

Painting Metal Components with Greater Transfer Efficiency



About Mueller Electric:



Ever since Ralph Mueller invented the “alligator clip” back in 1908, the Mueller name has been synonymous with quality, durability and reliability. Throughout the years, Mueller’s attention has remained squarely focused on the quality aspects of its products.

**“Mueller products
outlast all others and
cost less, because they
last.”**

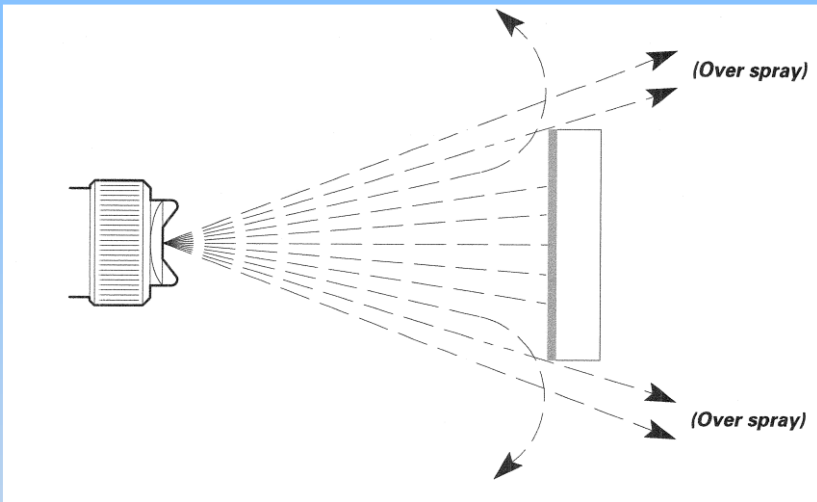
Mueller offers a broad and comprehensive line of both standard and custom products.

- Custom cable assemblies
- Grounding Solutions
- Heavy Duty Clips & Insulators
Connectors
- Test & Measurement
Products
- Wire & Cable
- Packaging

Mueller’s engineering and application support ensures the right product for a reliable & cost-effective solution.

1 Paint Transfer Efficiency

Painting metal components is never an easy task considering all the technical, material, and environmental variables throughout the process. When we talk of paint transfer efficiency, we are referring to the spray (painting) finishing process, which measures the amount of paint material adhering to the paint target in comparison to the amount of paint material that was sprayed through the paint applicator towards the paint target.



Thus, the transfer efficiency, is expressed in terms of a percentage. For example, of the paint sprayed from the applicator, what percentage of the material actually lands on the target? If we calculate a measurement of 75% transfer efficiency, then 75% of the paint sprayed landed on the target. The remaining 25%

landed elsewhere like the floor, walls or even your shoes. There are several factors that impact transfer efficiency including the spray equipment being used (including air and fluid pressure), ambient temperature, humidity, and moving air in the paint area. Additional factors include the actual shape and size of the paint target itself, spray finishing methods including atomization and the individual or robots operating the spray applicator. Finally, the electrical conditions of the applicator, paint material, metal target and holding fixture/carrier is very important and impacts both the paint transfer efficiency and the paint quality of the component. This paper will focus on this portion of the painting process and provide insight as to grounding methods and the control of electrostatic charges.

2 Painting Metal Components – Today's Challenges

Common sense would tell you that a metal object such as an auto chassis, bus chassis, a vehicle frame, etc. would be automatically grounded as it sits on a metal carrier of some sort as it travels through the paint line. So, why discuss the obvious, right?



Well, it's not that easy! Today's chassis and frames are pretreated with an undercoat or primer like never before. These undercoats and primers are extremely rugged as they seek to extend the life of a vehicle by standing up to harsh environmental elements such as moisture, chemicals, road hazards, heat and cold to name a few. This undercoat and primer is extremely thick and creates a solid shell around the chassis and frame. The thick shell not only provides solid protection but also provides a great insulator between the vehicle and metal frame which in turn breaks the quality ground connection that once existed.

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Painting Metal Components – Today’s Challenges



As a result of the interrupted ground, transfer efficiency measurements are looking more compromised than ever. With the cost of today’s paints, the thought of paint not landing on its intended target is not a welcome one. Perhaps your paint crew or robotics are sporting more of the paint than the intended target itself. Unfortunately, for the paint line manager, this is a good way to be in the spotlight for all the wrong reasons. It may sound simple, but all you have to do is re-establish a good solid ground like the one you used to have. The question is, how? And, once you think you have a good ground established, how do you confirm it? How do you get your transfer efficiency measurements back within appropriate expectations and keep paint waste costs as low as possible?

The proper grounding of electrostatic charges in the metal painting process is crucial not only for Paint Transfer Efficiency, but for the minimization of part scrap and rework, which can add significant cost to the process. With this, more attention has been directed at optimizing paint process grounding and made part of process improvement program objectives.

3 Paint Process Efficiency – Reduction of Rework - Importance of Proper Electrostatic Discharge

A target with an electrostatic charge causes paint to flow unevenly, or even repel paint, thus reducing the transfer efficiency and increasing the potential for part defects. If the electrostatic polar charge of the paint and metal component are the same, the two materials will repel. When this occurs, paint spray will be propelled unevenly around the target, creating uneven patterns, and inconsistencies. A metallic base amplifies this effect.

When an electrostatic grounding issue occurs during paint application, the painted metal component may need to be reworked, which is a costly and time-consuming event. Rework costs vary on the component itself. The rework of a painted vehicle can be in the \$500 range or more.



3 Paint Process Efficiency – Reduction of Rework – Importance of Proper Electrostatic Discharge

Electrostatic Grounding Systems: How much do they cost you to operate and maintain?

Each grounding method (charged paint/target; grounding clip assembly, etc.) improves paint transfer efficiency to varying degrees and thus the quality and process consistency of the painted plastic components. The next question to be asked is: Are the Rework savings realized through effective electrostatic grounding being eroded by the costs to operate and maintain those systems? Costs to be considered include:

- **INVENTORY:** What are the associated costs to purchase individual grounding components, and to monitor/maintain inventory levels?
- **LABOR:** What are the associated costs to build assemblies in-house, using your own staff, as opposed to buying a complete assembly?
- **SET-UP/CLEAN-UP:** What are the costs of set-up and clean-up?
- **EFFECTIVENESS & EASE OF USE:** Is the grounding method reliable, repeatable, reusable & cleanable?

3 Paint Process Efficiency – Reduction of Rework in the paint process ...continued

Ironically, and perhaps counter-intuitive, purchasing a complete, fully-assembled grounding solution is the lowest cost option.

Why?

- Grounding Assemblies can be customized to the exact requirements of your process. Each is precisely made and consistent
- The cost of a finished Assembly is LESS than the cost to purchase individual components and build yourself with in-house labor
- No scrap, broken or missing parts. Assemblies arrive ready-to-use
- Less administrative cost to order, stock, receive and count. Fewer SKUs
- A professional evaluation will help optimize your process



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Grounding Solutions from Mueller Electric

ELECTROSTATIC GROUNDING OPTIONS BY MUELLER ELECTRIC...

Mueller Electric stocks over 300 standard clip configurations, which are used in a wide variety of both industrial and test/measurement applications. Mueller is well-known for its grounding clip product line. Many OEMs purchase Mueller's heavy-duty, durable clips for their exceptional service life. Requirements for an electrostatic grounding clip, used in painting processes, are somewhat different than other industrial clips. **The design goal of an electrostatic grounding clip is to balance functionality, durability, and cost.** Since electrostatic grounding clips are subjected to a harsh environment (paint buildup; heat; cleaning solvents), these products need to reliably perform their function for their intended life, and withstand cleaning, yet be inexpensive enough to discard and replace on an interval that serves the requirements of the process.

As previously discussed, Paint Transfer Efficiency is important, and has many variables. Electrostatic discharge through proper grounding is one of those variables. If properly controlled, the benefits will be realized in a more uniformly coated part and in reduced rework. **It's not a question of whether or not to ground your process, rather how it will be done and the total cost of that method.**

4 Grounding Solutions from Mueller Electric

Mueller Recommends Several Effective solutions:

1. Purchase a standard, pre-fabricated assembly that is ready-to-use; or
2. Design & spec your own custom assembly to perfectly meet the needs of your process (specify each clip connector style & size; select wire type & length; etc.)
3. Add additional piece of mind with a measuring device that provides instantaneous feedback as to the quality of your ground connection.

Mueller's application engineers will evaluate your process and walk you through the options. Once an option is selected, samples can be requested for process testing.



Popular BU-21EZ Grounding Clip used in pre-fabricated assemblies

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Grounding Solutions from Mueller Electric

Pre-Fabricated Electrostatic Grounding Assembly:

This is Mueller's most cost-effective solution. One part number to order and monitor. Open the box, ready to use! The clip ends, wire lengths, and other requirements are selected during Mueller's review of your process.

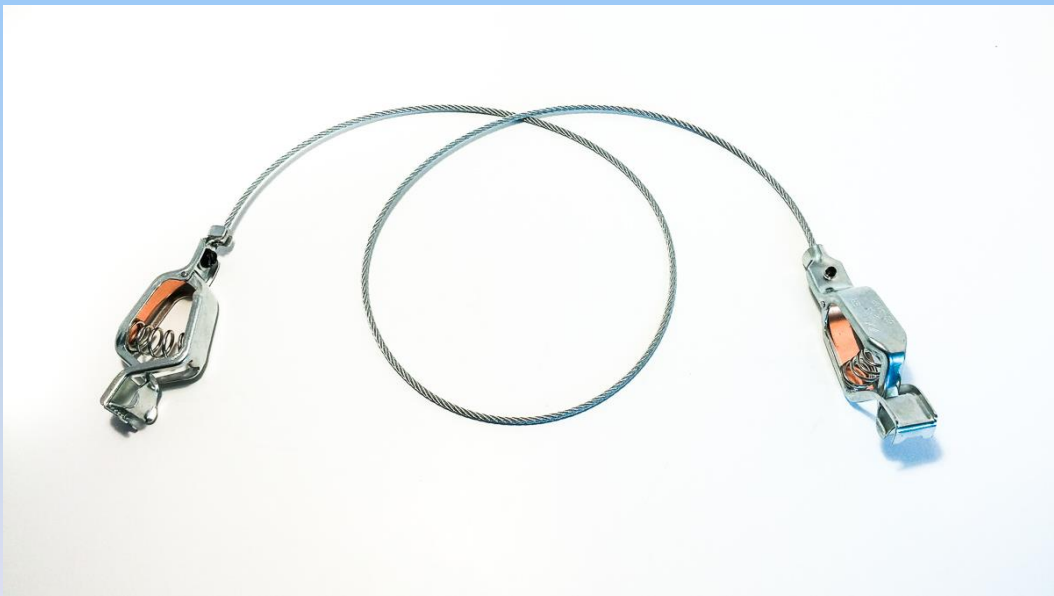
Pre-Fabricated Assembly Example 1: Mueller's large container grounding assembly has become the workhorse of paint room component grounding, especially on larger size drums and mixers. This assembly is particularly good at controlling electrostatic charges requiring larger discharge potential. Clamp pressure can be modified depending on your application and the larger handles make the clip easier to handle. The points make a solid connection to any metal grounding requirements for a good grip and solid ground.



The large container grounding assembly shown above includes a 24" length (custom lengths available) of stainless steel braided wire rope with BU-119 clips on each end. This assembly is commonly used in applications requiring heavy duty connections either an atmosphere controlled or uncontrolled environments.

4 Grounding Solutions from Mueller Electric

Pre-Fabricated Assembly Example 2: Mueller's heavy duty automotive clip grounding assembly is perfect for fully-automated part painting processes that require a rugged connection on both ends of the assembly which allows for a solid connection on the metal component (chassis, frames, etc.) and the carrier. In fully-automated processes, parts to be painted are placed on a carrier and transitioned through the paint line. The rugged connection clip places on the discharge side of the assembly is securely attached to the grounding point, with little risk of accidental disconnection. The same can be said for the other end which connects to the painted component. These clips will bite through most undercoated and primed objects for a solid ground connection so they can be implemented in lines pre and post primer stage. The automobile industry uses this type of grounding assembly on their fully-automated, robotic processes used to paint the metal components of a vehicle including the exterior finishes of cars, trucks and other vehicles.



Pictured above, the heavy duty automotive clip grounding assembly, with a BU-21 clip attached on both ends of a 3 foot long 1/8th inch stainless steel wire rope. Perfect for heavy duty paint applications. Custom wire lengths are available.

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Grounding Solutions from Mueller Electric

Pre-Fabricated Assembly Examples 3A & 3B: Are used in lighter weight applications where space is limited and the environment is less harsh. These assemblies are perfect for applications requiring highly-reliable, rugged clip connections on both sides of the assembly while providing a very cost effective option. Although lighter in weight, the clip end connections offer extra-firm placement, making them less vulnerable to inadvertent disconnection during the paint process. These light weight heavy-duty assemblies additionally offer excellent electrostatic grounding properties, enhancing paint transfer efficiency in an economical package.



Pictured above, the AI-000441 assembly utilizes BU-27 clips on both ends of an 18" length stainless steel braided wire rope, with custom lengths available.



The AI-000448 assembly utilizes BU-24 clips on both ends of an 18" length stainless steel braided wire rope, with custom lengths available.

4 Grounding Solutions from Mueller Electric

Design & Spec your own Custom assembly to Perfectly meet the Requirements of your Process

For those of you who are intimately familiar with your process and already know what works and what doesn't work, we invite you to custom design and spec your own assembly. Mueller helps with:

- A comprehensive in-stock inventory of clips & cables to mix-and-match
- Sample units to test & validate on your process
- “Ready-to-Use” assemblies, delivered OEM direct or through your preferred supply chain partner



Mueller's Engineering Department is standing by to assist.



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Grounding Solutions from Mueller Electric

Build Certainty into your Paint Process with Mueller's Ground Strength Indicating System

Although it may appear that a solid ground is established with your part lined up for painting but how do you really know? How many times have you sent parts through the paint booth only to see something less than optimal come out the other side? Chances are, the ground connection you thought you had really didn't take place. Why take a chance? Paint is expensive! You can now check your ground before the part goes through the paint booth with the new Ground Strength Indicating System from Mueller Electric. This device can check ground strength from small pieces to large objects like buses and trucks. It is very simple to use and the indicator provides immediate feedback to ground strength. Green for a good ground, red for a poor ground and blue if no ground exists. A siren will also sound if the ground is poor or non-existent. This is simple to install and put into your process.



5 Summary & Getting Started

SUMMARY

In summary, there are many methods for addressing electrostatic grounding in metal painting processes. Selection of the best method for your process is a simple and worthwhile exercise that consumes little of your time and provides a return in time and cost.

Mueller Electric's friendly and knowledgeable staff will guide you through the steps, including process analysis, applications engineering, and test sample procurement.

Benefits for your small investment in time...

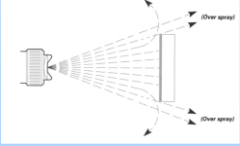
- improved part consistency
- reduced rework
- lower scrap levels
- labor savings
- lower overall costs.

To get started, please contact us:



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6 References & Acknowledgements



Transfer Efficiency, Graco, Inc.



Gm Auto Paint, The Field Seattle



Archive – Dürr, Dürr



Design for Environment im Lackier process Von BMW
De.paperblog.com



Automated Manufacturing Solutions Light Tunnel,
Porsche Leipzig



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