保服务。

Dafo group today consist of several subsidiaries, distributors and service providers

如今，达弗集团在全球拥有多家子公司、经销商与服务机构。

Do not compromise safety – get in touch!

安全不容妥协 —— 请联系我们!

dafo European Technology | 达弗® 消防

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