Joint Problems?

The Raw Truth About Handrail Splicing!

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Patrick Bothwell | David Ball

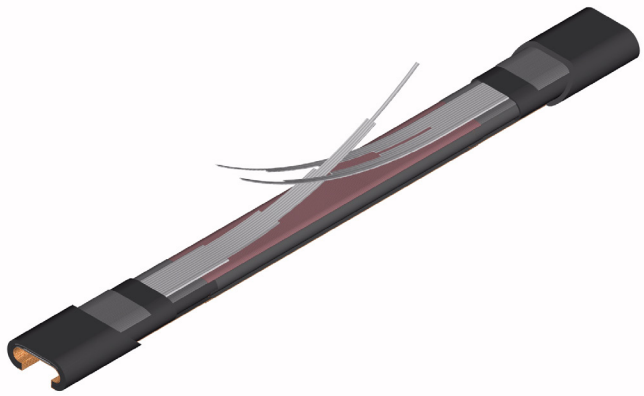
Make no mistake, the joint (or splice) in any endless handrail is the weakest part of that handrail.

There are several misconceptions about handrail joining methods, the terms used to describe their various configurations, and the service life to be expected from each.

The methods and apparatus used when making a handrail endless depend on the specific materials used in the construction of the handrail product. Rubber has traditionally been used as the base material for handrails. Naturally most raw rubber is not elastic at all — it is more like chewing gum until it is subjected to heat under pressure for a specific period of time. This process, known as curing or vulcanizing (after the Roman God of Fire, Vulcan) turns the rubber into a bouncy, tough, elastic product we think of as “rubber”. This process of cross-linking cannot be reversed. Once cured the rubber stays that way.

EHC also uses a proprietary thermoplastic polyurethane material in a growing number of its handrail products which works in a different but very useful way. At normal temperatures a thermoplastic has similar properties to that of cured rubber. It is elastic, resilient and tough. When heated above a certain temperature it begins to soften and becomes like a thick liquid during which it can be formed by molding or extrusion. When cooled it retains the desired shape and has the rubber like properties it possessed prior to heating and needs no further work done to it. This heating and cooling process is repeatable, unlike the curing of rubber.

Both rubber and thermoplastic handrails require a stretch inhibitor. Most often this is in the form of 18-20 individual steel cables which run the entire length of the handrail and prevent that handrail from elongating. In the splice area these cables are discontinuous – and the ultimate strength of the splice relies on the interweave, a term referring to the intersection of the cables in a splice, to give the splice its tensile strength. See the image below.



Rather than the strength of each individual strand of steel cable to achieve tensile strength, the interweave is made robust through the force to remove each cable from the rubber or thermoplastic material that it is embedded in. Stepping of the interweave increases the area of linear contact exponentially as opposed to simply butting the ends of the cables together. The combination of force required to remove each cable from the material in which it is embedded determines the final tensile strength of the splice.

With thermoplastic handrails, the moulding process allows for material in the interweave to completely flow together, encapsulating all the cables in a durable polyurethane matrix. Regardless of whether the splice is completed with factory equipment, or with portable field equipment – the resulting strength is the same and will exceed the code mandated 25kN breaking strength.

A further benefit from choosing NT is the splicing kit. This is the added material introduced into the splice joint to re-create the necessary volume and integrity the joint needs to last. Unlike rubber splice kits, NT requires very little added material and absolutely zero adhesives, solvents or dangerous goods. This is the undisputed king of handrail splices – quick and clean without the need for harsh solvents or adhesives.

With rubber handrails, the results depend on workmanship and the type of ends that are being spliced together. There are three types of rubber splice methods used globally.

- **Raw-to-Raw** splicing is the most commonly used method of factory splicing, but also recommended in the field, especially on handrail drives systems with tight forward and reverse bends. With Raw-to-Raw splicing, both ends of the handrail are composed of raw rubber, and are vulcanized together to form the highest quality rubber handrail splice. Adhesion between all layers is robust, force to remove each cable from the rubber in which it is embedded is maximized and tensile strength will also exceed 25kN.

- **Raw-to-Cure** splicing is most commonly used in the field. Comprised of one raw open end, and one cured end this configuration is popular in that it allows the handrail to be custom fit to the escalator in the field with relative ease. The cured end is torn-down in the field once the optimal final handrail length has been determined, raw and cured ends are then spliced together using special-purpose solvents and adhesives that encourage the cured rubber to bond with the raw rubber on the open end. Completed by a seasoned handrail splice technician tensile strengths are also above 25KN.

- **Cure-to-Cure** splicing using this method requires a trade-off on the durability of the splice – bringing together two cured ends requires more involved tear-down and build processes and relies heavily on adhesives to keep the splice together. Workmanship needs to be flawless in-order to ensure structural integrity of the splice.

Its important to appreciate that all these options require the afore mentioned splice kits which do contain components like the rubber handrail itself which are sensitive to ageing. Ensuring your rubber handrails are stored in their original packaging as well as in a dry, cool and dark location for less than 2 years is key. So too the splice kit materials, for rubber handrail joints have a limited shelf life and proper inventory management of both is essential for achieving a long life and trouble-free performance from your handrail. One final point to remember about Rubber handrail splice kits is that they do contain adhesives and solvents, which can be difficult and expensive to ship.

All the rubber options, as robust as they are; in the hands of a qualified technician, still require the extra step of finishing off the splice joint once its fully vulcanized. This finishing process involves trimming, sanding and polishing the joint surfaces to blend them into the same shape as the rest of the handrail. This step not only requires skill but time both to execute and for clean-up and materials which is not required when splicing NT handrail.

One key feature of the NT handrail field splice is that, unlike the rubber handrail, the process and equipment used on-site are identical to those used in the factory. Due to the characteristics of the thermoplastic rubber we have successfully developed an on-site splice procedure and bespoke portable moulding equipment. This allows EHC to reproduce a quality splice in the field that boasts the same robust durability, dimensional stability and breaking strength as that produced under the controlled conditions in the factory. The end result, is a finished appearance that is undiscernible from a factory splice. EHC's teams of certified service technicians and those of our official partners around the world, perform thousands of on-site splices every year.

With all methods of handrail splicing, success ultimately depends on the use of the proper splice materials for that specific type of handrail. All components or added materials including adhesives contained in splice kits have a limited shelf-life and need to be used while they are fresh. Out of date splice kits, might look OK but will compromise the integrity of the final splice, and in extreme cases cause the handrail to come apart at the splice.

Please do not hesitate to reach out to your EHC Global sales representative to answer any questions and to determine which method of handrail joint is best suited to your application.

Successful handrail splicing relies heavily on the skillset of the technician performing the splice – attention to detail. For this reason, EHC insists upon an annual certification requirement for all factory and field splice technicians. Splice integrity is the key to long service life and paramount to rider safety.

If you are experiencing problems with your handrail splices or any sort of premature handrail failure – please let us know, we'd be happy to help.