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1. Object

The

“Safety When Using Liquid Coatings”

safety concept enables the systematic assessment of explosion hazards in paint application systems.

The user tips should be noted with regard to the applicability limits.

This explosion risk assessment is required to be carried out by operators of such systems within the member states of the European Union as part of the explosion protection document for all areas in which an explosive atmosphere can occur.

Examples of different process stages are presented to assist in drafting explosion protection documents.

2. System requirements

No special software is required to use the concept, though the application assumes that the Microsoft® Windows® operating system version 98 or higher with the appropriate Explorer is available.



MS EXCEL®, part of the Microsoft® Office® package, is also required in order to use the calculation tools.



Furthermore, MS WORD® is needed in order to use the templates provided for creating explosion protection documents.



If certain elements of the safety concept are not supported by your system, please check whether all the required software components are installed.

3. Safety concept structure

The concept's system differentiates between three categories of explosion protection measures in its main sections.

Measures aimed at preventing or restricting the occurrence of an explosive atmosphere are termed **A**-measures, , i.e. **A**tmosphere measures.

Measures whose purpose is to prevent inadmissible ignition sources are termed **I**-measures, or **I**gnition source avoidance measures.

Furthermore, there are measures termed **C**-measures for **C**onstruction and design explosion protection measures which do not serve to prevent an explosion but reduce the effects of explosions by appropriate design of the equipment.

These measures can be called up individually via the menu as and when required.



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Safety When Using Liquid Coatings

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Safety concept application

Examples derived from Practical Experience
included examples – explosion protection documents

BASF Coatings AG has further safety concepts using the same system.

To prevent confusion as a result of different nomenclature, the protective measures which are comparable in all the concepts are presented in the “Safety When Manufacturing Paints and Coatings” concept with the same abbreviations for system-related reasons.

4. The explosion protection concept

The main protective measures are selectively specified for typical application systems.

On selecting the Explosion Protection menu option, a matrix is displayed for the various protective measures which only contains the measures relevant to the respective scenario in question.

When assessing the explosion hazards of the system in question, therefore, it is only necessary to consider and evaluate the measures listed in the particular case.



In accordance to the European legal requirements there are measures which are stipulated obligatory. These measures are highlighted by red shaded table elements in the matrix.

Example:

AV - Use of ventilation to dilute solvent concentration

Equipmen	Mixing equipment for coating materials	Pneumatic application systems	Electrostatic spray systems	Driers	Combined spray and drying booths
A-measures	<u>A</u>	<u>A</u>	<u>A</u>	<u>A</u>	<u>A</u>
	<u>AR</u>	<u>AR</u>	<u>AR</u>		
		<u>AT</u>	<u>AT</u>		
		<u>AP</u>	<u>AP</u>		<u>AP</u>
	<u>AD</u>	<u>AD</u>	<u>AD</u>		<u>AD</u>
	<u>AV</u>	<u>AV</u>	<u>AV</u>	<u>AV</u>	<u>AV</u>
	<u>AE</u>				
		<u>AC</u>	<u>AC</u>	<u>AC</u>	<u>AC</u>
				<u>AI</u>	

An artificial ventilation is required for spray booth facilities obligatorily. As a result the specific measures listed for this kind of equipment in chapter AV must be realized.

The necessity of other red marked measure is depending on the specific facility and operation conditions.

Spray booth facilities for example with a limited degree of dilution above 25% of an explosive concentration need in addition to measure AV equipment to control the concentration as described in chapter AC.

A compensation of the AC measures is possible by realization of constructive explosion protection measures as defined in chapter CP.

The not highlighted A-measures are possible technical solutions for specific types of equipment, but the realization is not obligatory.

For the decision in which cases these optional measures can be used is described in the corresponding chapters, which can all be selected directly out of the matrix.

After realization of the identified A-measures the areas must be classified in zones with respect to the probability of the occurrence of an explosive atmosphere, if the occurrence cannot be excluded in general despite of the taken A-measures.

For zone classification the samples in chapter A can be used orienting.

Areas which must be classified in zone 0 to 2, must be analyzed depending potentially ignition sources, as they are listed in the matrix of I-measures with respect to the type of facility.

Equipment:	Mixing equipment for coating materials	Pneumatic application systems	Electrostatic spray systems	Driers	Combined spray and drying booths
I-measures	I	I	I	I	I
	IE 1, IE2, IE3, IE3.2, IE5, IE6, IE7, IE8	IE 1, IE2, IE3, IE3.1, IE3.2, IE6, IE7, IE8, IE10,	IE 1, IE2, IE3, IE3.1, IE3.2, IE6, IE7, IE8, IE10, IE13	IE 1	IE 1, IE2, IE3, IE3.1, IE3.2, IE6, IE7, IE8, IE10, IE13
	IT 1, IT3, IT4, IT5	IT 1, IT2, IT3, IT4, IT5	IT 1, IT2, IT3, IT4, IT5	IT 1, IT2, IT3, IT4	IT 1, IT2, IT3, IT4, IT5
	IS 1, IS2	IS 1, IS2	IS 1, IS2	IS 1, IS2	IS 1, IS2
	IR 1, IR2	IR 1, IR2	IR 1, IR2	IR 1, IR2	IR 1, IR2

It must be assessed if each ignition source is excluded by suitable countermeasures as required in the specific chapter.

If it is not possible, or only possible to an unsatisfactory extent, to rule out all ignition sources which are inadmissible for the zone (please see the table for the effectiveness of the ignition source in zones), the extent of any explosion must be restricted to a harmless level by means of the design measures outlined below.

Technical regulations require the mandatory implementation of certain C-measures under defined framework conditions. These measures are shown correspondingly highlighted. The exact description is laid down in the individual chapters.

Equipment:	Mixing equipment for coating materials	Pneumatic application systems	Electrostatic spray systems	Driers	Combined spray and drying booths
C-measures	C	C	C	C	C
				CM	
		CP	CP	CP	CP
			CS		CS

The non highlighted C-measures again describe technical measures which can optionally be realized by using proper technical solutions; but this is not obligatory required.

The technical realization of the measures derived from this systematical demands defines the Explosion Protection Concept for coatings application facilities.

The definition of this Explosion Protection Concept is based on common coatings application facilities and processes, how they are in use in ordinary spray booths and infrastructure equipment .

If the process to analyze deviates from this bases with respect to the equipment or the application process, the assessment cannot be limited on the measures selected by using the matrix.

In this case it is necessary to investigate the facility by taking all the described measures into account.

Therefore it can be selected 'content' to get an overview about all the possible explosion risks depending on the handling of coatings.



The screenshot shows the BASF website interface. The top left features the BASF logo and the text 'The Chemical Company'. The main header is 'Safety When Using Liquid Coatings'. A navigation menu on the left lists various categories, with 'Safety concept application' expanded to show sub-items: 'Content', 'Principles', 'Explosion Protection', 'A-measures', 'I-measures', 'C-measures', 'Ex-Documents', and 'Tools'. A red arrow points to the 'Content' item. The main content area displays 'Safety concept application' and a video thumbnail titled 'Examples derived from Practical Experience' with the subtitle 'included examples – explosion protection documents'.

5. Using the tools

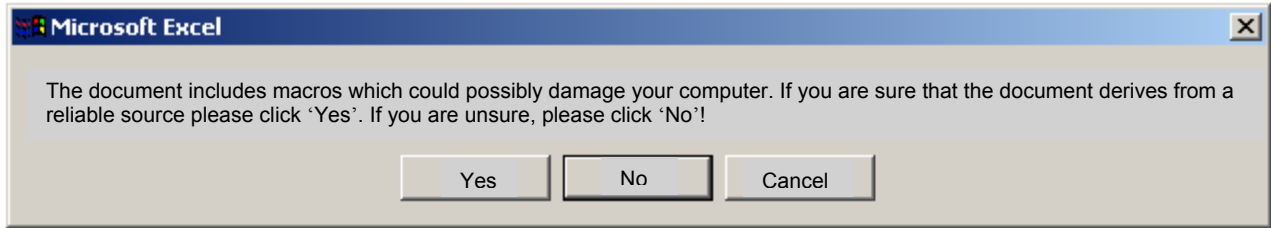
Certain safety-related characteristics are provided in the safety concept in tabular form as tools.

When assessing the combustibility of paint mist which can be assumed to be present during cleaning processes involving the use of high pressure in paint production, a mathematical algorithm can be used to determine the combustibility of paint sprays.

MS EXCEL® is automatically opened to carry out the calculations.


The calculation process involves the use of macros which may cause harm to the computer system if they are not from a trustworthy source.

The system therefore generates a warning like the following:



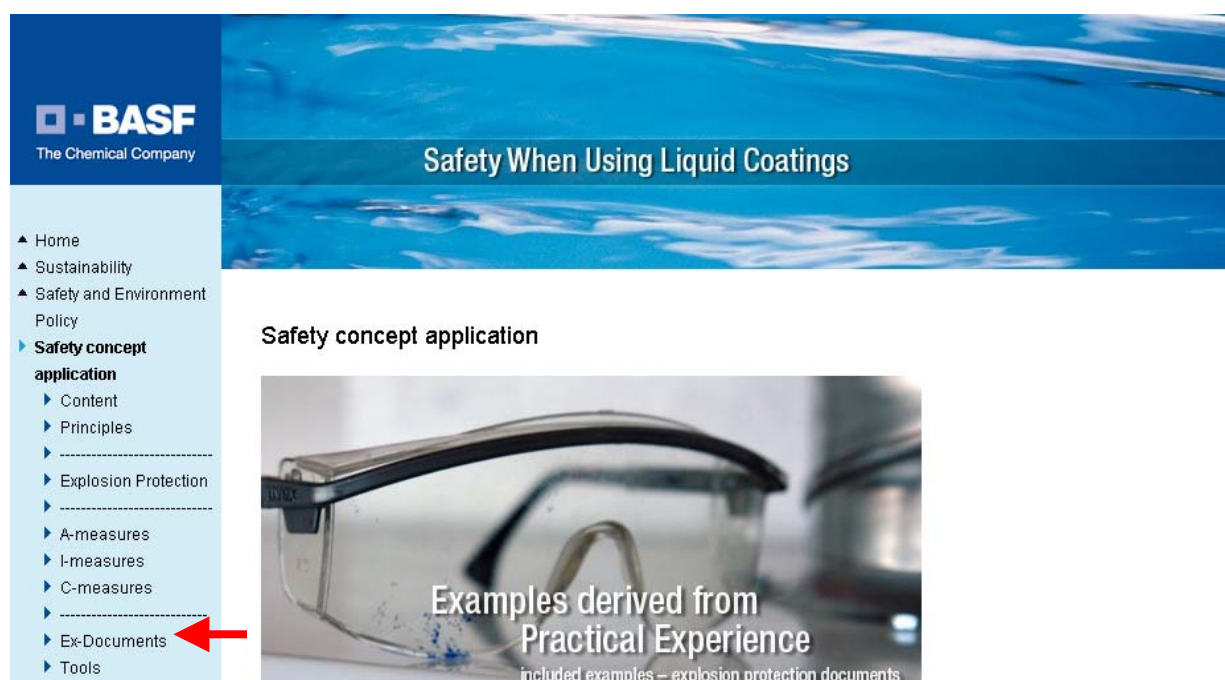
Please click “Yes” to confirm that you wish to use the calculation tools. The appropriate application is then displayed on your screen after a brief delay.

The input fields are not highlighted in the calculation sheets. These white fields require the mandatory input of data.

Coatings Solutions		Calculation module acc. to EN 1539 Ventilation system for chamber dryers (Method A)		 The Chemical Company	
Compartment drier for drying with high evaporation, drying die coatings and drying impregnating resins. Input is mandatory in the non-highlighted fields.					
Maximum admissible concentration of combustible materials in dryers					
Drying temperature 160 °C		Ignition temperature 200 °C		Limit temperature T_{LIM} 160 °C	
Drier operating conditions (operating temperature/safety equipment)	Basic requirements		Additional requirements		Calculation Maximum admissible concentration of combustible materials in dryers as % LEL
	Technical ventilation	Construction-based explosion protection by pressure relief	Concentration monitoring	Feed restriction of combustible materials by design of feed system	
	Control system to EN954-1 Category 3				
Alarm	Drier types with drying temperatures above limit temperature				

6. Sample explosion protection documents

The safety concept contains sample explosion protection documents which can be accessed directly via the navigation system.

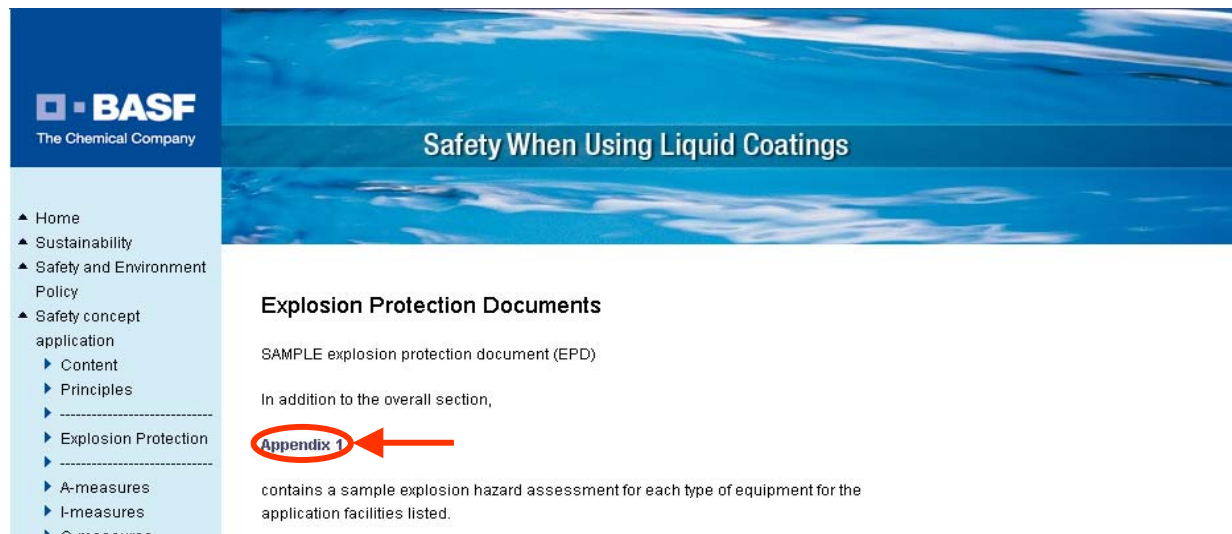


The necessary content of explosion protection documents is clearly defined by statutory requirements and specialist publications.

Requirements which apply in general to the entire application facility can be derived from these. A risk assessment (explosion hazard assessment) is also required to be conducted for each explosion-hazard area.

Correspondingly, the sample explosion protection document is designed in two modules.

The general details are presented in the main section by way of example. This section of the explosion protection document which is always applicable can be accessed in 'Appendix 1'.



The screenshot shows the BASF website interface. The top left features the BASF logo and the tagline 'The Chemical Company'. The main header is 'Safety When Using Liquid Coatings'. A navigation menu on the left lists various topics, with 'Explosion Protection' highlighted. The main content area is titled 'Explosion Protection Documents' and contains the following text: 'SAMPLE explosion protection document (EPD)', 'In addition to the overall section,', 'Appendix 1' (circled in red with an arrow pointing to it), and 'contains a sample explosion hazard assessment for each type of equipment for the application facilities listed.'

The risk assessment to be presented within the explosion protection document, by contrast, can only be drafted specifically for the relevant process stage and depends on the individual technical conditions of the systems.

Corresponding explosion hazard assessments, which can be accessed via ‘Appendix 1.1’ to ‘Appendix 1.17’, are therefore presented as a function of the relevant process stage.

7. Creating the explosion protection document

You can use the empty forms available under ‘Tools’ to create an explosion protection document for your system.

The following procedure is recommended:

Copy the general section of the explosion protection document from Appendix 1.
Adapt this section to your circumstances.

To create the explosion hazard assessment, please select the template designated as a sample explosion protection document from appendices 0.1 to 1.17 which corresponds to your process stage. However, this template should only be used as a guide.

You are recommended to use the empty forms to create the explosion hazard assessment to ensure that the system is dealt with completely and systematically.

Enter the plant section in question, the materials used by means of the numbering from the materials list also attached and the maximum operating temperature anticipated in the appropriate columns of the empty form.

Then decide, as a function of the materials and operating temperature, which zone would result without the application of A-measures. For paint spray there is the possibility of the occurrence of an explosive atmosphere as a function of the combustibility of the paint spray.

Section A provides assistance with the assessment. The sample explosion protection document can also be used as a guide.

Open the explosion protection concept for analysis purposes and check all the A-measures presented for the process stage to see whether an appropriate A-measure has been implemented in the system under assessment.

All the implemented A-measures must be documented in the appropriate column. Once all the existing A-measures have been shown, the next stage is to decide which remaining zone still has to be defined in the assessment area, taking account of the measures implemented.

The details in section A and the sample explosion protection documents can again be used to define this.

Once the zone has been defined, all the relevant ignition sources from the 'I-measures' matrix must then be evaluated with reference to the possibility of their occurring in the process stage, as laid down in the explosion protection concept.

If an ignition source can occur, it must be shown in the relevant column. Using the description within the relevant chapter, assess whether adequate countermeasures (I-measures) have been taken which will effectively prevent the occurrence of the ignition source.

The countermeasures taken must also be documented alongside the column containing the possible ignition sources.

Where ignition sources cannot be adequately prevented, the construction and design explosion protection measures taken can also be shown in this column.

Should a need for action for certain ignition sources be identified from the assessment, these measures should be recorded in the 'Notes' column.

Once all the areas have been analyzed in this way, the defined zones must be entered in corresponding zone plans.

If the system you have to assess is a special design which does not correspond to the basis used by the explosion protection concept, the analysis cannot be restricted to assessing the measures selectively displayed in the explosion protection concept. In these cases each of the measures shown in the Contents must be considered.

The procedure used for analysis and documentation can follow the same format, though a significantly greater input is required for such systems because no preselection of the relevant measures has taken place.

The general section (Appendix 1) must therefore be correspondingly supplemented within the specified tables with the individual explosion hazard assessments and the drawing numbers of the associated zone plans.

By following this process carefully as described, you not only end up with a document which meets the statutory requirements, but the systematic analysis of your system will give you an excellent overview of the safety level of your system and thus confirm that you meet the legal requirements.

A win-win situation from which you'll profit, we can safely say!