

## **Solutions Flash**

MetcoShield TSA solution packages for CUI applications benefit refineries and processing plants

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## Today's situation

### Technology

As global industrialization increases, the demand for products from oil refineries, natural gas refineries and chemical processing plants is continuously rising. To meet demand, plant operators constantly look for ways to increase production through better efficiencies and reduction of downtime.

A refinery consist of multiple processing units interconnected by pipeworks. Many of these plants were built during the 1950's and 1960's. Refining processes take place at elevated temperature levels. Since the energy crisis of the 1970's, the majority of the processing units and the pipes are insulated to minimize energy losses and for operator safety.

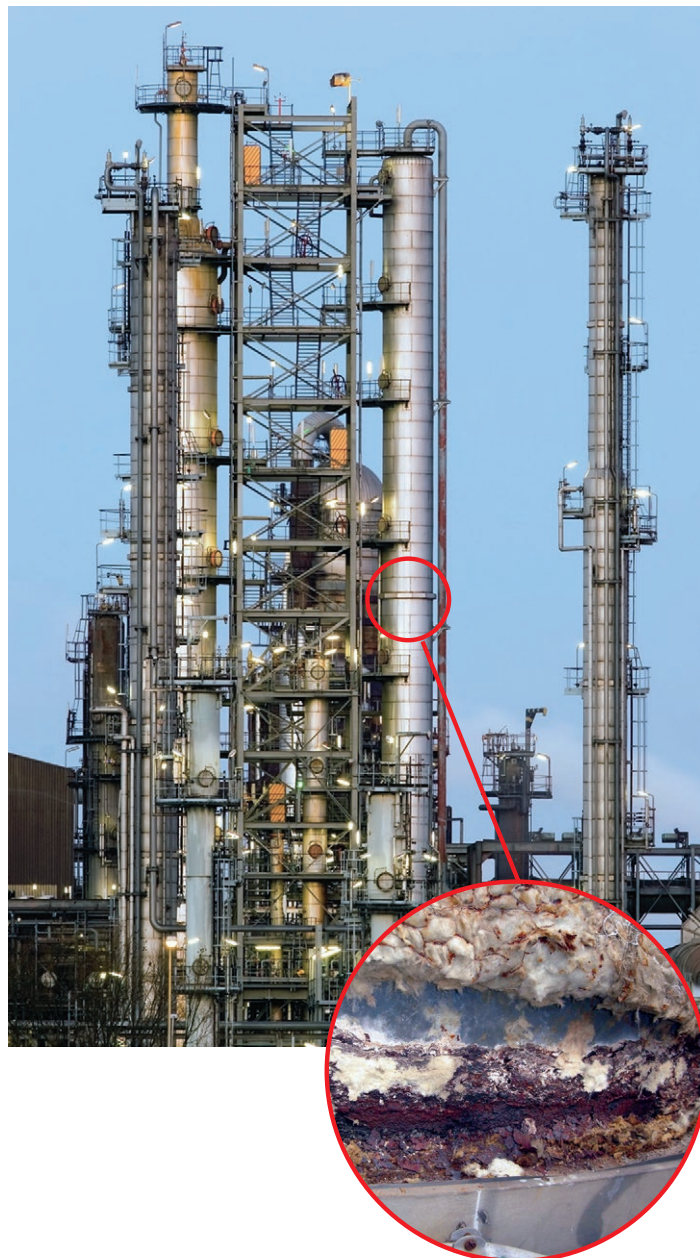
The insulation is designed to be water-tight to prevent water and corrosdents from reaching the stainless steel and carbon steel processing units and pipeworks. However, in practice, intrusion as a result of damage to the insulation and temperature differences as a result of process cycling can cause intermittent periods of wet and dry cycles, further promoting corrosion. The contaminants, generally chlorides and sulfates, in the presence of water cause Corrosion Under Insulation (CUI). As plants are most often situated at water fronts to facilitate incoming and outgoing transport, wet and humid conditions prevail.

CUI is long recognized as a major issue for petrochemical plants, and frequently consumes a large percentage of a plant's maintenance budget when both inspection and repair are considered. As a result, a great deal of effort has gone into management of CUI, and this has lead to the formation of a number of committees around the globe working on technical solutions.

A European group, EFC WP 13 and WP 15 Corrosion in the Refinery Industry, has produced a guideline<sup>1</sup> that addresses CUI solutions and how to manage them. Similar guidelines are available from NACE<sup>2</sup>.

Because of the vast areas to be protected at a facility and the expense involved in inspection, repair and replacement of insulation and damage resulting from CUI, plant operators would like a solution that can reliably last 25 years or more. Unfortunately, the traditional organic coatings employed have consistently fallen far short of expectations with an average life that is often less than 10 years<sup>a</sup>.

Both organizations recognize that the coating most likely to provide effective corrosion protection on insulated steel and stainless steel structures with a life expectancy of at least 25 years is Thermal Sprayed Aluminum (TSA).



Many refineries, such as the one shown above, have extensive CUI issues that result in very costly maintenance. Inset: A typical example of advanced CUI, in this case, at a tower stiffener ring.

<sup>a</sup> EFC WP 13 and WP 15 Corrosion in the Refinery Industry Corrosion Under Insulation Guideline

<sup>b</sup> NACE International, Paper No. 03029, Corrosion 2003

### Supply chain

When well-established maintenance and service processes are in place at a facility, the change from application of traditional organic coatings to TSA means adaptation that requires some changes.

For coating applicators accustomed to applying the conventional organic coatings, some new skills must be learned and new equipment acquired.

The site safety and maintenance managers may be hesitant to change to a new application firm as the existing team is probably well-versed in their plants safety guidelines for on-site work and is experienced in the pre- and post processing procedures of scaffolding, insulation disassembly, grit blasting, reassembly and installation of new insulation, as required.

### The Oerlikon Metco solution

With the help of the MetcoShield™ Coating Solution Package from Oerlikon Metco, applicators have at their disposal a comprehensive tool, designed to help applicators switch from organic coatings to TSA coatings. The MetcoShield™ Coating Solution Package consists of three modules. In combination, these modules provide the applicator with everything necessary to apply high quality TSA coatings. We help the applicator to master the required disciplines to apply TSA coatings using the combustion wire spray process, and understand

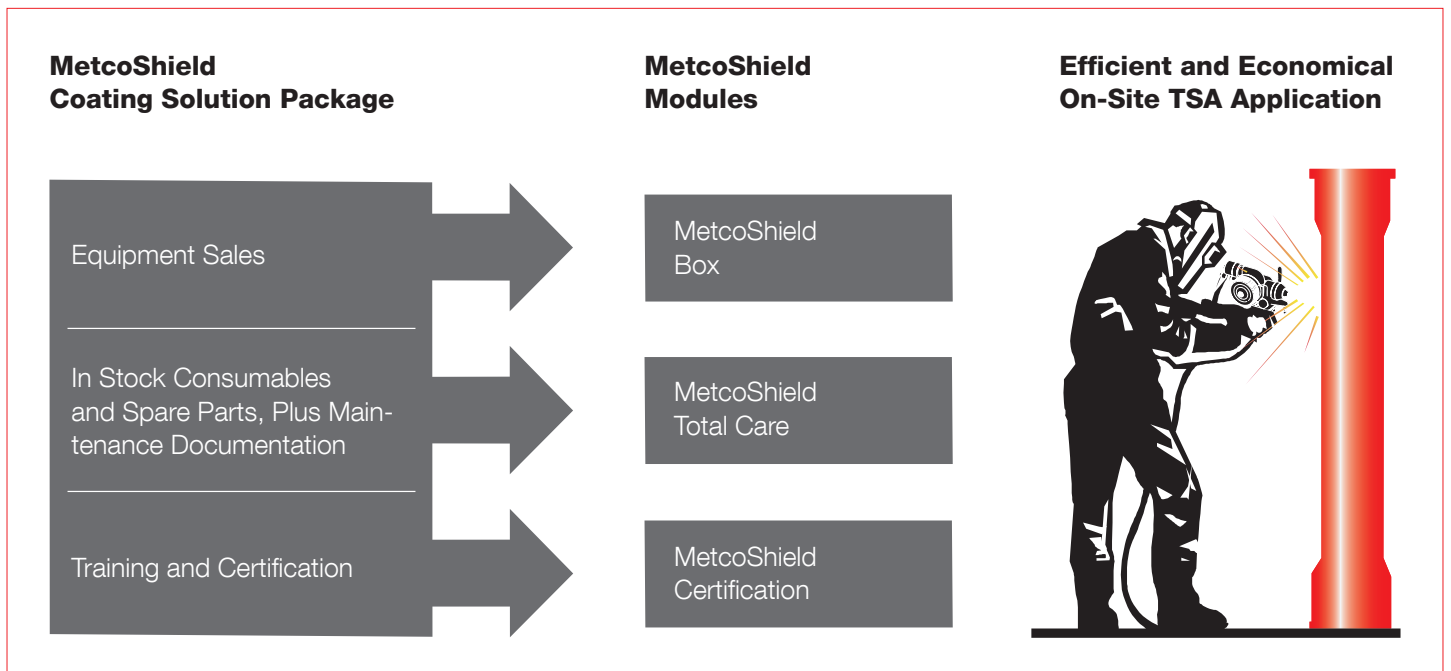
For on-site application, TSA is applied using one of two thermal spray processes: electric arc wire spray or combustion wire spray. The major difference in these two processes is the source of heat used to melt the aluminum wire feedstock material.

Electric arc wire spray uses, as the name implies, a high-power electrical arc as the heat source. However, many plants are uncomfortable with this process because of the long, glowing particle stream that is produced by the arc spray process. For this reason, electric arc wire spray is primarily used for in-shop applications.

Therefore, the second thermal spray process, that of combustion wire spray, is preferred. This process uses a controlled combustion flame to melt the wire feedstock.

thermal spray technology. At the same time, the modules offer flexible choices that will help minimize costs with a “first time right” approach and aid on-site application of the TSA coatings as efficiently and economically as possible.

Oerlikon Metco is the worldwide leader in thermal spray technologies, and brings more than 75 years of corrosion coating technology and application experience to our MetcoShield Coating Solution Package.



## Solution description and validation

### MetcoShield coating solution package overview

	Products	Description
Equipment	MetcoShield Box	<ul style="list-style-type: none"> <li>All equipment required to apply high-quality TSA coatings</li> </ul>
TSA Wire		<ul style="list-style-type: none"> <li>TSA wire stocked on-site with continuous replenishment by Oerlikon Metco</li> </ul>
Maintenance		<ul style="list-style-type: none"> <li>Maintenance of the spray equipment performed by qualified Oerlikon Metco experts at pre-defined intervals</li> </ul>
Spare Parts	MetcoShield	<ul style="list-style-type: none"> <li>Spare parts in stock at Oerlikon Metco with recommended on-site stocking levels for the project</li> </ul>
Maintenance Training	Total Care	<ul style="list-style-type: none"> <li>Training on daily safety checks</li> <li>Spare and wear part replacement training</li> </ul>
Quality Records		<ul style="list-style-type: none"> <li>Wire and spare part quality records</li> <li>Equipment maintenance records</li> <li>Training and certification records</li> </ul>
Operator Training	MetcoShield Certification	<ul style="list-style-type: none"> <li>On-site operator training with Oerlikon Metco training certification based on-site specifications</li> </ul>

### Equipment

MetcoShield Box coating equipment consists of an Oerlikon Metco Roadrunner™ Mobile Flame Spray System equipped with a Metco™ 16E Wire Combustion Gun. The entire system is built for convenience and constructed to the highest safety standards.

The Roadrunner system comes complete with all flowmeters and hoses to be installed on a compact, wheeled cart, which also has space for gas bottles. The Metco 16E spray gun incorporates a safety handle that immediately stops both the combustion flame and wire feed when released.

The Metco 16E is the latest generation of the Metco E-series guns that have been in use for decades by thousands of customers worldwide and are well-known for their reliable and robust design.

The system uses propane or propylene as the fuel gas, oxygen and air. The fuel gas and oxygen can be stored on the Roadrunner cart. No electricity is required.



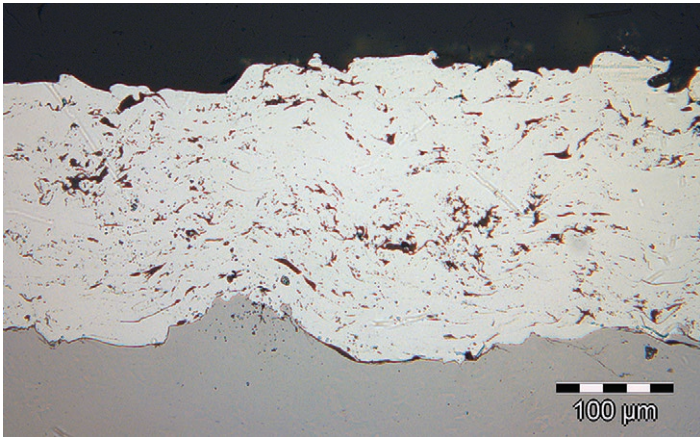
Oerlikon Metco Roadrunner Mobile Flame Spray System with Metco 16E Wire Combustion Gun (hoses and aluminum wire are not shown; gas bottles are supplied by the customer)

## TSA wire

Oerlikon Metco provides aluminum wire in accordance with ISO 209 and EN ISO 14919. For Corrosion Under Insulation, Grade 1100 aluminum wire is advised.

Aluminum wire in three diameters:

- **3/16 in (4.76 mm)** diameter wire is sized for use with the combustion wire spray process. This wire diameter allows a high spray and deposit capacity and is used for high production rates on large surfaces such as towers, vessels and heat exchangers. This wire is available in coils.
- **1/8 in (3.17 mm)** diameter wire is sized for use with the combustion wire spray process. As the smaller wire diameter allows flexible gun movement, is convenient for working in narrow or difficult to reach spaces such as weld seams on pipe racks. This wire is available in coils.
- **2.5 mm (0.098 in)** diameter is used for the arc wire spray process. This wire is available in coils or drums for continuously automated applications.



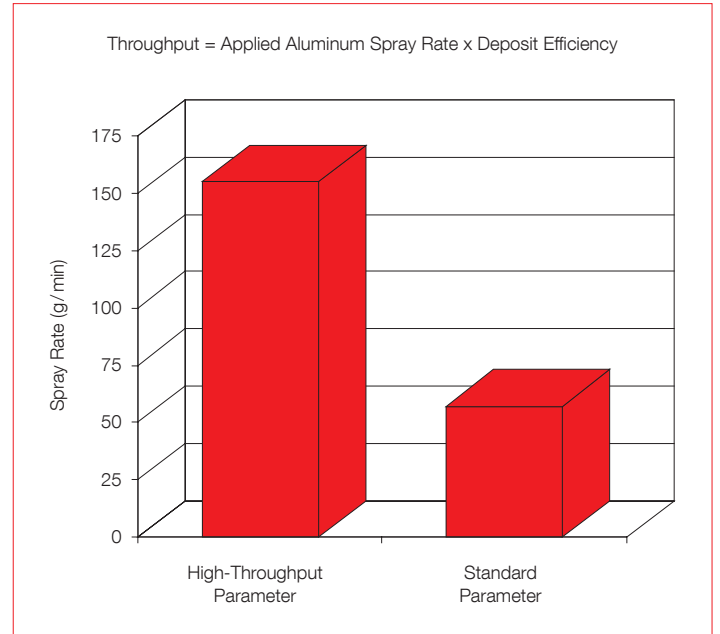
Photomicrograph cross-section of a typical, high quality TSA coating produced using Oerlikon Metco equipment and TSA wire.

## Spray efficiency

Oerlikon Metco's TSA solution package is efficient and quickly applies high quality aluminum coatings. Operators can use either standard parameters using 1/8 in (3.17 mm) wire or high-throughput parameters using 3/16 in (4.76 mm) wire. Both produce excellent, long-lasting coatings. However, because the parameter window is smaller for the high-throughput parameter, it is recommended for use by experienced thermal spray operators.

**Note:** Deposit efficiency is the ratio of the weight of material sprayed onto a flat surface vs. the weight of material consumed by the gun, without plate edge effects. It is not to be confused with target efficiency, which considers the geometry of the coated component and surface.

**Coverage:** 1 m<sup>2</sup> coated with aluminum 300 μm thick requires approximately 770 g of applied aluminum wire.



## Maintenance

Equipment maintenance schedules within the MetcoShield Total Care Module are controlled by wire consumption. Once the Metco 16E Combustion Wire Gun has consumed a defined quantity of TSA Wire, it should be overhauled at one of Oerlikon Metco's service facilities, which are strategically positioned around the globe. Our service engineers will completely overhaul the gun. The customer receives a freshly maintained gun on site ensuring that TSA spray schedules and coating quality are maintained at a high level.

Daily gun maintenance is to be performed by the applicator, which consists of simply cleaning dust and contamination from the exterior of the Metco 16E gun. Wear parts (see Spare Parts) are to be exchanged by the applicator on a pre-defined schedule.

## Spare parts

Oerlikon Metco ensures that all spare and wear parts needed for the daily maintenance from the Metco 16E Wire Combustion Gun are available on site. To facilitate spare and wear part replacement in the shortest amount of time, easy to follow illustrated maintenance instructions and schedules are included. This ensures that the Metco 16E gun is always ready for operation. Oerlikon Metco stocks the spare and wear parts at the start of each job and restocks on demand.

## Maintenance training

The equipment training in the MetcoShield Total Care Module consists of operator training for performance of daily equipment safety checks, instructions on spare and wear part replacement and other practical maintenance and safety issues related to the MetcoShield process.

## Quality records

Based on the need to maintain a high level of quality and traceability, provided with the MetcoShield Coating Solution Package are all related quality documents that include:

- TSA wire, wear and spare parts records
- Maintenance training documentation
- Operator certifications (see Operator Training)

## Operator training and certification

The MetcoShield Certification module includes a 3 day comprehensive operator training course in theory and hands-on practical experience for the following topics:

- CUI, background, costs, mitigation
- Thermal spray technology
- Thermal spray operation
- TSA coating quality control overview
- Thermal spray operating safety
- Thermal spray equipment operation for TSA application
- Surface preparation
- Hands on spraying (on sample test pieces)
- Local site TSA application standards<sup>c</sup>
- Preparation and spraying of samples for certification (per requirement of local spec)<sup>c</sup>
- Certification exam
- Oerlikon Metco certification based on the site specification<sup>c</sup>

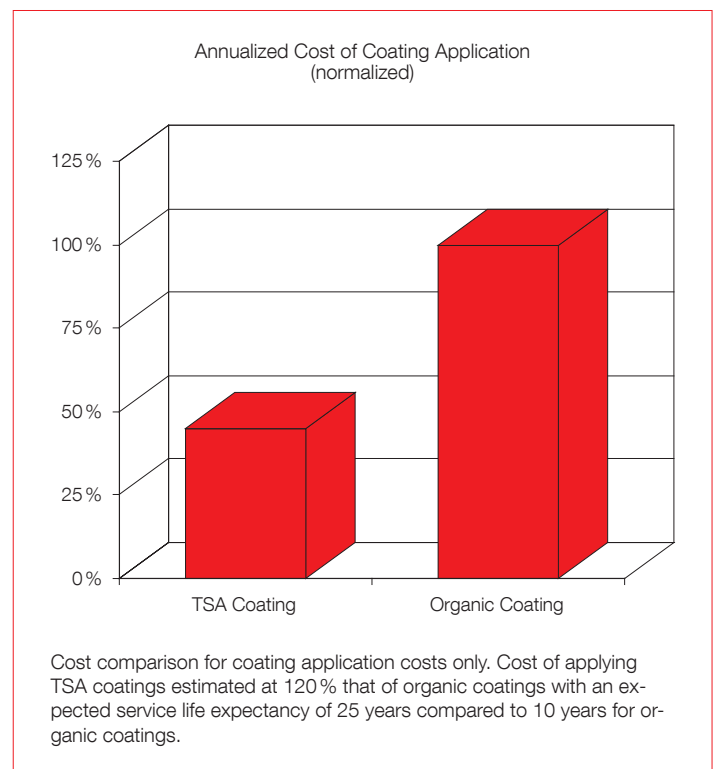
Certification is valid for ½ year and is the validation is site-specific. A certification can be extended through proof of on-going work or through re-examination. Certificates can be revoked for claims of bad quality or work practices.

## Cost comparison

The cost of applying TSA coatings compared to conventional organic coatings is approximately 5% to 20% higher<sup>d</sup> depending on surface area and geometry. However, as the service life of the TSA coating can be more than 250% that of conventional organic coatings, TSA is the more economical choice. Furthermore, when all costs are considered, TSA coating economics are outstanding.

Cost considerations:

- Surface preparation
- Coating application
- Field installation of new equipment, or on-site refurbishment
- Initial inspection and quality assurance
- In-service inspection
- In-service maintenance
- Repair/replacement as a result of CUI



<sup>c</sup> Based on the local site's standards and practices

<sup>d</sup> EFC WP 13 and WP 15 Corrosion in the Refinery Industry Corrosion Under Insulation Guideline

## Customer benefits

For the refinery owner, the MetcoShield solution addresses the issues of risk and cost. The refinery owner can continue to use trusted suppliers, certified to apply TSA coatings efficiently and economically.

For the applicator, the Oerlikon Metco value proposition provides everything required to make the transition from organic coatings to TSA coatings, ensures that the job site is supplied at all times and operators are trained and certified. The applicator can concentrate on getting the job done without the worry of managing logistics.

The TSA solution for CUI prevention helps protect refineries and petrochemical plants from operational risks with a solution that lasts longer and works more reliably; reducing costs for inspection, repair and replacement.

Independent validation of the TSA solution by organizations such as EFC and NACE confirms maintenance-free and inspection-free performance for 25 years or more, resulting in a potential 50 %+ cost reduction for CUI-related maintenance in combination with significantly reduced risk exposure.

## Benefits of TSA for CUI prevention

### Effective

- Provides sacrificial protection to steel in wet and humid environments, including cyclical wet/dry environments
- Tolerates mechanical damage to the coating without loss of protection
- Protects steel and stainless steel structures
- Long life of 25 years or more before coating replacement

### Economical

- Low life-cycle cost
- Initial application similar in cost to organic coatings
- Minimizes maintenance and inspection requirements

### Efficient

- Can be applied on live equipment
- Wide service temperature range of -100 to 500 °C (-150 to 930 °F)
- No cure time
- Coatings apply quickly

### Environmental

- Sustainable corrosion protection
- No VOC's (volatile organic compounds)
- No maintenance
- Reduces waste from insulation replacement

## Benefits of the MetcoShield coating solution package

### Effective

- Oerlikon Metco technology: used by thousands of customers for corrosion prevention applications
- Simplifies logistics and purchasing allowing applicator to concentrate on core competency: that of coating application
- MetcoShield Certification ensures operators are trained for quality coating application

### Economical

- MetcoShield Total Care means applicators are continuously prepared for the job
- Uses proven equipment that requires minimal maintenance
- Excellent throughput, especially using high-throughput parameters, saves time and cost
- Coatings are easily applied without the worry of sagging or running, thereby saving time

### Efficient

- MetcoShield Total Care ensures everything required for TSA coating application is always on site
- MetcoShield Box comprised of rugged, reliable equipment
- Equipment is simple to use and operate
- Compact, mobile equipment package easily transported to any location on site

### Environmental

- MetcoShield Box equipment designed to meet the latest safety standards
- Built-in safety handle on the Metco 16E Combustion Wire Gun prevents risk to personnel and equipment if accidentally dropped
- No electricity used in the process, eliminating arcing hazards