

Trends and recommendations

for cable management and mounting systems in data centres

Experience, market outlook and recommendations for developers



1. Purpose

This document explains what Krüge believes should be the standard for cable management and mounting systems in data centres, and why. It draws on our deliveries to the Nordic data centre market in recent years, current product and corrosion standards, and manufacturers' documentation.

The purpose is to give the developer a sound basis for decisions early in the project, while changes remain inexpensive. Experience shows that material and coating choices are often finalised late, resulting in either over-specification or a mixed installation that is costly to operate.



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The document answers four questions:

- How are material choices in data centres evolving?
- Which coating should form the basis of the specification, and why are zinc whiskers a concern?
- Which product and profile choices provide the best whole-life value?
- What should be prefabricated, and what should remain flexible?



2. Summary of recommendations

- Steel remains the main material in data centres. Aluminium and composites serve niche applications.
- A whisker-free coating should be mandatory in data halls and supported by manufacturer documentation.
- Set a documentation requirement rather than banning a process. Stress in the zinc layer drives whiskers growth. Conventional electroplating should not be used in data halls, while documented coatings such as zinc-nickel may be accepted.
- Most market documentation consists of manufacturers' declarations rather than independent test reports. Define the required documentation level before tender.
- Use one coating as a general rule, with defined exceptions for exposed zones.

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**As a general rule,
use one coating
throughout the
delivery**



2. Summary of recommendations

- Standardise cable ladders and cable trays in zinc-magnesium (ZM). Supply wire mesh trays in documented electroplated zinc (EZ) when used only indoors, and hot-dip galvanised (HDG) when the same delivery extends both indoors and outdoors. For outdoor cable ladders and cable trays, use ZM or Sikla HCP. Supply fasteners hot-dip galvanised.
- Fasteners and small components must be covered explicitly. This is where deviations occur in practice.
- Standardise two or three defined packages rather than a single product. Treat everything outside the packages as a justified deviation.
- Prefabricate where the geometry repeats and the interfaces are fixed. Prefabricating undefined interfaces shifts the cost rather than removing it.
- Make the material choice during design, not procurement.



**Make the material
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3. Market outlook and drivers

3.1 Construction pace and standardisation across sites

Hyperscale and colocation operators increasingly build to the same template across locations. Suppliers must therefore deliver identical solutions in Norway, Sweden and Denmark, with the same product names, documentation and installation instructions. Project-specific solutions that cannot be repeated become costs that follow the developer to the next site.

3.2 Installation capacity

Skilled installers, rather than materials, are the scarce resource in most projects. This is the main driver of prefabrication: it moves labour from the construction site to the workshop, where it costs less, is more predictable and is easier to quality-assure. The benefit is greatest when the same module is repeated many times.

3.3 Power density and cooling

Higher power density per rack and the introduction of liquid cooling in parts of the market increase the amount of pipework and cabling per square metre. Cable routes must fit into tighter risers, cross more systems and meet stricter requirements for documented load capacity and support spacing. Model coordination is becoming increasingly important.

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3.4 Sustainability and documentation

Requirements for EPDs, recycled content and steel traceability now form a standard part of enquiries rather than an add-on. These requirements should be clarified early because they affect both supplier selection and lead time. Third-party verified EPDs compliant with EN 15804+A2 are available for Vantrunk zinc-magnesium cable ladders and fittings (Appendix E).

3.5 BIM as a prerequisite

Model-based design is standard, and suppliers are expected to contribute objects, load calculations and clash detection at an early stage. Krüge delivers in Revit, E3D and PDMS. Experience shows that projects involving suppliers during the modelling phase require substantially fewer changes during installation.

4. Material selection: are data centres still choosing steel?

The short answer is yes. Steel still accounts for the main volume in data centres, and we see no sign of this changing in the near term. There are several reasons:

- High load capacity for the cost and longer spans, resulting in fewer support points.
- A broad, mature range of accessories that allows on-site adaptation without custom manufacturing.
- Reliable documentation for fire performance, loads and corrosion.
- High recyclability and established EPDs.



Krüge's portfolio is built around recognised data centre brands.



Vantrunk supplies cable ladders and cable trays, Valdinox supplies EASYCONNECT wire mesh trays, Sikla siFramo provides load-bearing frames and supports, Sikla siMetrix provides modular mounting systems, and Sikla MS 41 and MS 27 provide mounting channels. All systems are available with manufacturer documentation for zinc whiskers and corrosion class, enabling one specification per zone.

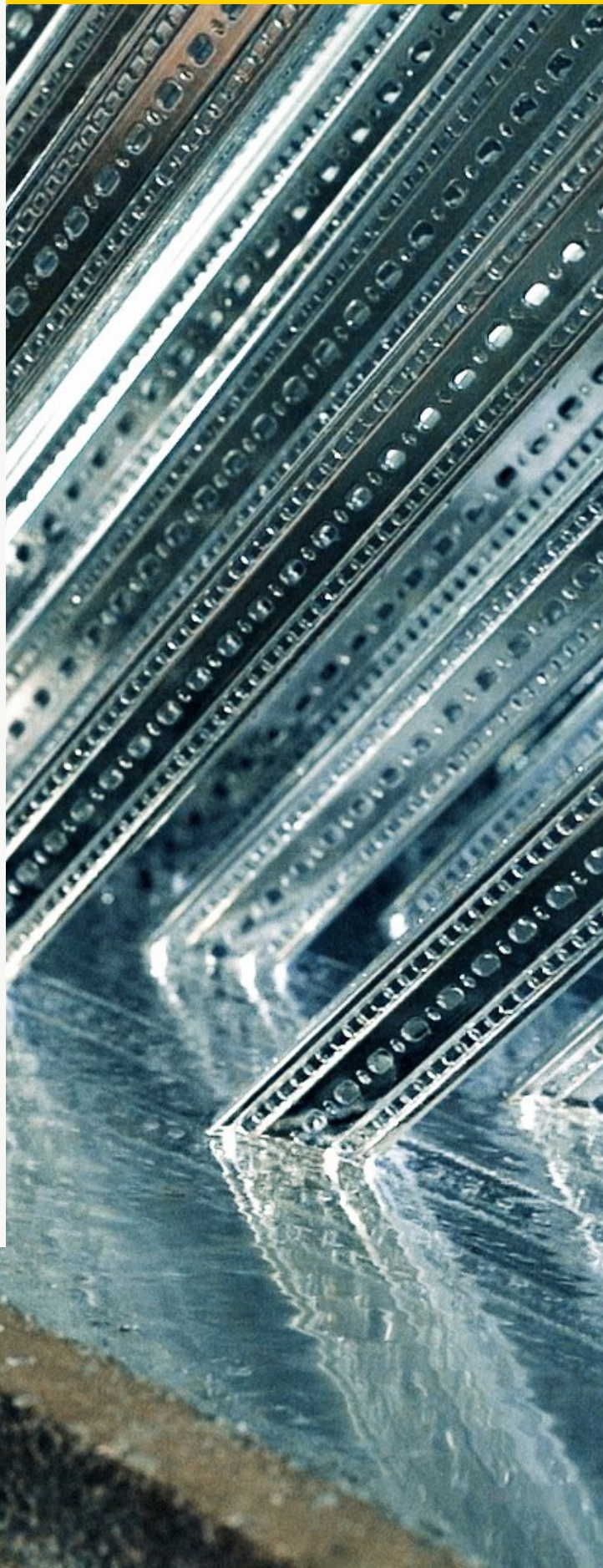


5. Coatings and zinc whiskers

5.1 What zinc whiskers are and why they matter in data centres

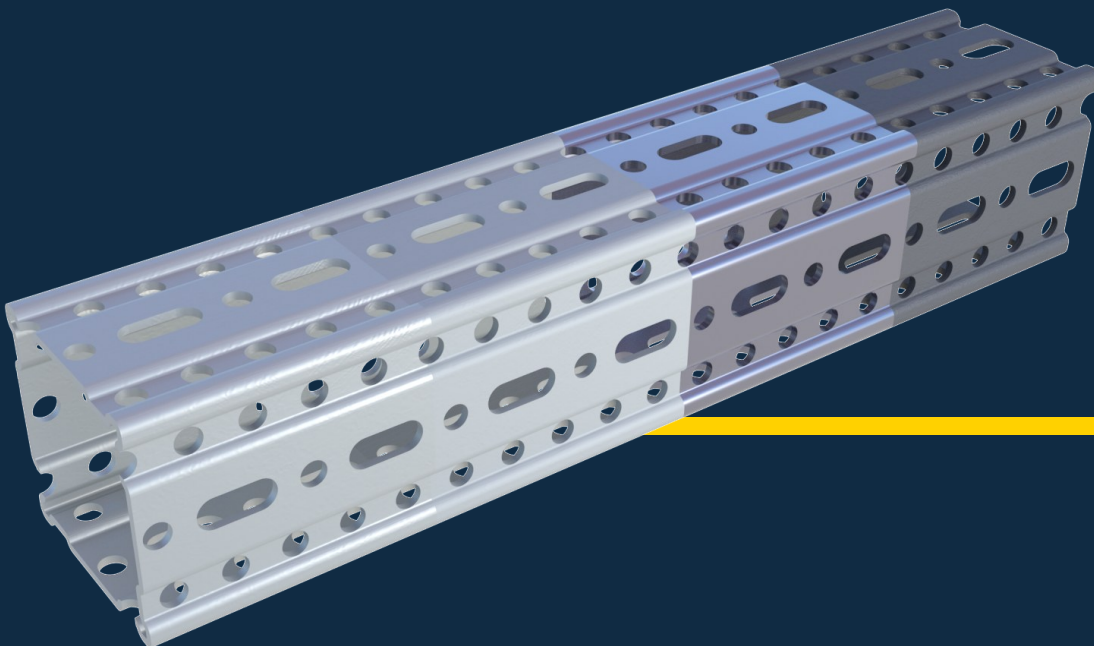
Zinc whiskers are hair-thin conductive crystals that can grow from some zinc coatings. A few micrometres wide, they can reach several millimetres and are difficult to detect visually. Internal stress in the zinc layer drives growth. Loose whiskers carried by airflow can short-circuit circuit boards, damage equipment or cause data loss. NASA documented the phenomenon in the early 2000s.

The issue is best known from raised floors, but applies to all zinc-coated surfaces in data halls. Cable management systems form large continuous surfaces, often above equipment or in its airflow. Coating choice is therefore an operational risk, not merely an aesthetic or corrosion decision.



The decisive distinction is not between “galvanised” and “non-galvanised”, but between processes that leave internal stress in the zinc layer and those that do not. Conventional electroplating is the process most often identified as critical.

The situation is more nuanced for thermal processes. Manufacturers do not associate them with known whisker growth, while the BEAMA industry guide classifies pre-galvanised steel as “possible” and post-fabrication hot-dip galvanising as “very rare”.



5.2 Overview of relevant coatings

Method	Reference	Typical use	Whisker	Comments
Electroplating	EN ISO 2081	Dry indoor environments	Critical	Internal stress in the coating creates a risk of whisker growth. Not recommended in data halls unless the manufacturer provides specific documentation for the coating; see Appendix D.
Electroplated zinc-nickel	EN ISO 19598 / ASTM B 841	Indoor use, small components	None known	Electrolytic process, but the nickel content counteracts whisker growth; see Appendix D.
Pre-galvanising (Sendzimir)	EN 10346 / ASTM A 1063	Indoor C1 to C3	Not known according to the manufacturer; "possible" according to BEAMA	Thermal process. Sources differ; see Section 5.3. Assess cut edges for corrosion.

5.2 Overview of relevant coatings

Method	Reference	Typical use	Whisker	Comments
Post-fabrication hot-dip galvanising (HDG)	EN ISO 1461; EN ISO 10684 for fasteners	C3 to C5	Very rare	Thicker coating. A separate standard applies to screws and nuts. According to BEAMA, it may shed some zinc flakes.
Zinc-magnesium (ZM)	EN 10346	C2 to C4	Manufacturer's declaration, not a test report	Zinc-aluminium-magnesium. Corrosion class 8 to EN 61537 according to the manufacturer (Appendix C). Not covered by BEAMA.
Zinc flake, basecoat + top seal	EN 13858 / EN ISO 10683 / ASTM F 3393	Fasteners and components with complex geometry	None known	Used where the geometry is unsuitable for hot-dip galvanising

5.2 Overview of relevant coatings

Method	Reference	Typical use	Whisker	Comments
Powder coating on galvanised steel	EN ISO 12944-5	Whisker-critical zones	Reduces risk	A barrier layer that may delay whisker growth, although prevention has not been documented (BEAMA). Enables colour coding.
Aluminium	EN 573 / EN 755	Weight-critical zones	None	Lower load capacity; assess galvanic contact

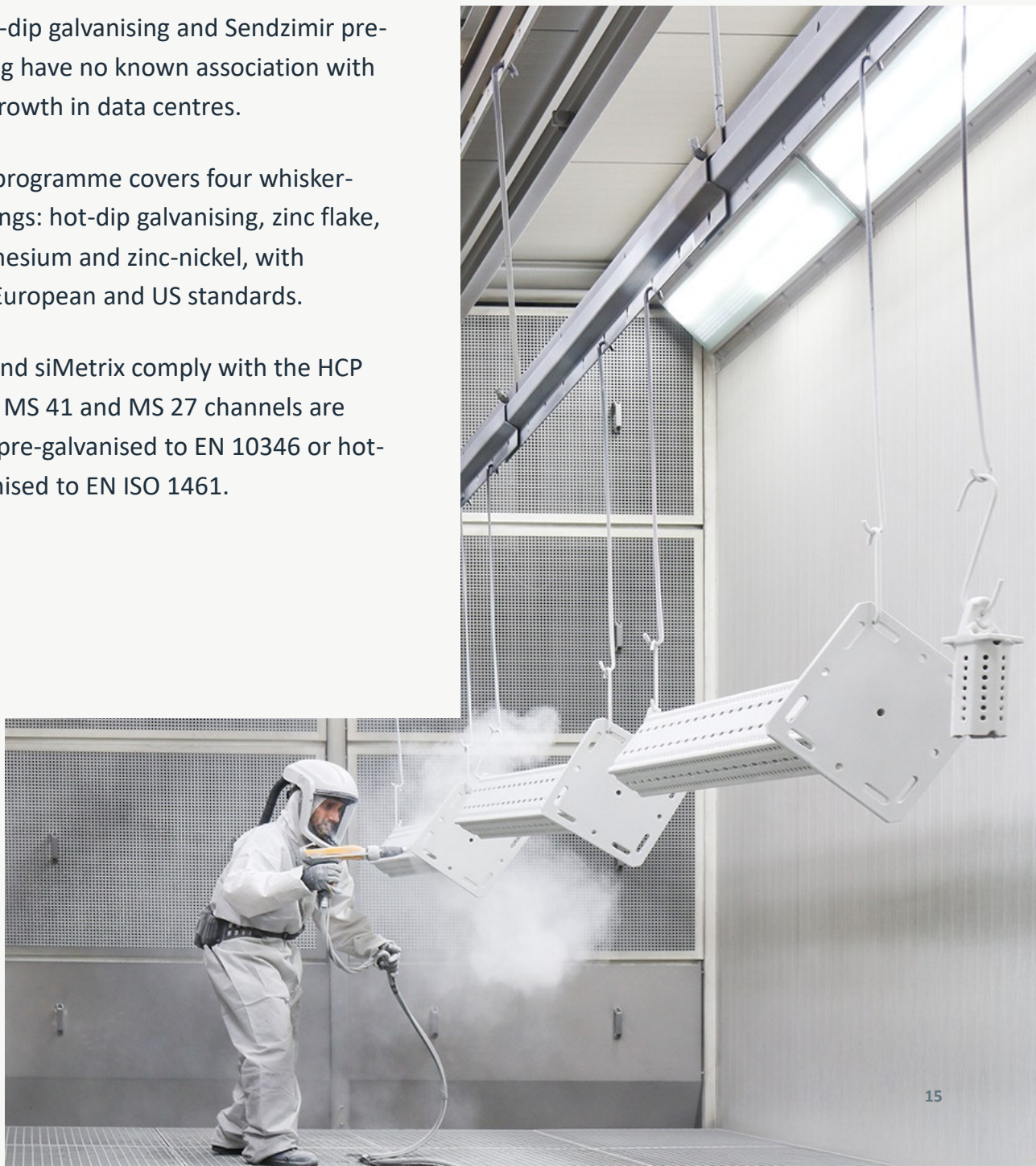
System requirements for cable ladders and cable trays follow NEK EN 61537. The corrosion class is determined in accordance with EN ISO 12944.

5.3 Documentation basis

The assessments above are based on documentation from manufacturers in Krüge's portfolio and independent industry guidance. The status for each manufacturer is summarised below.

Sikla (siFramo, siMetrix, MS 41 and MS 27). Technical statement from Sikla SHQ GmbH, Appendix A. Key points:

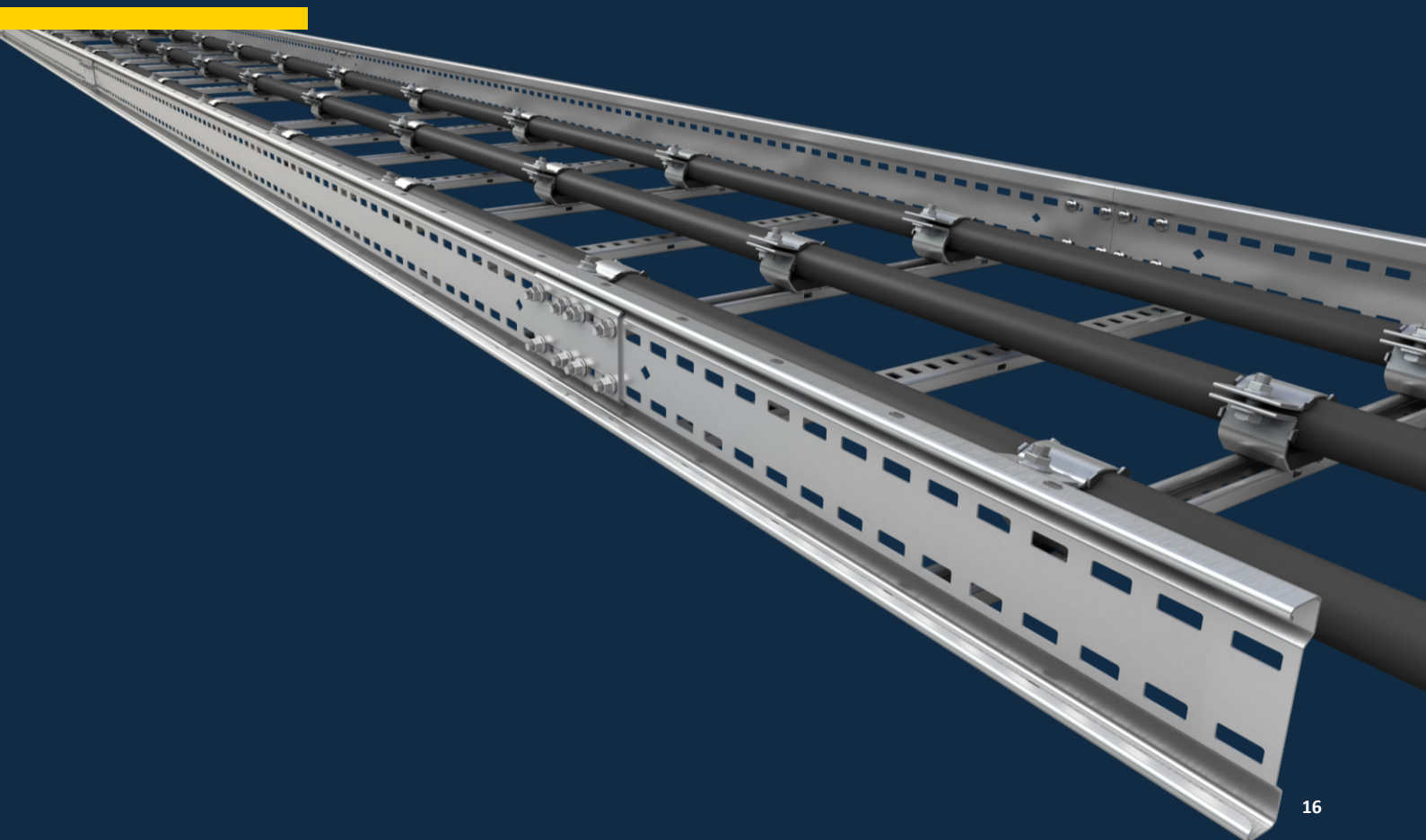
- Electroplating is the critical process because it creates internal stress in the zinc layer.
- Batch hot-dip galvanising and Sendzimir pre-galvanising have no known association with whisker growth in data centres.
- The HCP programme covers four whisker-free coatings: hot-dip galvanising, zinc flake, zinc-magnesium and zinc-nickel, with relevant European and US standards.
- siFramo and siMetrix comply with the HCP standard. MS 41 and MS 27 channels are available pre-galvanised to EN 10346 or hot-dip galvanised to EN ISO 1461.



Vantrunk / Unitrunk Group (cable ladders and trays).

Unitrunk declares that its hot-dip galvanised, pre-galvanised and zinc-magnesium products are zinc-whisker-free (Appendix B). For ZM to EN 10346, the manufacturer documents corrosion class 8 to EN 61537 after more than 1,000 hours of salt spray, compared with class 6 for HDG to EN ISO 1461 (Appendix C). An independent salt spray test is available on request.

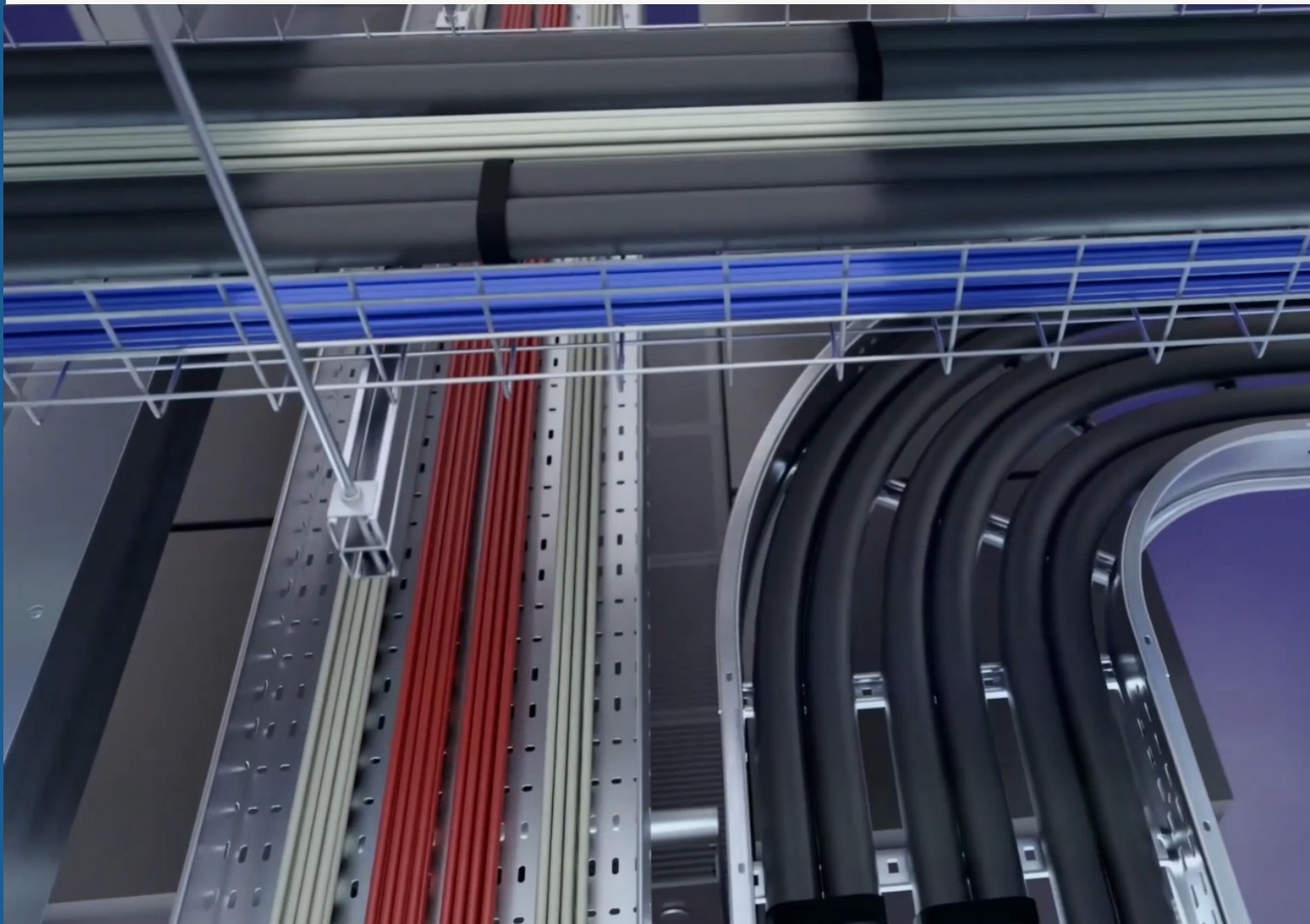
No independent whisker-growth report is available for ZM310. In 2026, the manufacturer described ZM310 and pre-galvanised steel to EN 10346 as suitable for data halls and cable management, subject to the project specification.



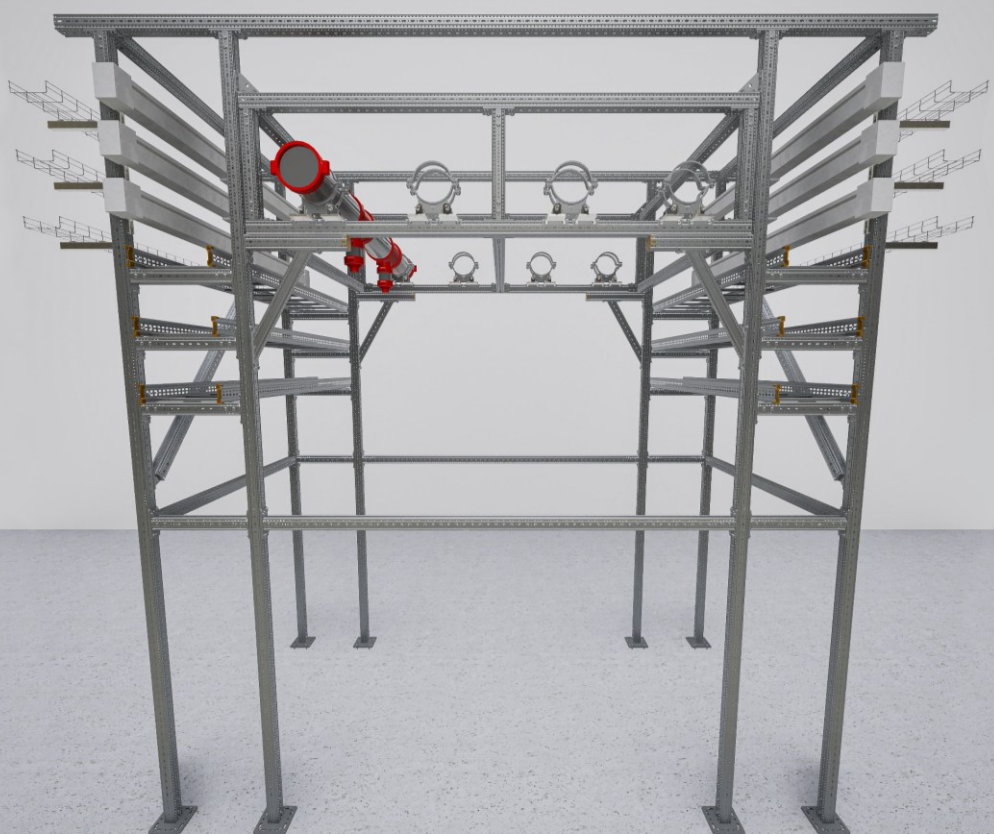
5.3 Documentation basis

Valdinox EASYCONNECT (wire mesh tray). A four-year Valdinox study followed nine zinc and hot-dip galvanised coatings under electron microscopy for at least 12 months (Appendix D). All electroplated zinc coatings developed whiskers except acid-bath zinc with Cr3 passivation and a zinc layer above 10 µm, and zinc-nickel. EASYCONNECT EZ uses the first exception. The manufacturer says whisker formation is reduced to a negligible level. EASYCONNECT is also available HDG. Valdinox conducted the study.

Industry guidance (BEAMA). BEAMA's guide for cable ladders and cable trays, prepared by an industry panel that included Vantrunk, classifies whisker risk by coating. It lists electroplated and pre-galvanised steel as "possible", post-fabrication hot-dip galvanised steel as "very rare", and organically coated black steel and non-metallic systems as "none". The guide states that no equipment failures caused by whiskers from cable management systems have been reported. It does not cover zinc-magnesium.



Documentation clarification: the material above consists of manufacturers' technical statements and declarations, one manufacturer-led study and one industry guide. None is an independent third-party test report. "Not known to cause whisker growth" means no cases have been observed; it is not a measured test result. This is the level most manufacturers currently provide. If an independent third-party report is required, define this early because it will substantially limit supplier and coating options.



5.4 Recommendation

- Specify a whisker-free coating as a mandatory requirement in data halls and rooms with exposed electronics.
- Standardise cable ladders and cable trays in zinc-magnesium (ZM) to EN 10346. Both Sikla and Vantrunk consider ZM whisker-free (Appendices A and B), and it has a higher corrosion class to EN 61537 than hot-dip galvanising (Appendix C).



5.4 Recommendation

- Formulate the requirement as a documentation requirement that refers to the coating standard rather than a product name, so compliance can be verified in the delivery.
- Do not formulate the requirement as a general ban on electrolytic processes. Zinc-nickel and certain electroplated zinc coatings with a documented process (see Appendix D) are considered whisker-free, and a process ban would exclude otherwise suitable solutions. Conventional electroplating without such documentation is not accepted in data halls.
- Explicitly include fasteners, screws, nuts and small components. Supply them hot-dip galvanised to EN ISO 10684, which Sikla documents as whisker-free (Appendix A). Vantrunk has confirmed that bolts and cable ladder joints are supplied hot-dip galvanised. Fasteners are often supplied electroplated as standard even when the rest of the system is hot-dip galvanised, and this is where deviations occur in practice.
- Assess cut edges and on-site modifications for corrosion. For thermally galvanised surfaces, the cut edge is a corrosion issue rather than a whisker issue.
- Obtain documentation for each delivery and archive it with the O&M documentation so it remains available for future extensions.



6. One coating throughout the delivery

We recommend using one coating throughout the delivery wherever practical. The reasons are:

- Avoids contact between coatings and reduces galvanic corrosion at joints.
- Creates a consistent appearance and makes deviations easier to spot.
- Simplifies stock, labelling and logistics, reducing installation errors.
- Simplifies after-sales work and extensions by using one item per function.



A valid objection is that this principle conflicts with corrosion classes as soon as parts of the delivery are installed outdoors, on roofs, in cooling galleries or in generator rooms. Full standardisation would then mean either over-specifying indoor areas or under-specifying outdoor areas. Neither provides good value.

The recommendation is therefore more precise: use one coating as a general rule, with a short list of exceptions for defined zones. Determine the exceptions during design and include them in the standard. Uncontrolled variation between deliveries should not occur.

The principle applies to the overall coating specification rather than the process used for every component. As described in Section 5.2, component geometry may require different whisker-free processes within the same delivery. The key requirement is consistent performance and whisker characteristics, rather than an identical process.



7. Profile and product selection

Profile selection should be based on whole-life cost rather than price per metre. We recommend using the following comparison criteria:

Criterion	What is measured	Why it matters
Load capacity relative to weight	Permissible load at a given span	Determines the number of support points and therefore installation hours
Installation time	Time per metre and tool requirements	Often the largest single cost in the delivery
Accessory range	Coverage without custom production	Determines how much must be resolved on site
Cable protection	Edge design and bend radius	Affects cable damage and pulling speed

7. Profile and product selection

Criterion	What is measured	Why it matters
Suitability for prefabrication	Repeatability and joint design	Determines how much work can be moved to the workshop
Documentation	Testing, EPDs, fire and zinc whiskers	Always required, but lead times vary considerably
Lead time	Stock item versus made to order	Critical in projects with short construction programmes

For documentation, manufacturer information on zinc whiskers is available for the systems we recommend in data halls; see Section 5.3. The level of documentation varies between manufacturers and should be assessed alongside load capacity, installation time and suitability for prefabrication.

7.1 Kruge’s data centre portfolio

The portfolio is structured so that one system covers each function, with a common coating specification and shared accessories across the range. This allows the developer to standardise by function rather than by individual item.

System	Function	Material and coating	Notes
Vantrunk cable ladders and cable trays	Main routes for power and data	Steel, zinc-magnesium (ZM310, EN 10346), for indoor and outdoor use.	Covers data halls and exposed zones. EPD available for ZM cable ladder; see Appendix E. Declarations of conformity to EN 61537 are included in Appendices F and G.
Valdinox EASYCONNECT wire mesh tray	Route for data and low-voltage cabling	Steel. EZ when used only indoors; hot-dip galvanised (HDG) when the same delivery extends both indoors and outdoors	Bends and crossings are adapted on site. EZ is documented by the manufacturer; see Section 5.3

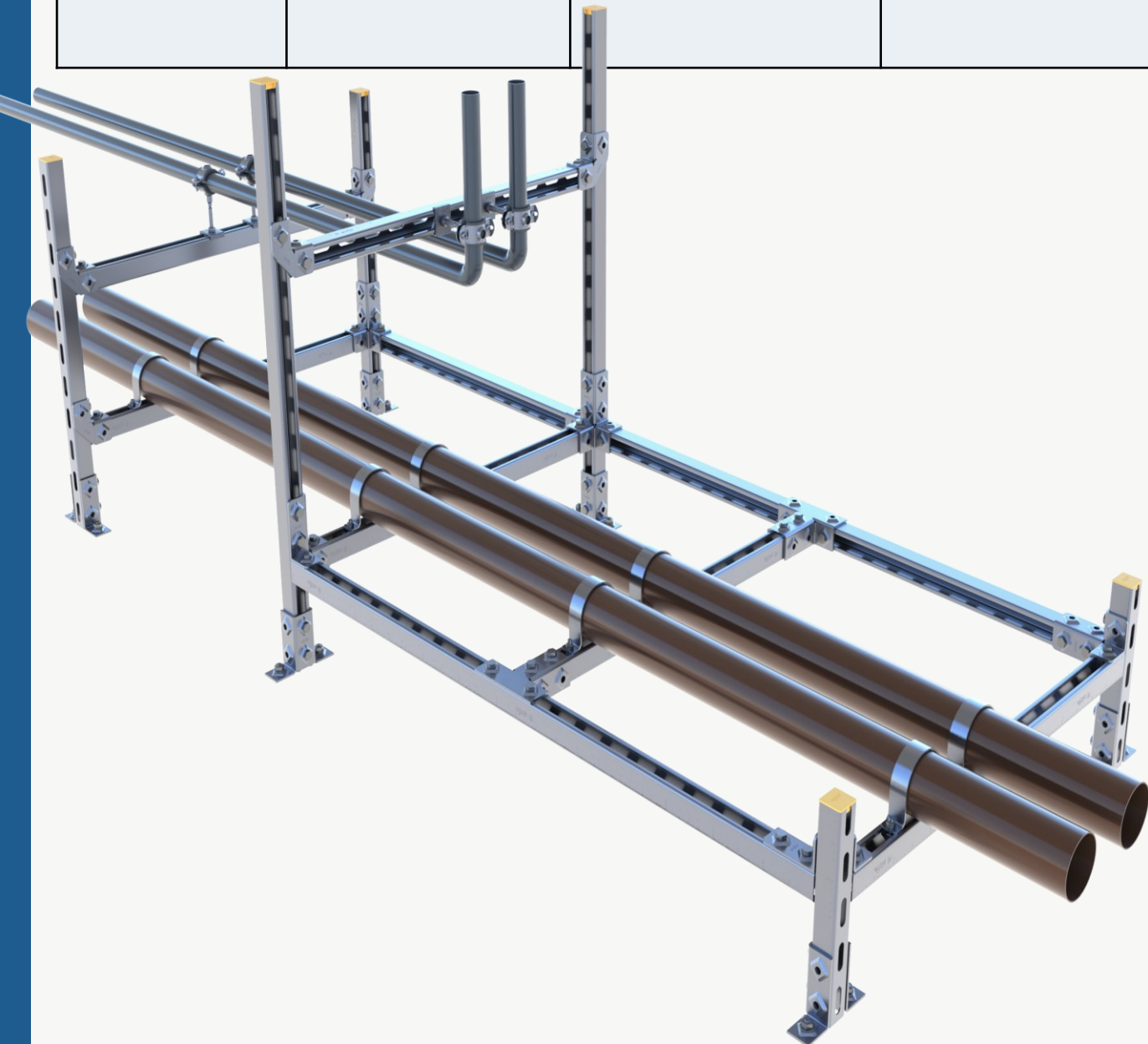
7.1 Kruge’s data centre portfolio

System	Function	Material and coating	Notes
Sikla siFramo	Bolted framing system for supports, brackets and load-bearing structures	Steel, HCP coating	Bolted connections with no on-site welding. Well suited to prefabrication
Sikla siMetrix	Modular mounting system	Steel, HCP coating	Compliant with the HCP standard; see Section 5.3



7.1 Kruge’s data centre portfolio

System	Function	Material and coating	Notes
Sikla MS 41 and MS 27	Mounting channel	Steel, pre-galvanised (EN 10346) or hot-dip galvanised (EN ISO 1461)	Covered by Sikla’s technical statement; see Section 5.3
Fasteners and accessories	Fixings, joints and clamps	Hot-dip galvanised to EN ISO 10684	Subject to the same whisker requirements as the rest of the system



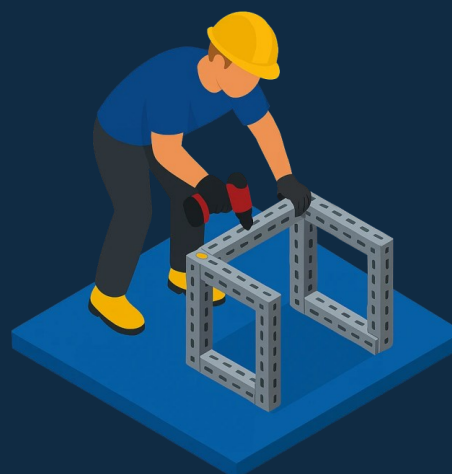
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Prefabrication creates value when the geometry repeats and interfaces are defined. It offers no benefit when building tolerances are unknown. In that case, it simply moves the cost from the construction site to the workshop.

8.1 Well suited

- Main routes with repetitive geometry.
- Standardised branches and crossings.
- Bracket and frame solutions repeated for each rack row.
- Complete supports delivered fully assembled and labelled.

siFramo is the system in the portfolio best suited to prefabrication because its bolted connections are repeatable. Modules are assembled and inspected in the workshop and require no welding or hot work on site. Vantrunk cable ladders are supplied in tailored lengths and packed in installation sequence to match the same modular layout.



8. Prefabrication

8.2 Less suitable

- Final adjustments to the existing structure.
- Zones where other disciplines have not completed model coordination.

8.3 Conditions for cost-effective prefabrication

- Interfaces fixed in the model before production starts.
- Tolerances agreed and documented, with a defined adjustment range at the fixing point.
- Labelling and packing in installation sequence rather than product sequence.
- One design freeze date for changes.



Zinc whisker requirements and prefabrication are connected: prefabricated modules are assembled in the workshop with a complete fastener set. If the coating requirement is defined before production, the documentation follows the module. If it is only clarified on site, fasteners must be replaced individually, which is both costly and difficult to verify.



9. Proposed standard

We propose defining the standard as a small number of zone-based packages rather than one product for the entire facility. This provides predictability without restricting the project.

Pkg.	Zone	Mandatory requirements	Recommended requirements
A	Data halls and rooms with exposed electronics, whitespace	Whisker-free coating on profiles, accessories and fasteners, documented by the manufacturer with reference to the coating standard. Cable ladders and cable trays in ZM to EN 10346. Wire mesh trays in EZ. Fasteners hot-dip galvanised to EN ISO 10684. Conventional electroplating without product-specific whisker documentation is not permitted.	Prefabricated supports. Colour coding by system.

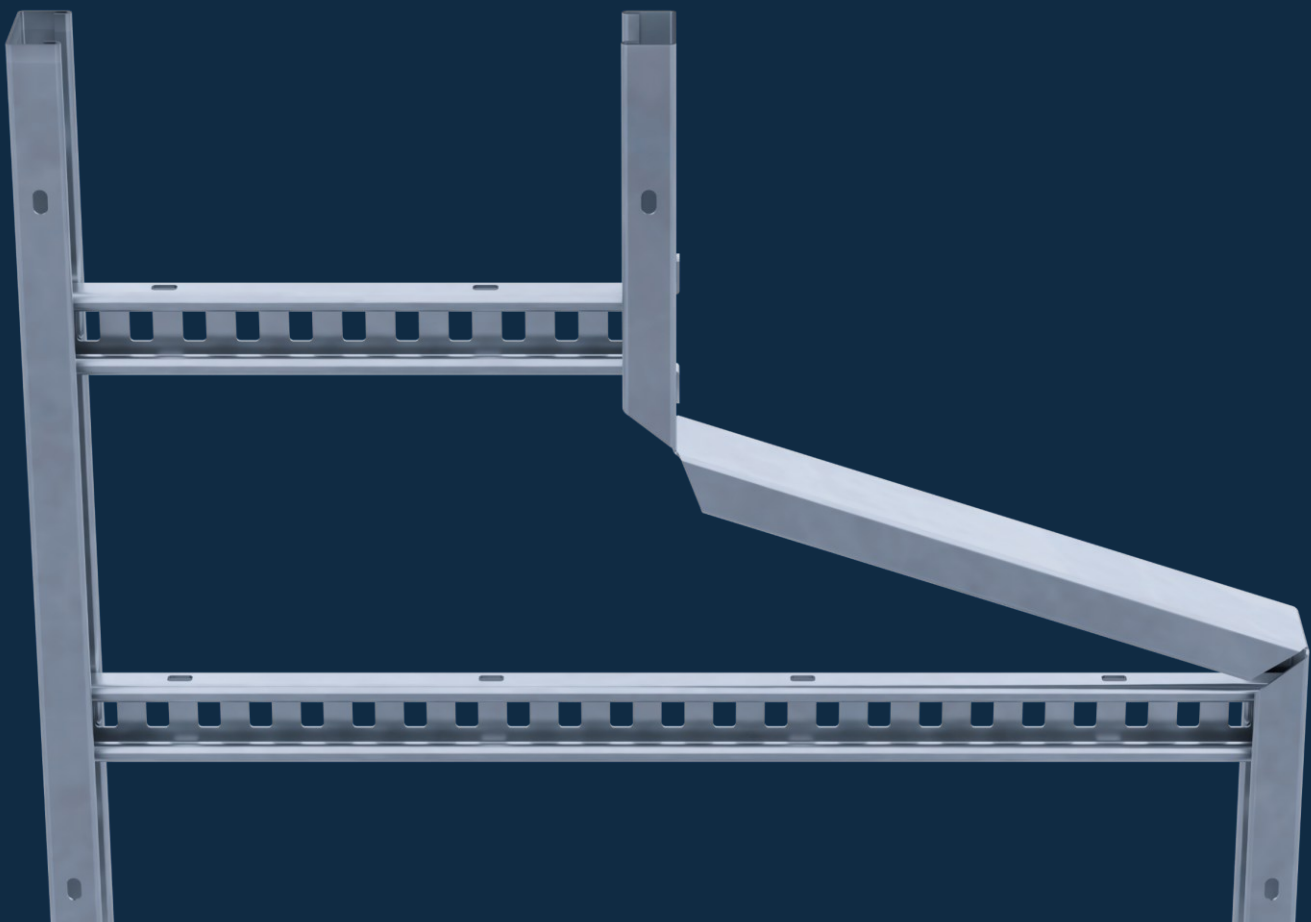
Pkg.	Zone	Mandatory requirements	Recommended requirements
B	Technical rooms, greyspace, cooling galleries and generator rooms	Corrosion class to EN ISO 12944 for the actual environment. Documented load capacity at the selected span. Cable ladders and cable trays in ZM where the corrosion class permits.	Use the same profile family as Package A to share accessories. Use a whisker-free coating where the room shares air with the data hall.

Pkg.	Zone	Mandatory requirements	Recommended requirements
C	Outdoor areas, roofs and exposed zones	Cable ladders and cable trays in ZM or Sikla HCP, selected for the corrosion class. Wire mesh trays hot-dip galvanised (HDG). Fasteners hot-dip galvanised to EN ISO 10684.	Dedicated maintenance plan and inspection interval.

Within Kruge's portfolio, Package A uses Vantrunk cable ladders, Valdinox EASYCONNECT wire mesh trays, siFramo load-bearing frames and the siMetrix mounting system, all with manufacturer documentation on zinc whiskers; see Section 5.3.

Package B uses the same systems, with coatings selected for the room's corrosion class.

Package C uses ZM or Sikla HCP for cable ladders and cable trays, and hot-dip galvanised (HDG) wire mesh trays. This gives the developer the same accessories and installation principles across all three packages.



9. Proposed standard

Coating selection by system. The table below shows the standard coating for each system. Where a wire mesh tray extends both indoors and outdoors within the same delivery, supply the full run hot-dip galvanised (HDG) to avoid mixing coatings within one route.

System	Indoor (Packages A and B)	Outdoor (Package C)	Notes
Cable ladders and cable trays (Vantrunk)	Zinc-magnesium (ZM) to EN 10346	ZM or Sikla HCP, selected for the corrosion class	Standard coating for data centre cable management, indoors and outdoors
Wire mesh tray	EZ, Valdinox EASYCONNECT (Appendix D)	Hot-dip galvanised (HDG)	Where the wire mesh tray extends both indoors and outdoors, supply the entire delivery hot-dip galvanised (HDG)

9. Proposed standard

System	Indoor (Packages A and B)	Outdoor (Package C)	Notes
Load-bearing frames and mounting systems (siFramo, siMetrix)	HCP	HCP, selected for the corrosion class	See Appendix A
Mounting channel (MS 41, MS 27)	Pre-galvanised to EN 10346	Hot-dip galvanised to EN ISO 1461	See Appendix A
Fasteners and small components	Hot-dip galvanised to EN ISO 10684	Hot-dip galvanised to EN ISO 10684	Confirmed by Vantrunk for bolts and joints. Electroplated fasteners are not accepted

On flexibility: a standard with unrestricted flexibility is not a standard. Keep the packages fixed and treat anything outside them as a deviation requiring brief written justification and one approver. This preserves project flexibility without letting the delivery drift. Experience shows that deviations fall sharply once justification is required.



10. Collaboration and interfaces

For the standard to work in practice, we propose the following approach:

- Involve the supplier during design rather than procurement, so material choices and support principles can be fixed early.
- Maintain one point of contact for each party throughout the project.
- Include model objects and load calculations in the delivery rather than treating them as extras.
- Use a shared deviation log throughout the project and hand it over at completion.
- Review lessons learned after each sub-project so the standard can be updated between sites instead of becoming obsolete.



11. Appendices

Appendix A:	“Technical Statement: Zinc Whiskers”, Sikla SHQ GmbH, by Peter Menz, Head of Research & Development.
Appendix B:	Declaration on zinc whiskers from Unitrunk Group to Krüge AS, by Johan Casparsson, Director Business Development, dated 8 May 2025.
Appendix C:	“Zinc Magnesium (ZM): Process and Corrosion Classification”, Unitrunk Group, by Dominic O’Hara, Group Technical Manager, dated 10 June 2025.
Appendix D:	EZ Zinc Whiskers Stopper, Valdinox (2025).
Appendix E:	“Cable Management Ladder ZM” and “Ladder Fitting ZM”, EPDs from Unitrunk Group, EPD Hub, dated 2 May 2025.
Appendix F:	Declaration of Conformity, Speedway Cable Ladder System and Cable Tray Systems (LVD 2014/35/EU, EN 61537), Vantrunk Ltd, dated 18 September 2025.
Appendix G:	EU Declaration of Conformity, Cable Management Systems (LVD 2014/35/EU, EN 61537, EN 10346), Unitrunk, dated 11 October 2021.
Additional source, not attached:	BEAMA, Best Practice Guide to Cable Ladder and Cable Tray Systems, section on zinc whiskers and Table 7.



DATA CENTRES

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FROM BIM TO A COMPLETE SOLUTION

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