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Dry powder-foam dual agent firefighting

If the throw range of dry powder is too short…

Generally, new technical solutions and equipment open ways to the introduction of non-conventional elements in firefighting tactics. It is true also for dry powder and foam dual agent firefighting technology to be introduced in this article because it undoubtedly opens a new chapter in the old history of dry powder firefighting. Technology of new combined dual agent nozzles can primarily be deployed in the industry; however, in certain cases it might extend our tactical opportunities when fighting other type of fires as well.
In the following article I give you a review of the basics, the importance of simultaneous foam/dry chemical operation and dual agent nozzles.

Key words: firefighting, Dual agent, HydroChem, ChemCore, dry powder, foam firefighting

1. Dry powder and foam dual agent firefighting

Saying that the most frequently applied firefighting tactics in industrial firefighting is the combined one is not exaggeration. With the simultaneous application of different extinguishing materials the blazing flames can be eliminated with higher efficiency within a shorter period of time. In certain cases the intervention can only be successful if different extinguishing agents, in accordance with their extinguishing features, are simultaneously deployed.
Simultaneous application of extinguishing gases, dry powder, foam, normal or sprayed water jets is also known. Application of water, besides the water need of the extinguishing foam, is common; in most cases we use it as a self-contained extinguishing material. However, in the oil and chemical industry water is rarely deployed without being mixed with foam concentrate; “pure” water is most frequently used for cooling back hot appliances or for the protection of adjacent technology.
In industrial environment the most frequently deployed combined extinguishing method is the simultaneous application of dry powder and extinguishing foam.
During conventional combined firefighting foam and powder guns are deployed as coordinated, but separate units.
In general, foam covers the surface of the burning fuel pool, this way extinguishing the 2D fires. This method can be completed with deploying dry powder, which has some special, not detailed in this article, extinguishing features, making it possible to successfully extinguish spatial, three-dimensional (3D) fires. Besides the capability of extinguishing 3D flame fires, dry powder has another special feature; it is capable of getting into such covered areas and putting out the fires there that cannot be attacked directly by other extinguishing jets.

Several features of the dry powder mean serious limits regarding its deployment, out of which the most important ones are as follows:

- Deployment time of dry powder guns or monitors is limited; powder fire-fighting can be done only until the capacity of the powder tank. There is no opportunity for quick refilling on the scene of the fire; therefore, planned and well-prepared deployment of dry powder is very important.
- The capacity of the powder gun or monitor basically defines the size of the biggest extinguishable flame.
- There are different regulations and recommendations in use to define the calculation method for dry powder firefighting. (E.g. application of 0.6 kg/sec dry powder is necessary for every single square metre of the flame.) It is conceivable that the available dry powder guns and monitors alone are not suitable for fighting big fires; and it emphasizes the importance of the deployment of combined firefighting.
- The efficient shooting range of dry powder nozzles has not a patch on the ones of foam or water jets; generally, it is between half - fourth of them. Due to their throw range dry powder guns/monitors have to be placed closer to the flames. In case of fires with high thermal radiation, or in built-up areas it can be an insoluble task, ruling out the opportunity of deploying dry powder.

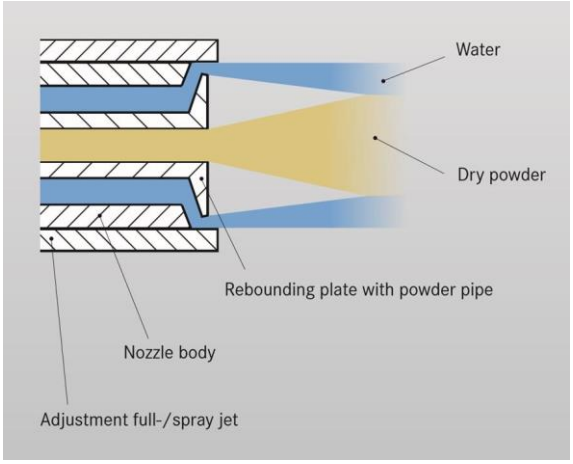
This latter limiting factor might cause serious problems, for example if the shell of a fuel storage tank is damaged and a two-phase fire occurs: a surface (2D) fire and a flowing fuel (3D) fire. [1] Pool fire of the bund can be extinguished with foam even in case of bigger bund surfaces. However, because of the limited throw range of the dry powder monitors we cannot extinguish the 3D fire, which has a continuing source of flammable liquid. The distance between the dam of the fuel-filled bund and the tank shell can reach up to 40-50 metres; therefore, for the efficient deployment of powder guns or monitors their throw range should be higher. The conventionally made dry powder monitors cannot meet this expectation.

2. Common axis dual agent nozzles: Two firefighting agents in the same thrown-steam

In the development and spread of the technology of common axis dual agent nozzles Williams Fire & Hazard Control Services [2], the American expert of foam and powder firefighting, is in the vanguard. HydroChem is the brand of the Williams Fire and Hazard Control's patented dry chemical application method, which projects dry chemical through the centre of the foam/water stream, resulting in an effective range. [3]

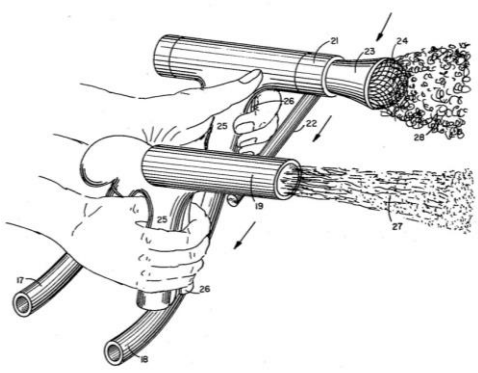
These products make possible the simultaneous application of the two extinguishing materials. In this kind of grouping similar products from other manufacturers also fit in, that is why I use this one to introduce the design of different equipment.

Because of a special technical solution these nozzles are suitable for water, foam and dry powder firefighting. From a single equipment one of these extinguishing materials, or if it is needed, dry powder simultaneously with foam or water can be applied. The biggest advantage of deploying this technology is not combined firefighting, but the extended shooting range of the dry powder nozzle. As a result of its special design, during foam or water application dry powder can be applied into the centreline of the jet.



Common axis dual agent nozzles [4]

The liquid jet embracing the dry powder catches the powder and carries it; that way the efficient shooting range of powder will be the same as the one of the foam jet. With the extended shooting range dry powder monitor (dual agent) even a stream fire, which is too far for a conventional monitor, can be reached and extinguished, while the foam, providing transport to the powder does the cooling of the environment and the blanketing of the pool surface. With the application of this technology the efficient throw range of the powder can be three or four times longer as the one of a conventional monitor with similar capacity.



Twin agent nozzle concept in 1963 [5]

Commercially there are other types of combined water/foam – dry powder guns and monitors also in use. In most cases these “Twin agent” solutions contain the body of the gun out of which two nozzles, put next to or under each other, are led out. That way the two nozzles moving together during the intervention, parallel apply the two type of extinguishing materials. The distance and position of the centreline of the parallel extinguishing material jets can be different. Due to this difference the foam jet does not carry the dry powder; therefore, it does not help the firefighters to a longer powder range.

Modern twin agent nozzles [6] [7]

Dual agent nozzles can be used with almost any kind of foam agents; however, special attention is required for making the right choice regarding dry powder. With this equipment exclusively those hydrophobic powders can be used that do not absorb the water content of the foam. If using non-hydrophobic powders, they become wet, and as a result they not only do not take part in firefighting, but might destroy the foam as well.

In the range of dual agent guns you can find three groups of equipment in accordance with their capacity:

- Handheld guns;
- Medium capacity monitors;
- High capacity monitors.

3.1. Handheld HydroChem guns

Among handheld HydroChem guns the one produced by Williams is the most common. The infinitely variable jet comes along with three water/foam capacities (225, 360, 475 l/min), while from dry powder capacities you can choose 2,25 and 4,5 kg per second [2]. The two inlet hoses, needed for the extinguishing material supply and their total reaction force make the use of the guns tough. Changing the position and direction of the jets require coordinated work from the operators.

Operation of handheld HydroChem gun

Firefighting with HydroChem handgun (Photo: FER Százhalombatta)

3.2. Medium capacity dual agent monitors

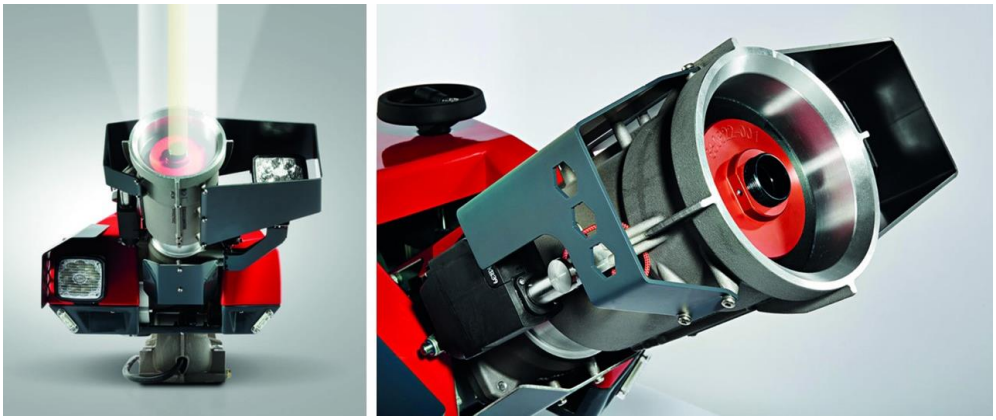
In Williams's product range this capacity group is bodied by the HydroChem versions of the Ranger monitor nozzle family. The different specifications offer 950 – 5700 l/min water/foam capacity adjustable automatically with infinitely variable jet, and 9 kg/sec powder capacity. [2]

In the product range of other producers, you can find equipment with different capacities; moreover, multiple difference of the foam – powder proportion also occurs. The combined monitor of Swiss Vogt Company provides 2.400 l/min solution capacity together with 40 kg/sec dry powder capacity [8].

Vogt HydroChem Monitor (Photo: FER Algyő)

The ChemCore nozzle was developed by the Austrian Rosenbauer in order to optimise the output of the extinguishing agent. The ChemCore nozzle is completely integrated into the monitors, and available for the turrets of

- RM15 (up to 1,900 l/min (480 gpm) water, up to 1,5 kg/sec (3,3 lb/s) dry chem),
- RM35 (up to 4,750 l/min (1,250 gpm) water, up to 10 kg/sec (22 lb/s) dry chem),
- RM65 (up to 6,000 l/min (1, 585 gpm) water, up to 15 kg/sec (33 lb/s) dry chem),
- RM80 (up to 9,500 l/min (2,500 gpm) water, up to 15 kg/sec (33 lb/s) dry chem) and
- RM130 (up to 15,000 l/min (4,000 gpm) water, up to 15 kg/sec (33 lb/s) dry chem). [4] [9] [10]



Rosenbauer RM80 ChemCore [9]

Medium capacity dual agent guns can be kept in service as mounted on trucks, trailers or foldout legs, but its fix, built-in version is also well-known. Besides manual operation these monitors can be operated electrically, hydraulically, and there are also different versions of remotely controlled ones.

3.3. High capacity dual agent monitors

The capacity range of high capacity dual agent monitors is not precisely defined; usually it is between 18-20.000 l/min solution or more. In their several features they are similar to the medium capacity monitors', but with bigger sizes, shooting ranges and extinguishing capacities.

In case of high capacity monitors, the "transportable" versions mounted on trucks, trailers and sometimes on containers, with adjustable solution and powder capacities, are characteristic. In this category the version of monitors mounted on foldout legs, because of the big back forces cannot be realized; and neither the fix, built-in versions are common.

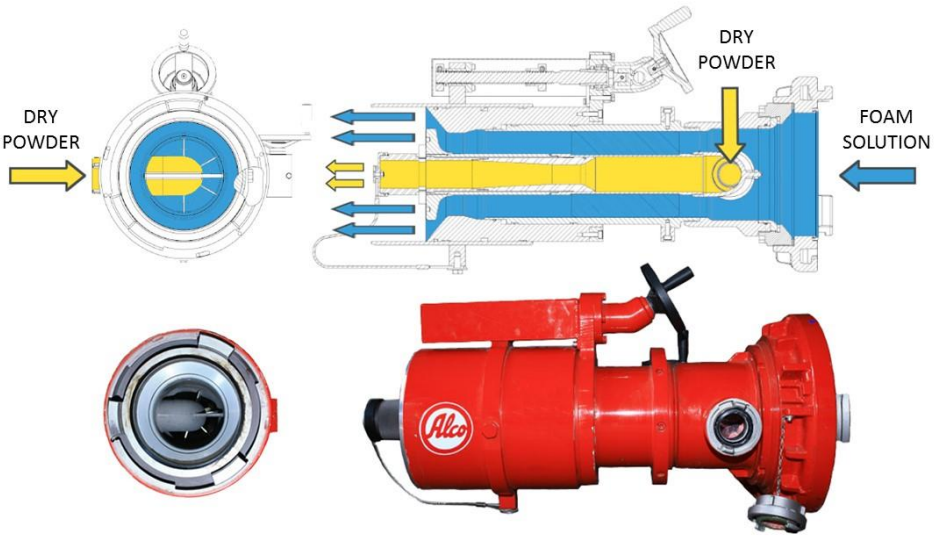
In basic case the unit (generally not the monitor nozzle!) is suitable for foam mixing; however, this opportunity, similarly to Range 3, cannot be applied for every type during HydroChem operation as well.

The capacity range of the Ambassador Monitor, made by Williams is between 3.700-22.700 l/min at 7 bars, to which 11 kg, 22 kg, 33 kg or 45 kg dry powder can be added [2].

Ambassador Monitor (Photo: FER Százhalombatta)

The German Alco[1] APF 8-HR monitor is suitable for the application of up to 30.000 l/min water/foam solution amount. With this monitor the MZVP12000 type nozzle can be used in dual agent operation. In this case its capacity can be infinitely varied between 6.000 and 12.000 l/min, the form of the jet can be solid or sprinkled, and the dry powder capacity is 20 or 30 kg/sec [11].

Alco APF 8-HR monitor (Photo: FER Tiszaújváros)



Alco MZVP12000 type dual agent monitor nozzle [12]

Apparently, it is not optimal that for deploying combined firefighting we have the opportunity to do it only with lower foam capacity, but taking the usage conditions and the aim to be achieved into consideration, it is acceptable.

[1] Albach GmbH & Co. KG; Frankfurt

With the deployment of dry powder, it is not our goal to extinguish huge fire surfaces; all the more, we purposefully use it to fulfil a certain extent of the task. Corresponding with the above, deploying dry powder is necessary for fighting – local – 3D fires (e.g. stream fire of spilling fuel, gas flare fire), for which usually a smaller amount of dry powder is enough; while huge pool fires can be taken under control with other tactics and materials and with further equipment – generally with foam firefighting. At the same time, the relatively smaller capacity than the maximum one of the monitor is still outstanding, and it guarantees the most important advantages expected from the deployment of this dual agent technology: ensures huge, even above 100 metres shooting range of the jet, and it is capable of carrying the dry powder to such distance.

The Rosenbauer RM130 turret is the top product of the Company's monitor family. It is as suitable for demanding industrial firefighting situations as it is convenient in meeting the tough foam quality requirements at airports, with its maximum flow rate of 15,000 l/min (4,000 gpm). The ChemCore nozzle delivers up to 20 kg/sec dry powder directly in the O-Stream with superior throw range and extinguishing capabilities. [9]

High capacity monitors – similarly to the medium capacity ones – have versions controlled remotely or on the spot; with manual, electrical or hydraulic operation.

4. Summary

The new (common axis) dual agent technology might open new perspectives in the well-known combined firefighting method. Simultaneous application of generally used extinguishing agents is a basic principle during certain interventions; however, their usage with the traditional equipment is a burden because of some limiting facts. These problems of combined firefighting are decreased by dual agent equipment, in which deployment of dry powder and water/foam is possible from the same nozzle.

HydroChem monitor mounted on extinguishing boom (Photo: FER Százhalombatta)

Besides the advantages of dual agent monitors detailed above, it can also be mentioned that with this construction the range of applicable extinguishing materials from one monitor body is completed with dry powder. Earlier a monitor lifted up in the basket of a hydraulic platform or on an extinguishing boom gave opportunity to deploy “only” water or foam; the modern dual agent technology gives us the opportunity to apply also dry powder, or to deploy combined firefighting [13]. In case of the conventional in-building of the monitors, mounted on the top or on the front wall of a truck, separate water/foam and dry powder monitors had to be used. Using this modern, combined tool the application of all three extinguishing materials is ensured from one monitor mounted on one truck; besides cost cutting it can provide further truck construction advantages as well (e.g. less reinforcement and simpler control is needed, weight reduction is possible).

Of course, the application of this solution is unnecessary in case of universal fire trucks. Building dual agent guns into industrial fire trucks is reasonable only if the professional risk assessment of the protected area gives proof for the demand of dry powder firefighting from huge distances.

Besides further practical investigation of this technology I suggest examining and improving the calculation method of the necessary resources of dry powder firefighting, because the recent one does not take into consideration the various spatial fire extinguishing capabilities of different type of dry powders. With the introduction of EN 13565-2 standard the classification of foam agents has become one of the basic factors for calculating foam firefighting; the standard considers the diversity of foam agents in a scientific and regulated way. [12] In the area of planning dry powder firefighting, carrying out a similar improvement seems necessary as well; especially in the mirror that some dry powders available on the market, have five times higher fire extinguishing capabilities than the others [14].

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