CERTIFIED PREMIUM INDUSTRIAL TOOLS

WHITE PAPER

SAFETY TOOLS

for explosive environments

Building a safer world

EGA Master

ART IN INNOVATION

BE SAFE...BE EFFICIENT

SAFETY TOOLS
for explosive environments

Workplace accidents that lead to loss of life remain one of the main challenges that some industries have. In a survey carried out during the Ferroforma International show in 2015, 51% of those surveyed thought that there is a direct relationship between work-place accidents and the tools used. This result is in line with EGA Master´s experience across the over 150 countries we distribute to.

The reality is that today, most companies and employees do not know how to work safely, and what tools need to be used in hazardous environments.

1- ATEX DIRECTIVES

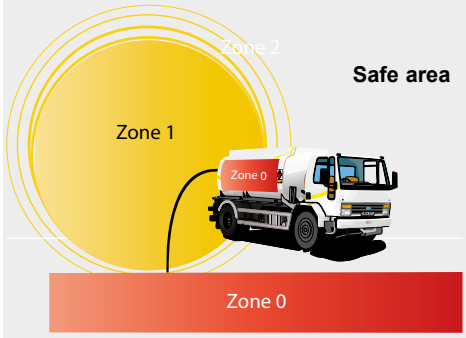
Many governments are gradually developing legislations, regulations and standards in order to enhance safe working conditions and practices. Europe is one of the regions that is leading the way with the development of a legislation (Directive 1999/92/EC) that defines the requirements for working safely in hazardous environments.

According to the Directive 1999/92/EC, and the EN 1127 norm it cites, standard steel tools are considered a source of ignition and hence a hazard in the presence of an explosive atmosphere. The Directive prohibits any source of ignition in such classified areas, and it declares hand tools as a source of mechanical sparks; so hand tools should be carefully selected avoiding or reducing the generation of risky sparks..

The EN 1127 norm specifies that steel tools can never be used in Zones 0/20;never in 1/21 or 2/22 if there is a group IIC gas in the atmosphere; and never in any classified area if the tools used create sparks during the normal use (chisels, hammers, files, etc.).

The Directive defines 3 different zones as shown in **Figure I.**

Figure I



ZONE 0/20	Danger is always present, for a long time or frequently.
ZONE 1/21	Danger is occasionally present.
ZONE 2/22	Danger is seldom present or present for a short time.

2- USE OF NON-SPARKING TOOLS

Non-Sparking tools are tools that generate low energy sparks, always below the ignition energy of the hazardous substances (gas or dust) present in the environment. Non-Sparking tools are therefore called so whenever the sparks caused are always below lower ignition limit, and thus safe to use in explosive environments.

Considering that the ignition energy is different for different types of gases, gases are classified into four main groups as show in the following table:

Explosion group	**Class of temperature (maximum surface temperature allowed)**					
Temperature of ignition	T1 (450 °C)	T2 (300°C)	T3 (200 °C)	T4 (135 °C)	T5 (100 °C)	T6 (85 °C)
	450 °C	300 - 450 °C	200 - 300 °C	135 - 300 °C	100 - 135 °C	85 - 100 °C
I	Methane					
IIA (Energy of ignition higher than 0,18 mJ)	Acetone Ammonia Benzene Ethylacetate Methanol Propane Toluene	i-amyl acetate n-butane n-butanol 1-butene Propylacetate i-propanol Vinylchloride	Amyl alcohol Gasolines Gas-oil Heating oil n-hexane	Acetaldehyde		
IIB (Energy of ignition between 0.06 & 0.18 mJ)	Hydrogen cyanide Coal gas (lighting gas)	1.3-butadiene 1.4-dioxane Ethylene Ethylene oxide	Dimethyl ether Ethyl glycol Hydrogen sulphide	Diethyleter		
IIC (Energy of ignition less than 0,06 mJ)	Hydrogen Water gas (CO+H2)	Acetylene			Carbon disulphide Ethyl nitrate	

Gases with the lowest ignition energy are the most dangerous ones since the probability of a spark reaching the ignition energy is higher. As a result, it is important that the right non-spark tool is always chosen.

Non-sparking tools offering is mainly divided in two categories: Aluminium-Bronce (Al-Bron) and Copper-Beryllium (Cu-Be). Cu-Be tools are the safest ones since the sparks they generate have the lowest energy level. Cu-Be tools are therefore safe to be used across all gas groups (I,IIA,IIB, IIC).

Cu-Be tools are also harder and more resistant than Al-Bron tools, and hence last longer if used frequently or demandingly. The following tables provide a summary of the exact composition and benefits of Al-Bron and Cu-Be tools:

Cu-Be tools are the safest ones since they can be used in all groups (I,IIA,IIB, IIC). Cu-Be tools are also harder than Al-Bron tools, and hence last longer.

Copper-Berylium Alloy		
Composition	Be	1.8%-2%
	Ni+Co	0.2%-1.2%
	other	<0.5%
	rest	Cu
Hardness	283-365 Brinell	
Tensile Strength	1250 N/mm2	

Aluminium-Bronze Alloy		
Composition	Al	10%-12%
	Ni	4%-6%
	Fe+Mn	<5.8%
	other	<0.5%
	rest	Cu
Hardness	229-291 Brinell	
Tensile Strength	800 N/mm2	

CONCEPT	Cu-Be
Hardness	283-365 Brinell
Magnetism	Non ferrous substance in the composition makes it safer when non-magnetic applications are required
Durability	Much higher due to the higher hardness and tensile strength. Higher efforts can be made
Price	Higher price due to the special raw material used

CONCEPT	Al-Bron
Hardness	229-291 Brinell
Magnetism	Minimum ferrous component makes them not 100% non-magnetic, although its low magnetism make it appropiate for non critical non-magnetic applications
Durability	Not as much as Cu-Be
Price	Around 30% lower price

EGA Master offers the widest range of non-sparking tools in both Al-Bron and Cu-Be alloys. EGA Master has also developed tools made out of ACETILEX alloy, indispensable when there is acetylene gas in the environment.

In the presence of acetylene gas, copper and acetylene react to form highly explosive acetylides. Considering that both Cu-Be and Al-Bron alloys have a high content of copper in their composition, Cu-Be or Al-Bron alloys are not safe. Tools made out of ACETILEX should therefore be used instead.

EGA Master offers the widest range of tools in both Al-Bron and Cu-Be alloys to ensure safe working conditions.

3. QUESTIONS AND ANSWERS

In order to provide users and decision makers around the world with a simple yet powerful source of knowledge, we hereby summarize the most important information related to the use of non-spark tools to work safely in hazardous environments:

1- What is an explosive atmosphere?
It is a mixture that flammable substances in the form of gases, vapours, mists or dusts form with air. When such a mixture is formed, an ignition would lead to a combustion that spreads to the entire unburned mixture.

2- Does a flammable substance on its own represent an explosive atmosphere?
No, it does not. Sufficient air and substance mixture must exist. Each substance has a minimum and maximum percentage of air (oxygen) required to enable a combustion. Without air (oxygen) a flammable substance on its own does not represent an explosive atmosphere.

3- Then, a liquid is not considered explosive atmosphere?

The liquid itself is not an explosive atmosphere. However, vapours generated on its surface, if mixed with air, can result in an explosive atmosphere.

4- What directives regulates work in or near explosive atmospheres?

ATEX is the name given to the European Directives for regulating work in or close to explosive atmospheres. More specifically, the Directive 1999/92 / EC is the main directive that outlines the minimum requirements for improving the health and safety protection of workers at risk from explosive athmospheres.

5- Should we identify and indicate areas with potentially explosive atmospheres?

Yes, it is necessary to classify areas according to the likelihood of having a hazardous explosive atmosphere. It is classified as Zone 0 for gases or Zone 20 for dust if an explosive atmosphere is present for periods of more than 1000 hours per year. Zone 1 (or 21) if an explosive atmosphere is likely to occur between 10 and 1000 hours per year. Zone 2 if an explosive atmosphere persists between 0.1 hours (6 minutes) and 10 hours a year. If this period is shorter, then there is no need to classify the area.

6- What kind of measures should be taken into account in these areas?

The directive states that all potential ignition sources must be avoided, but if it is not possible, they should be at least reduced to a minimum. Measures should also be taken to mitigate the detrimental effects of a possible deflagration.

The Directive 1999/92 / EC outlines the minimimum requirements for improving the health and safety protection of workers at risk from explosive athmospheres.

7- Would it be enough to check with detection equipment that there is no explosive atmosphere when working?

No, it is not enough. It is compulsory to evaluate all possible measures to eliminate all foreseeable risk. Nevertheless, it is important to highlight that according to the law all necessary safety measures need to be taken when working in or close to an explosive atmosphere or not. If the zone is ATEX classified, all means must be put in place in order to avoid or reduce ignition sources and mitigate the consequences of an explosion.

8- What elements does the Directive affect?

To all those elements that could generate a spark, including machines, devices, clothing and tools among others.

9- Are normal steel tools a source of ignition?

Yes they are according to Directive 1999/92 / EC and EN 1127

10- So, can I ever use steel tools in hazardous areas?
EN 1127 specifies that no steel tools may ever be used in Zones 0, 20. In Zones 1 and 2, type A steel tools are allowed (do not generate sparks in normal use: screwdrivers), and type B (hammers, files, saws, etc.) if it can be guaranteed that there is no explosive atmosphere in the workplace. In areas with presence of Group IIC gases, NO steel tools are allowed.
In Zones 21 and 22, type A tools are allowed. Type B tools are allowed as long as a shielding between the workplace and the explosive atmosphere is guaranteed, in addition to the removal of dust deposits, keeping the workplace sufficiently humid to ensure that these deposits do not rise.

11- What is a non-sparking tool?

It is a tool made of an alloy whose sparks never have enough energy to generate the deflagration of an explosive atmosphere. Such tools are considered safe.

12- Why is it safe?

The main reason why non-sparking tools are safe is because their use will not generate energy or heat at temperatures that will reach the ignition point of a gas. This is because the alloys used have a very low friction coefficient.

13- How can be verified that the tools are safe?

Non-spark tools are tested under extreme conditions that are hundreds of times more stringent than those that may exist in a common explosive environment. Alloy samples are grinded at high speeds creating sparks that are directed to an explosive atmosphere. This particular atmosphere is created by selecting the most dangerous gas (with the lowest ignition energy), and the optimal mix of oxygen to maximize the deflagration capacity. If after 100 tests the athmosphere has not deflagrated, the alloy is considered completely safe.

14- What non-sparking alloys exist?

The most common alloys are copper beryllium (also called beryllium copper or Cu-Be) and aluminum bronze (also called Al-bron).

15- What is the difference between the two?

Although copper-beryllium alloy is priced between 20% and 40% higher than the aluminum bronze, it also has superior mechanical and safety properties, which generally make it the most profitable decision over a longer period of time.

- The Cu-Be alloy has a hardness of up to 40HRC, 40% higher than the Al-Bron, so it wears less and has a 40% longer life.

- The Cu-Be resistance is a 50% higher than the Al-Bron, and hence it resists 50% more effort than an Al-Bron equivalent tool.

- The Cu-Be is completely non-magnetic. The Al-Bron contains 3% of iron, and hence it is slightly magnetic.

The Cu-Be alloy is the best choice in 90% of cases, as its properties make it more profitable and safe.

- The Cu-Be is safer because its sparks have less energy than the Al-Bron. The Cu-Be is especially recommended in atmospheres listed in the group IIC.

16- How do I decide which alloy is the best option for me?

Cu-Be is the best choice in 90% of cases, as its best properties make it more profitable and safe. The Al-Bron is only competitive when the following four conditions are met simultaneously:

- The tool will be used very occasionally, not periodically.

- Great efforts will not be made.

- Complete non-magnetism is not required.

- Will not be used in IIC group atmospheres. If all of these conditions occur at once, the Al-Bron may be the best option. But if only one of these conditions is not met, then the Cu-Be is the right decision.

17- Are there other safe materials or alloys for hazardous atmospheres apart from the Cu-Be and Al-Bron?

Yes, other alloys include, for example, copper, tin bronze, brass or manganese bronze.

18- Are copper, brass or tin bronze, substitutes for Cu-Be and Al-Bron?

No. While the sparks will not have enough energy to ignite an explosive atmosphere, their hardness and resistance levels are lower than those of the Cu-Be and Al-Bron (between 4 to 6 times lower), so they are not suitable for hand tools.

Only mallets or hammers can be manufactured in these alloys. Nonetheless, their low useful life makes them a less cost-effective option even in the short term.

Therefore, copper, brass and tin bronze mallets and hammers are not a substitute for Cu-Be or Al-Bron. These alloys are useful and necessary only when a very low hardness is required.

19- Is it true that the Cu-Be is carcinogenic?

There is some confusion about this issue. Yes, it is proven that beryllium in the form of dust, inhaled continuously over long periods of time (for example in foundries where this alloy is melted and appropriate safety measures are not in place) can cause lung cancer.

However, there is no evidence or recorded cases about Cu-Be causing any cancer. The reasons are:

a) Cu-Be has only 2% of beryllium in its composition.

b) It is not in powder form, so you do not inhale it.

c) The exposure is minimal.

It is for this reason that there is no country in the world to prohibit or restrict the use of this alloy. Moreover, it is a common alloy in the coating of certain aircraft components, precisely because of its low coefficient of friction. Therefore, the risk that Cu-Be tools represent for the user is infinitely inferior to other agents to which we are exposed to on a daily basis (e.g. air pollution).

20- Is there any non-sparking alloy without beryllium, and also completely non-magnetic?

Yes, bronze manganese (Mn-Bron). It is similar to Al-Bron in terms of its physical properties, but the lack of iron in its composition makes it completely non-magnetic. However, it is not often used in the manufacture of hand tools because despite its benefits, it carries a higher cost.

21- What alloy should be used in an atmosphere of acetylene?

Acetylene is a gas in the IIC group, and therefore common non-sparking alloys have no capacity to trigger its deflagration. However, acetylene is a substance that reacts with any alloy with a copper composition higher than 65%, creating a new compound called copper acetylide, which is highly explosive. As both Cu-Be alloys and Al-Bron contain more than 80% of copper; they must never be used in acetylene environments. In such environments, steel tools would likely be safer than Cu-Be tools.

However, EGA Master has developed an alloy called ACETILEX® that is safe to use in environments with Acetylene. ACETILEX® tools have less than 65% of copper in their composition, making it the only completely safe alternative on the market for working in environments with acetylene.

22- And plastic-coated steel tools safe?

They are not completely safe. Considering that it is not possible to coat all active parts of a tool, plastic coatead tools are not considered safe to be be used in the presence of an explosive athmosphere. They are therefore called spark reduction tools, not non-sparking tools.

Their use is therefore not recommended for the following reasons:

a) They do not avoid the risk of explosion

b) The plastic coating is susceptible to become damaged, further increasing the exposed areas

c) The standard EN 1127-1 prohibits the use of steel made tools in most zones and groups of gas.

ACETILEX®, developed by EGA Master, is a safe alloy to work in environments with acetylene gas.

4. CERTIFICATIONS

Considering the potential catastrophic consequences associated with choosing the wrong tool, it is critical that workers are 100% sure that the tools they are using have the right. This is best achieved through the certification of the tools by independent third parties.

EGA Master´s non-sparking tools are certified by the prestigious German Federal Institute for Materials Research and Testing (BAM), which is a European Union approved laboratory to certify according to 94/9/EG Directive.

CERTIFICADO
DE CONFORMIDAD

Certificamos que las herramientas antichispa fabricadas por EGA Master en **Aluminio-Bronce** cumplen con la Directiva Europea ATEX 1999/92/EC en las zonas de trabajo 1 y 2 (Gas, Vapor) y/o Zonas 21 y 22 (Polvo). Además, son seguras en grupos de explosión I, IIA, IIB, IIC (excepto acetileno por la formación química de acetilita explosiva) de acuerdo a la ISO/IEC 80079-20-1:2017.

Composición química
Al: *10% - 12%*
Ni: *4% - 6%*
Fe+Mn: *5,8% - 7%*
Resto: *Cu+Al+Ni+Fe+Mn ≥99,0 %*
Dureza
241-311 Brinell
Resistencia a la tracción
800 N/mm2

Certificamos que las herramientas **Cobre-Berilio** fabricadas por EGA Master cumplen con la Directiva Europea ATEX 1999/92/EC en las zonas de trabajo 1 y 2 (Gas, Vapor) y/o Zonas 21 y 22 (Polvo). Además, son seguras en grupos de explosión I, IIA, IIB, IIC (excepto acetileno por la formación química de acetilita explosiva) de acuerdo a la ISO/IEC 80079-20-1:2017.

Composición química
Be: *1,8 % - 2,3 %*
Ni+Co: *> 0,2 %*
Co+Ni+Fe: *< 1,2 %*
Resto: *Cu+Be+Co+Ni+Fe ≥ 99,0 %*
Dureza
311- 408 Brinell
Resistencia a la tracción
1250 N/mm2

CERTIFICATE
OF COMPLIANCE

We hereby certify that, EGA Master **Aluminum-Bronze** Tools fulfill the demand in the European ATEX Directive 1999/92/EC for work in Zones 1&2 (Gas, Mists or Vapors) and/or 21&22 (Dusts). EGA Master Aluminum-Bronze Tools are totally safe against explosion risk working in environments of all gases classified as Risk Groups I, IIA, IIB and IIC (except acetylene) according to ISO/IEC 80079-20-1:2017.

Chemical composition percentage
Al: *10% - 12%*
Ni: *4% - 6%*
Fe+Mn: *5,8% - 7%*
Cu+Al+Ni+Fe+Mn ≥99,0 % ***Balance***
Hardness
241-311 Brinell
Tensile Strength-Break
800 N/mm2

We hereby certify that, EGA Master **Copper-Beryllium** Tools fulfill the demand in the European ATEX Directive 1999/92/EC for work in Zones 1&2 (Gas, Mists or Vapors) and/or 21&22 (Dusts). EGA Master Aluminum-Bronze Tools are totally safe against explosion risk working in environments of all gases classified as Risk Groups I, IIA, IIB and IIC (except acetylene) according to ISO/IEC 80079-20-1:2017.

Chemical composition percentage
Be: *1,8 % - 2,3 %*
Ni+Co: *> 0,2 %*
Co+Ni+Fe: *< 1,2 %*
Cu+Be+Co+Ni+Fe ≥ 99,0 % ***Balance***
Hardness
311- 408 Brinell
Tensile Strength-Break
1250 N/mm2

EGA MASTER S.L.
Aner Garmendia
CEO at EGA Master

SAFETY TOOLS
for explosive environments

Certificate

N°: BAM/ZBF/008/10

3rd Revised version

BAM
Bundesanstalt für Materialforschung und -prüfung

12200 Berlin, Germany
T: +49 30 8104 0
F: +49 30 8104 7 2222

Hereby it is confirmed by the BAM Certification Body, that the

Material aluminium-bronze

of the manufacturer

EGA Master S.L.
Zorrolleta 11, Jundiz Industrial Estate
01015 Vitoria
SPAIN

meets the requirements of **BAM Standard operating procedure „StAA-NEG-005": „StAA zur Schlagfunkenprüfung von Werkstoffpaarungen" dated 2019-07-02** and thus the non-sparking tools made of this material are appropriate for use in potentially explosive atmospheres of zone 1 and/or 21 according to Directive 1999/92/EC of all explosion groups (I, IIA, IIB & IIC) according to ISO/IEC 80079-20-1:2017, if the terms and conditions set out in the annex to this certificate are met.

The certification is based on certification contract N° **BAM-ZBF-0004-2020-EGA dated 2020-08-26** and comprises according to standard ISO/IEC 17065:2012 a design-type test with the manufacturer's declaration of conformity (BAM Certification system I).
The products certified by BAM may be labelled with the certification mark "BAM design-type tested" / "BAM Baumustergeprüft".

The certificate is valid until 1 August 2025.

BAM test report **20017926; BZS-GS/024/20 dated 19 February 2021** as well as procedure no. **BZS-GS/024/20** form the basis of this certificate.

Bundesanstalt für Materialforschung und -prüfung (BAM)
Unter den Eichen 87,12205 Berlin, **2021-02-23**

Dr. J. Sunderkötter
BAM Certification Officer

Dr. R. Grätz
BAM Assessor

Distribution list: 1st Certificate holder — 2nd BAM Certification Body

Sicherheit in Technik und Chemie

BAM

Bundesanstalt für Materialforschung und -prüfung

12200 Berlin, Germany
T: +49 30 8104-0
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Certificate

N°: BAM/ZBF/007/10

3rd Revised version

Hereby it is confirmed by the BAM Certification Body, that the

Material beryllium-copper

of the manufacturer

EGA Master S.L.
Zorrolleta 11, Jundiz Industrial Estate
01015 Vitoria
SPAIN

meets the requirements of **BAM Standard operating procedure „StAA-NEG-005": „StAA zur Schlagfunkenprüfung von Werkstoffpaarungen" dated 2019-07-02** and thus the non-sparking tools made of this material are appropriate for use in potentially explosive atmospheres of zone 1 and/or 21 according to Directive 1999/92/EC of all explosion groups (I, IIA, IIB & IIC) according to ISO/IEC 80079-20-1:2017, if the terms and conditions set out in the annex to this certificate are met.

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Bundesanstalt für Materialforschung und -prüfung (BAM)
Unter den Eichen 87,12205 Berlin, **2021-02-23**

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Sicherheit in Technik und Chemie

CERTIFICATE

5. PRESENTATION

EGA Master is a European manufacturer of Premium industrial tools for the most demanding industrial users. It offers a complete one-stop solution based on continuous innovation that significantly improves safety and efficiency.

The range currently includes Industrial tools, Pipe tools, 1000V Insulated tools, ESD Electro-Dissipative tools, Non-sparking tools, Titanium non-magnetic tools, Anti-drop tools, Stainless steel tools, Pneumatic tools, Hydraulic Tools, Underwater tools, ATEX-certified Intrinsically-Safe Explosion-Proof Instruments and Tool Control Systems.

EGA Master products and solutions are used by the most demanding industries such as aerospace, military, automotive, shipbuilding, railway, power, construction, oil & gas or mining.

Some end users of EGA Master are companies and institutions such as Exxon Mobil, Shell, Airbus, United Nations, NATO, Coca Cola, Audi, Volkswagen, Nissan-Renault, Mercedes-Benz, Siemens or Philips. You can find a list of our most important end users, as well as some case studies in the following link: (https://www.egamaster.com/en/references).

Relevant facts about EGA Master:

• Exports 90% of its production to over 150 countries across five continents.

• Is ISO 9001, ISO 14001, ISO 37001 and ISO 45001 certified.

• Offers unlimited life-time guarantee for its tools.

• Is the most awarded tool manufacturer, as evidenced by the attached long list of awards.

SOME END USERS

ENERTIME

France

Thomas Delaire
Responsible for purchases and Projects

"With its wide catalog and speed, EGA Master has allowed us to find the perfect tool for each operation. The complete customization of their tools has allowed us to gain efficiency and to work with complete safety"

ADNOC

UAE

K.K.R.
Senior Engineer- Workshop Plant Operations Division

"The tools performance remained very good as per the feedback received from my team"

PPG

Mexico

Eng. Mario Feregrino
EHS Team Leader

"At PPG safety is very important. Through EGA Master we have access to the solutions that we need to ensure the safety and productivity of our employees."

SONATRACH

Algeria

Mohamed Khelif
Mechanical Engineer

"EGA Master is a manufacturer that offers very good tools in terms of reliability, durability and finish."

ENDEL ENGIE

Reunion Island

Bertrand Baret
Purchasing Manager

"We are always looking to work with suppliers that can provide solutions that meet our needs. The ability of EGA Master to innovate and provide such a flexible service is of great value to us".

TESTIMONIALS

EGA Master

ART IN INNOVATION

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