IMPROVED HEALTH STANDARDS THROUGH REDUCTION OF HAZARDOUS CONTENTS IN THE WELDING FUME

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Hazardous welding fume reduction as a critical factor in increasing the health and safety standards for welders.

Health and workplace safety are a core values of voestalpine Böhler Welding and we have taken it as our responsibility to ensure the highest health and safety standards for our customers with the products and the services we provide.

Health and safety enjoys the highest priority in our corporate philosophy and is fundamental to our entire business.

Why is health and safety so important? This question may seem trivial at first, but it is a vital issue. We firmly believe that every person has the right to work in an environment which is safe and healthy, without any fear of injuries or health risks.

We value the lives and well-being of our customers. Customers expect from us not only high-quality products and services, but also proof that we care about health and safety standards.

Our commitment to health and safety extends to all levels of our company.

This article will provide you with comprehensive insight into our approach to minimize risks in relation to welding fumes.

We are convinced that investing in health and safety is not only the right thing to do, but something that will also make your company more successful and sustainable in the long term. We invite you to walk this path with us to create a safer and healthier working environment together.

RISKS OF WELDING FUMES

Welding generates a complex mixture of gases and, in particular, certain fume contents can present a health risk to welders. In recent years health and safety requirements have become more stringent, being especially driven by specific regulations.

Extensive research and tests have also shown that certain metals and specific welding processes lead to a higher risk potential.

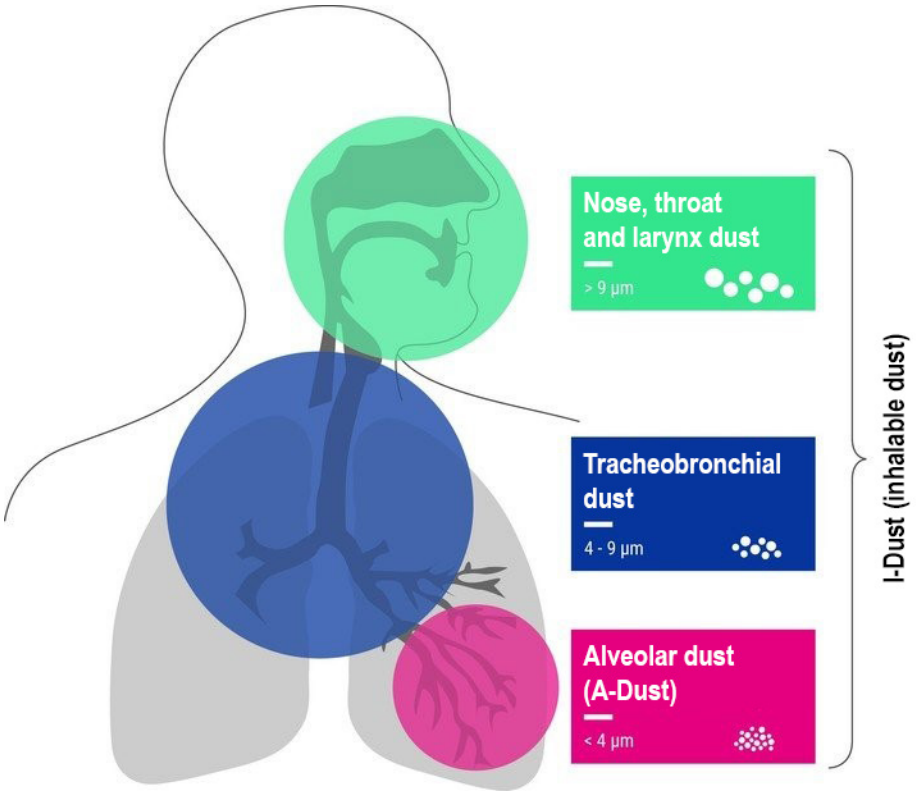
Of course, it is of the utmost importance for voestalpine Böhler Welding to avoid or, if avoidance is not completely possible, to minimize the risk of hazardous welding fumes in the products we offer and, at the very least, to provide the best possible personal protection equipment for welders.

HUMAN RESPIRATORY SYSTEM

The human respiratory system is divided into the upper airway system, which comprises the nose, throat and oral cavity, and the lower airway system, which comprises the trachea, bronchi and all airways that are intensively separated from each other in the lungs.

All particles smaller than 10 micrometres (µm) are difficult for the nose and throat to filter and therefore enter the lungs directly.

Welding produces fumes and gases with particles between 0.01 µm to 10 µm in size, depending on many different aspects. The fact is, however, that welding fumes can penetrate deep into our lungs without us immediately realising it. This is a constant problem with welding. We often only feel the consequences of welding fumes years later.



Source “TRGS 528”

EMISSION RATES AND RELEASE OF WELD FUMES

From a study by the European Chemicals Agency (ECHA) on welding fumes and fumes from other processes that similarly generate fumes in the workplace, we know that different welding processes have different emission rates. To provide unsurpassed protection for the welder, the highest emission rates and hazardous chemicals must either be avoided or minimized to as great an extent as possible.

The following aspects influence the composition, the rate of generation and the particle size of welding fumes.

- The chemical composition of the base material and the welding wire
- The welding process parameters (current, shielding gas used, technique)
- Surface coating and contamination of the material and welding wire
- Local condition of the workplace (indoor, outdoor, enclosed area)
- Workplace control measures and how effective they are (ventilation, local exhaust ventilation, automation of the welding process, extraction at source)

This study clearly shows that TIG or SAW welding, for example, has a rather low emission rate, while MIG/MAG welding with solid wires has a high emission rate, measured in mg/s. It is also evident that MAG cored wire welding (FCAW) even has a very high rate of emission in certain cases.

Chemical composition of the base material and weld wire and the most hazardous welding fumes

The ECHA study also shows that weld fume contents can be categorized into stressful for the respiratory tract, carcinogenic or toxic. In this article we want to concentrate on Cr(VI) and Mn as both elements pose a high risk on welders' health.

When Cr(VI) occurs in hexavalent form during welding, the fumes are highly toxic and can damage the eyes, skin, nose and throat and cause different types of cancers. On the other hand, manganese oxide fumes can lead to manganese accumulation and can damage the lungs, liver, kidney and the central nervous system.

HOW TO PROTECT WELDERS FROM HAZARDOUS WELDING FUMES

Safety in the workplace is the key factor for the protection of welders and it is the responsibility of the employer to ensure workplace safety according to workplace environment and health requirements. Within voestalpine Böhler Welding health and safety is a top priority and is reflected in the wide range of welding equipment, consumables, personal protective equipment and welding automation offered.

Which measures is voestalpine Böhler Welding taking to reduce the welder's exposure to welding fumes?

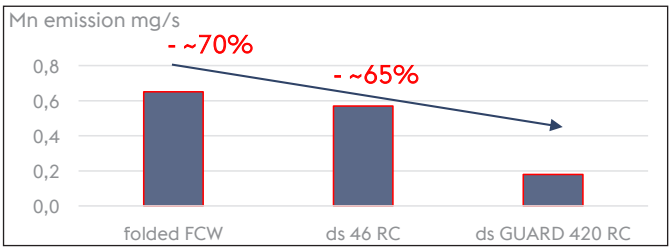
We follow the so-called STOP principle.

S – Stands for Substitution at the Source: Chemical composition of welding consumables

In order to minimize the risk posed by our flux cored wire range, voestalpine Böhler Welding has developed the GUARD consumables range: diamondspark GUARD with significantly reduced emission of manganese fumes during the welding process, and FOXcore GUARD with significantly reduced emission of Cr(VI). In this case, the very toxic fumes from welding consumables are also minimized.

Our diamondspark GUARD rutile cored and metal cored wires are used in the general construction and shipyard industries. As you can see in the graphs below, diamondspark GUARD cored wires are the perfect protection for welders.

diamondspark GUARD 420 RC

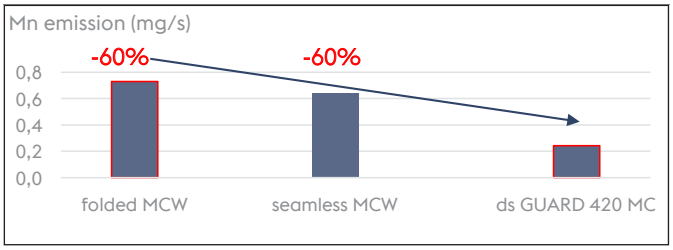


Welding paratmeters	
Shielding gas	M21 (82%Ar-18%CO_2)
Ampere	240 A
Voltage	28,5 V
Wire diameter	1,20 mm

» - 70 % Mn emission in comparison to unalloyed folded flux cored wires

» - 65 % Mn emission in comparison to unalloyed seamless cored wires

diamondspark GUARD 420 MC



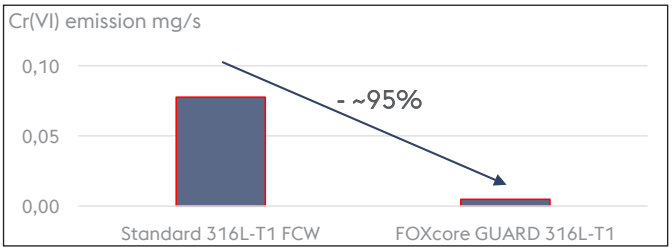
Welding paratmeters	
Shielding gas	M21 (82%Ar-18%CO_2)
Ampere	270 A
Voltage	30 V
Wire diameter	1,20 mm

» - 60 % Mn emission vs unalloyed folded MCW

» - 60 % Mn emission vs unalloyed seamless metal cored wires

Our FOXcore GUARD range consists of high-alloyed, austenitic, stainless flux cored wires with low Cr(VI) emission. The airborne Cr(VI) has been reduced without compromising weldability. The high productivity and performance is maintained. We have several different high-alloyed flux cored wires in our range for welding stainless steels, low-alloy steels and dissimilar welds. One example of this can be seen in the reduction in Cr(VI) emissions of our FOXcore GUARD 316L-T1.

FOXcore GUARD 316L-T1



Welding paratmeters	
Shielding gas	M21 (82%Ar-18%CO_2)
Ampere	270 A
Voltage	32 V
Wire diameter	1,20 mm

» -95 % Cr(VI) Emission vs Standard 316L-T1 Fülldrähten

T – stands for Technical Solution: Isolation, engineering controls and automation of the welding process

Isolating or automating the welding process would be another way to reduce the risks from welding fumes, as the welding area is then separated from the rest of the workplace.

There is also the opportunity to improve the health and safety equipment of the welding area itself by installing the most sophisticated fume extraction systems to minimise exposure to potential welding fumes in the workplace.

Isolation and automation:
voestalpine Böhler Welding has taken a further step in the field of the collaborative robotics with the development of the CO-BRO® GUARD, a collaborative welding cell in combination with welding protection.

Flexibility, ease of use, mobility, the best welding performance and maximum health, safety and environmental protection were the driving forces behind the inclusion of the CO-BRO® GUARD in our product range.

The exclusive GUARD enclosure guarantees the max. HSE protection available today. The CO-BRO® GUARD completely separates the welding process from anything else

in the workshop near the machining environment and incorporates the GUARD fume concept with an advanced fume extraction system, both integrated with high vacuum type (fumes extraction torch) or roof mounted/under the table low vacuum ready.

Welding Process:
In terms of welding processes, voestalpine Böhler Welding optimised the existing rapiDeep GMAW process by fine-tuning it with the GUARD welding consumables.

rapiDeep is an innovative welding process based on a highly concentrated arc, which results in a uniform reduction in heat input, greater precision, easier control, deeper penetration and a lower risk of undercuts.

This can significantly increase the welding speed, which has a direct impact on cost savings (higher productivity, less welding time). The R&D engineers at voestalpine Böhler Welding have found that narrowing and shortening the arc is also beneficial in terms of fume emissions. On that basis, specific synergic welding programmes were developed for the GUARD welding consumables based on rapiDeep in order to further improve their performance in this aspect.

O – stands for Organization Solutions:

voestalpine Böhler Welding is committed to employee and welder protection and offers innovative solutions for the health of welders.

This is particularly associated with health and safety training and raising awareness of the potential hazards of welding fumes, UV and IR radiation.

Health and safety awareness is part of our technical advice to customers, part of our external communication and special training courses help to further raise awareness.

Evolution Vision^{65FM} Air Kit

P – stands for Protective Measures: Providing personal protective equipment (PPE) with the highest level of protection

PPE is the last barrier for the welder, protecting them from inhaling harmful fumes and gases. Welding helmets from voestalpine Böhler Welding, in particular, offer the highest possible protection when used in conjunction with powered air-purifying respiratory (PAPR) systems, as they are certified as TH3. This makes it possible to breathe 99.8 % particle-free air. If the PAPR system is used with gas filters, the level of protection goes even further, as it protects not only against welding fumes, but also against gases.

PPE is a “must have” for the daily work of a welder. However, there are work steps in the preparation and post-processing of the weld seam where the importance of PPE is still too rarely taken into account. The helmet is flipped up or removed too quickly and this leads to the inhalation of residual fumes, particles and gases from the working environment.

Our Evolution Vision flip-up welding helmets, with their UHD ADF displays and large, clear visors, are ideal for providing welders with the optimal protection from particles, spatters slag and welding fume before, during and after welding. Only when the helmets are used together with our PAPR Systems are the lungs also optimally protected from welding fumes.

A SAFE AND HEALTHY WORKING ENVIRONMENT FOR WELDERS

The reduction of welding fumes is critical for the safety of the welder and will become even more important in the future. The exchange of information, knowledge and research make it clear that certain fumes are dangerous and can be avoided by taking certain measures. The increased safety standards are a great benefit for the health of welders.

Manufacturers of welding consumables, equipment and personal equipment can focus on reducing fume emissions, which ultimately leads to better welder health, better working conditions and greater satisfaction.

DORIS MISSBICHLER

SPECIALIST GLOBAL TECHNICAL EDITING

I have been working for voestalpine Böhler Welding since 2009 in different positions in Marketing, Project Management, Industry Segment Management and Global Key Account Management. In my current position I am responsible for external content in Global Marketing.

I love the big diversity of different topics and technical solutions which are part of our communication. It is great to see our content developing in an emotional message.

FRANCESCO CICCOMASCOLO

HEAD OF FULL WELDING SOLUTIONS

I have been working for voestalpine Böhler Welding since 2012 and in my actual role I am managing projects which combine welding equipment, automation, consumables and accessories to develop turn-key solutions adding value through know-how in metallurgy and applications.

Dealing with different types of mechanization and automation in welding is part of my working life in the last two decades.

THOMAS BAUER

GLOBAL PRODUCT MANAGER PPE & ACCESSORIES / SPECIALIST INDUSTRIAL DESIGNER

As a designer, I was able to start in the up-and-coming PPE (Personal Protective Equipment) sector at voestalpine Böhler Welding in 2019 and give free rein to my creative side to shape the appearance of our PPE product portfolio and give some special editions their shape and appearance.

With the additional appointment as product manager for PPE and accessories 2021, I was also given the task of further developing our existing product portfolio and adding PPE products that are certified to the highest standards and thus contribute to the protection of the welder.

FILIPPO CAMPACI

GLOBAL PRODUCT MANAGEMENT FLUX CORED WIRES

I am Global Product Manager for flux cored wires and responsible for meeting the new stricter requirements for welding fumes as well as making our product range as safe as possible. We are working on reduction of Mn and Cr(VI) content in our wires to reduce the fumes from those materials during the welding process and to raise health standards during welding.

JOIN! voestalpine Böhler Welding

We are a leader in the welding industry with over 100 years of experience, more than 50 subsidiaries and more than 4,000 distribution partners around the world. Our extensive product portfolio and welding expertise combined with our global presence guarantees we are close when you need us. Having a profound understanding of your needs enables us to solve your demanding challenges with Full Welding Solutions - perfectly synchronized and as unique as your company.

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