

TECHNICAL ACCEPTANCE CONDITIONS FOR ZINC COATINGS

1. Subject matter and scope of the TAC.

The subject of TAC are the requirements to be met by the material delivered for galvanizing and the usable properties that the zinc coating produced at the galvanizing plants of FAM Sp. z o.o. should have.

The TAC below also applies to zinc coated products with passivation service and the appearance of the passivated coating. A zinc coating is also understood as a zinc coating with passivation.

2. Technical requirements to be met by products delivered for hot dip galvanizing.

- 2.1 Products delivered for galvanizing shall be packed on pallets or racks allowing unloading with fork lifts. The weight of the parcel should not exceed 3 tones. Products delivered without pallets or racks are exposed to mechanical damage during unloading, internal transport and loading, for which the galvanizing plant is not responsible. Small items should be packed in collective packaging (crates, containers, buckets) or bound and combined with the rest of the delivery.
- 2.2 The product should consist of components made of a single grade of steel and of similar wall thickness. It should be made of ordinary quality carbon structural steel. Below is information on the relationship between the composition of the steel and the properties of the zinc coating.

Category	Typical levels of reactive elements % (mass fraction)	Additional information	Typical coating properties
A	$\leq 0,03$ % Si and $< 0,02$ % P	See NOTE 1 and NOTE 3	The coating has a shiny appearance and a finer texture. The structure of the coating includes an outer layer of zinc.
B	$\geq 0,14$ % Si to $\leq 0,25$ % Si	Other elements can also affect the reactivity of the steel. In particular, phosphorus levels above 0.035% will result in increased reactivity.	The coating can have a glossy or matte appearance. The coating structure may include an outer layer of zinc or the iron-zinc alloy may extend over the surface of the coating depending on the composition of the steel.
C	$> 0,03$ % Si to $< 0,14$ % Si	Too thick coatings may form.	The coating has a darker appearance and a thicker texture. Iron/zinc alloys dominate the coating structure and often extend to the surface of the coating, with reduced resistance to handling damage.
D	$> 0,25$ % Si	The thickness of the coating increases with increasing silicon content.	

NOTE 1 Steels with a composition according to the formula $Si \leq 0.03\%$ and $Si + 2.5P \leq 0.09\%$ should also exhibit these properties. For cold rolled steels, these characteristics are expected to be observed when the steel composition meets the formula $Si + 2.5P \leq 0.04\%$.

NOTE 2 The steel compositions indicated in this table will vary due to other factors (e.g. hot rolling) and the limits of each range will vary accordingly.

NOTE 3 Steels with a silicon composition $< 0.01\%$ that also have an aluminum content $> 0.035\%$ may exhibit lower reactivity, which may result in a lower than expected coating thickness. These steels may exhibit reduced levels of coating cohesion.

NOTE 4 The design of the product to be galvanized may also affect the properties of the coating.

- 2.3 The product must not contain spaces that are closed or that close when it is immersed, as there is a risk of explosion. In this case it is necessary for the client to drill vent holes. Their location and size must be agreed with the galvanizing plant. The galvanizing plant has no obligation or possibility to check the correct execution of the through-holes. In this case, it relies on the customer's declaration that they have been properly executed in accordance with WTO requirements. The galvanizing plant is therefore not responsible for the lack of properly made concealed holes in the structure intended for galvanizing and its flowing out during galvanizing. If significant irregularities are detected in the holes, the material will not be galvanized without the customer's consent. In case of technologically very complex structures (trailers, platforms and other structures having a large number of welded joints) when the verification of the correctness of the process holes is impossible or would be very time consuming, the galvanizing plant assumes the principle of their correct execution in accordance with the accepted on the order document, i.e. GTCS and TAC. The galvanizing plant is also not responsible for the improper course of the galvanizing process (lack of immersion of the structure, lack of coating due to lack of vent holes).
- 2.4 The product shall be designed so that it does not carry in its internal and external spaces the individual process media through which it passes during the galvanizing process. Drainage holes should be made as close as possible to the respective edges to allow free drainage of the chemical and zinc baths. The galvanizing plant is not responsible for leaks of process bath media from inside the structure during its use.
- 2.5 Railings and balustrades that include a handrail should always be suspended with the railing facing upwards. This must be taken into account when making the vent holes and holes for hanging the structure.
It is permissible to galvanize railings and balustrades with the railing facing downwards, after prior agreement with the sales department.
- 2.6 The product should have holes of (depending on the size of the structure) 8-32mm (recommended min. $\varnothing 10$). Minimum hole sizes depending on the size of the structure are shown in Table 2.
- 2.7 The product should have holes or other design features to allow it to be suspended from a wire or hook. The holes should be chamfered - sharp edges can break the wire.
- 2.8 Detailed holes guidelines are given in Annex 1 to the WTO – Hole drilling instructions.
- 2.9 The product to be galvanized shall be free of impurities on its surface that cannot be removed in the process of degreasing and pickling in hydrochloric acid (lacquers, paints, adhesives, stickers, greases, silicone-based anti-chipping agents, welding slag, scale, sander, etc.). All impurities shall be removed by the supplier, preferably by abrasive blasting. This applies in particular to all welded joints.
- 2.10 The zinc coating on heavily corroded material may be of a deteriorated quality. In the case of delivery of very corroded structures, with the so-called pitting the Zinc Plant has the right to refuse the service or propose additional costs related to the above-norm etching process.
- 2.11 In case of inherent stresses in the structure, deformation of the product shape is possible due to heating in the zinc bath to 450°C. Sheet-metal parts or sheets which are part of larger structures may become wavy. It is recommended to use embossing to limit deformation.

So-called louvre fences with internal vents can also be deformed due to the high risk of them sticking, which prolongs the time spent in the furnace.

Self-stresses arise independently of the cooling after galvanizing, e.g. already at the stage of sheet metal production, then forming and cutting. The next most common place where the structure is exposed to stress is the welding shop. The heat introduced into the structure is released during galvanizing and deformation occurs.

The galvanizing plant does not perform straightness checking and straightening of elements that have been deformed during the galvanizing process.

- 2.12 The product delivered for galvanizing shall be free of weld spatter. The joints should be continuous and non-porous. The galvanizing plant is not responsible for defects on welds caused by inadequate preparation. There shall be no chips, cutting burrs or shot residues in the structure or in the holes.
- 2.13 There shall be no gap in the product structure with a width of less than 5 mm
- 2.14 Overlapping surfaces should have vent holes.
- 2.15 It is not allowed to galvanize products that already have galvanized components.
- 2.16 Steel or cast iron components welded into steel structures may not be suitable for galvanizing.
- 2.17 It is advisable to deburr sharp edges. The coating on sharp edges is prone to chipping. This also applies to centrifuged products.
- 2.18 If it is necessary to protect the threads against zinc coating, use a special protective agent or silicone which is resistant to 800-1000°C. The threads only need to be lubricated and this should not be done at the last moment before galvanizing. The preparation (silicone), which is in excess or has not yet had time to solidify, combines with the bath during the galvanizing process and soils the construction.

3. Coating material.

The products are galvanized in an alloy complying with the ISO 1461 standard.

4. Requirements to be met by zinc coatings.

4.1 Coating appearance.

- 4.1.1 The zinc coating should meet the requirements of EN ISO 1461: "Protective coatings applied to steel and cast iron products by dipping. Requirements and test methods." The sum of the individual not fully galvanized areas must not exceed 0.5% of the total surface area of the object. A single spot with a defect must not be larger than 10 cm². All places with defects (not fully galvanized) not exceeding the above requirements will be corrected by the galvanizing plant in accordance with point 5.

Information about the not fully galvanizing on the material due to air pockets, impurities, weld blowouts, sticker spots, etc., the size of which will be in accordance with the above, will be placed on the WZ document.

In cases where the number of defects is greater, the customer will receive a solution proposal from the galvanizing plant in the form of a so-called internal non-compliance and should then communicate its decision. Until the customer's decision is received and handed over to Production, non-conforming material is suspended from further performance of the service.

- 4.1.2 White corrosion on the coating cannot be the basis for a complaint, as long as the minimum thickness of the zinc coating on the products is observed.

- 4.1.3 It is permissible for there to be overflows in the areas of zinc dripping. Sharp zinc icicles are not permitted. An overflow is a thickening of the zinc to a height of about 5mm with dulled edges. An icicle is a sharply pointed flash.
The galvanizing plant does not reduce overflows inside pipes or profiles.
- 4.1.4 Surface irregularities of the substrate material, e.g. rolling slag pits, grooves, depressions in the weld face, corrosion pits, rolling or delamination may remain visible or become apparent after the hot-dip galvanizing process.
- 4.1.5 Striped thickening of the zinc coating may occur on the products subjected to the abrasive blasting treatment, however it does not reduce the anticorrosive effect of the coating.
- 4.1.6 In the case of discontinuously welded or spot-welded components, leakage of flux residues or zinc ash is possible, resulting in dark or reddish-yellow patches on the zinc coating at the joints.
- 4.1.7 Small holes in the components (up to approx. 6mm) may be flooded with zinc alloy. The galvanizing plant does not perform hole calibration and reaming operations or thread machining.
- 4.1.8 As a result of the inhomogeneity of the external surface of the product (different chemical composition, geometrical structure of the surface, technological history, thickness, etc.), the zinc coating on the same product may be formed in a different way and look differently.
- 4.1.9 The zinc coating to be painted must be properly prepared. Preparation procedures (washing, grinding, polishing, commissioning of components) relate to orders for the manufacture of duplex systems (galvanizing and painting) received and performed exclusively at the Rawa Mazowiecka Plant.
- 4.1.10 Grid-type structures may have light overhangs left behind called curtains. Full cleaning of grid-type structures from curtain can only be carried out by arrangement with the sales department.
- 4.1.11 Removing the ash will not completely clean the area where the ash is deposited. Under the influence of atmospheric conditions, ash residues can be released leaving a black mark.
The traces of ash (ashes) are treated with high zinc paint. In the long term, the treated areas oxidize more slowly than the remaining galvanized surface causing a characteristic discoloration on the structure.
- 4.1.12 It has to be taken into account that, as with zinc plating without passivation, numerous factors influence the deterioration of the appearance and a considerable shortening of the life of the passivation coating – storage in the air and without washers and spacers, chemical influences, corrosive environment.
- 4.2 The thickness of the zinc coating is in accordance with EN ISO 1461. The maximum thickness value depends on the steel grade, product dimensions, surface development and the duration of the reaction between the steel and the zinc alloy.

Table 1 – Coating thickness of non-centrifuged zinc coated components

Group of galvanized components	Average coating thickness values	
	Minimum coating thickness at μm	Average thickness of coating in μm
Steel parts with a thickness < 1.5 mm	35	45
Steel parts with thickness ≥ 1.5 mm to ≤ 3 mm	45	55
Steel parts with thickness >3 mm to ≤ 6 mm	55	70
Steel parts with thickness > 6 mm	70	85
Cast iron parts with thickness < 6mm	60	70
Cast iron parts with thickness ≥ 6 mm	70	80

Table 2 – Coating thickness of centrifuged galvanized components

Product and its thickness	Minimum unit coating thickness in μm	Local coating mass (minimum value) ^b g/m^2	Average thickness of coating in μm	Average coating weight (minimum value) ^b g/m^2
Threaded products of diameter: > 6 mm ≤ 6 mm	40	285	50	360
	20	145	25	180
Other products (incl. castings) ≥ 3 mm < 3 mm	45	325	55	395
	35		45	325

4.3 Coating adhesion.

The hot-dip zinc coating is diffusively bonded to the substrate and withstands the loads occurring during normal use of galvanized products. Overgrowth of the coating due to inappropriate steel grade, product dimensions or surface development can be a problem.

5. Protection of areas not covered with zinc coating.

All areas not covered with zinc should be protected by painting with a professional high zinc paint. For improved aesthetics, a layer of high zinc paint containing aluminum dust can be applied to the zinc paint layer. The total thickness of the applied layers must be at least $30\mu\text{m}$ more than the thickness requirements of Table 1 but not less than $100\mu\text{m}$. Places not covered with zinc should be mechanically cleaned before painting with a wire brush or sandpaper, degreased with solvent and thoroughly dried. Do not paint on wet or insufficiently dried areas. All operations related to the improvement of the surface after galvanizing shall be carried out in the finished products warehouse.

To improve the aesthetics of the repair, a zinc spray can be used depending on the desired effect

WARNING! If the galvanized product is to be additionally protected by a coat of paint, do not spray-paint.

6. Tests of the zinc coating.

6.1 Checking the appearance of the coating.

Examination of the appearance of the zinc coating shall be carried out by visual inspection with the unaided eye from a distance of 1 meter. The appearance of the coating shall conform to the requirements of item 4.1. All products shall be visually inspected.

6.2 Checking the thickness of the zinc coating.

The thickness of the zinc coating should be measured with a magnetic thickness gauge according to EN ISO 1461. The measurement shall be carried out at a minimum of three points distributed as evenly as possible over the surface of the product. To determine the thickness of the coating in one place at least 5 measurements should be taken on an area of approx. 10cm² and the arithmetic mean of the measurements constitutes the local thickness of the coating. The arithmetic mean of the local thicknesses thus measured shall constitute the average value of the coating thickness on the test object. A product meets TAC requirements if the average coat thickness calculated in this way is not less than the values given in Table 1. Thickness tests shall be carried out on at least one product per batch. In the case of batches of one type, or on one product of each type of element if the batches are made up of different assortments of materials.

6.3 Checking the adhesion of the zinc coating.

There is no need to test the adhesion between the zinc coating and the substrate as the zinc coatings have sufficient adhesion due to the diffusive nature of the bond. In general, thicker zinc coatings require more careful treatment than thinner ones. Bending and forming after zinc plating by single dipping is not normally used.

7. Final arrangements.

7.1 Products are galvanized and treated according to treatment standards A, B and C adopted at FAM Sp. z o.o. Visualization of the standards is available in each of the plants as well as on the company's website.

7.2 Products delivered to FAM are accepted and billed on the basis of weight.

7.3 Material delivered after 3:00 p.m. and reserved for production "on demand", which does not meet the TAC requirements and it is not possible to obtain the customer's approval for adjustment to TAC requirements will be galvanized the next day after obtaining the necessary information from the customer.

7.4 For structures having internal spaces, the requirements in this TACs do not apply to the internal surfaces, but only to the external surfaces of the object.

The galvanizing plant is not responsible for the quality of the zinc coating in places that cannot be measured, inspected and cleaned, e.g.: the inside of pipes, closed profiles etc.

7.5 In case of special requirements regarding the appearance of the galvanized surface or the thickness of the zinc coating, the galvanizing plant shall be informed in writing before the delivery of the product for galvanizing.

7.6 If the zinc coating is to be additionally protected by painting, this must be agreed in writing with the galvanizing plant.

7.7 The galvanizing plant is not responsible for damage caused during transport, storage and installation outside the galvanizing plant. Any possible loss of zinc resulting from the

above-mentioned circumstances must be immediately treated by the recipient with zinc paint in accordance with EN ISO 1461. Confirmation of qualitative and quantitative receipt of galvanized material is a signed Stock Issue Confirmation (CI) document.

- 7.8 In order to maintain the aesthetics of the product (to prevent white corrosion) it is recommended to transport it by covered vehicles and to store galvanized products in covered and ventilated places until the natural pass of the zinc coating.
- 7.9 A batch of galvanized details found to be non-compliant with TACs requirements may be resubmitted for Quality Control acceptance after rectification of the defects.
- 7.10 Unjustified call for the removal of warranty defects will result in charging the customer for the costs incurred by FAM Sp. z o.o.

8. Related standards.

PN-EN ISO 1461:2011 Zinc coatings applied to steel and cast iron products by immersion. Requirements and test methods.

9. Attachments.

- 9.1 Hole drilling instructions
- 9.2 Machining standards A, B, C.

Warsaw, 30 November 2022

EXAMPLES OF CUSTOMIZATION OF STEEL PRODUCTS FOR HOT DIP GALVANIZING

TABLE 1 – Zinc flow through the structure - design of openings.

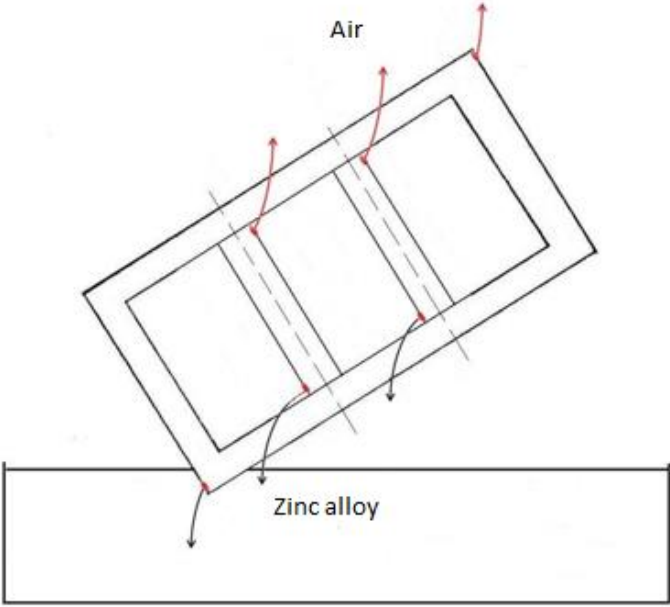
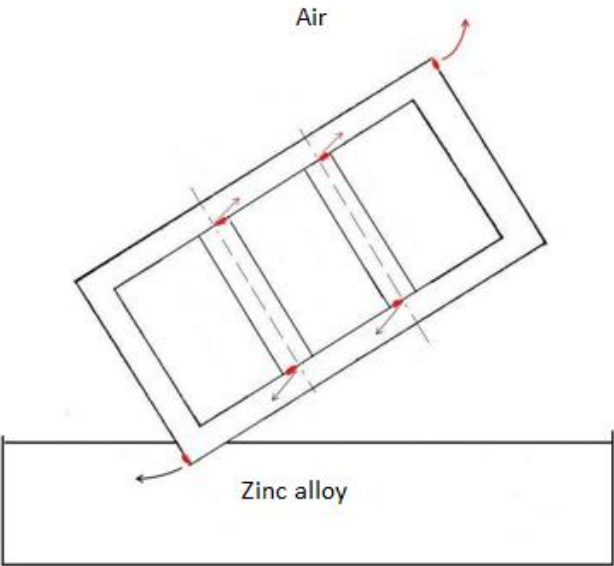
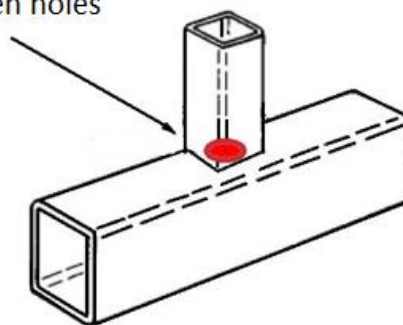
<p>Zinc flow inside a closed structure (profile, tube)</p> <p>Utility penetrations on the outside – overflows may occur</p>	
<p>Zinc flow inside a closed structure (profile, tube)</p> <p>Concealed utility penetrations – for safety reasons, care must be taken when drilling them</p>	

TABLE 2 – Design of openings. The required size of the following openings also applies to the size of the external openings.

The concealed openings shall be selected and arranged so as to ensure smooth pull-out from the sump and the least possible zinc residue inside the structure

Hidden holes






Hollow section dimensions, mm			Minimum hole diameter for a given number of holes, mm		
			1	2	4
15	15	20 x 10	8		
20	20	30 x 15	10		
30	30	40 x 20	12	10	
40	40	50 x 30	14	12	
50	50	60 x 40	16	12	10
60	60	80 x 40	20	12	10
80	80	100 x 60	20	16	12
100	100	120 x 80	25	20	12
120	120	160 x 80	30	25	20
160	160	200 x 120	40	25	20
200	200	260 x 140	50	30	25

TABLE 3 – Design of openings - openings for suspension and drainage.

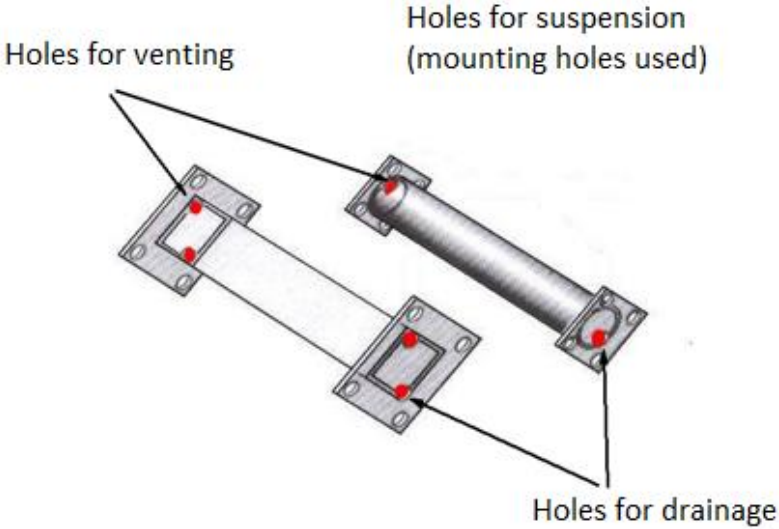
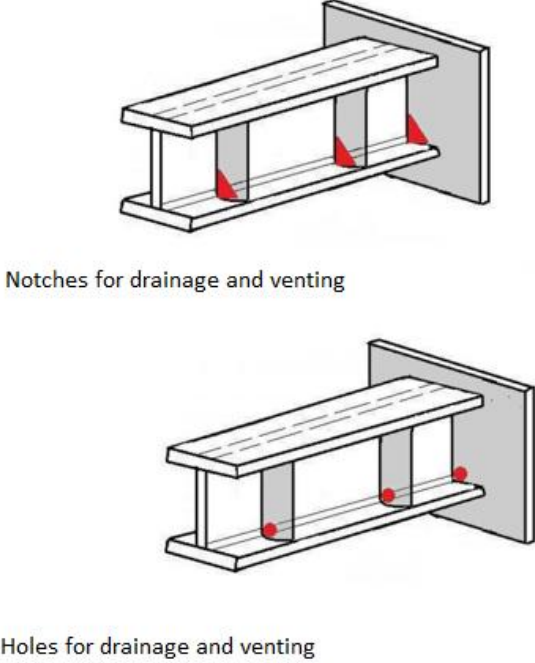
<p>Holes for suspension should allow for easy wire suspension</p>	 <p>Holes for venting</p> <p>Holes for suspension (mounting holes used)</p> <p>Holes for drainage</p>
<p>Ventilation and drainage must also be ensured for open structures (sections)</p> <p>Bevels or openings made in the structure may be used</p>	 <p>Notches for drainage and venting</p> <p>Holes for drainage and venting</p>

TABLE 4 – Construction for galvanization

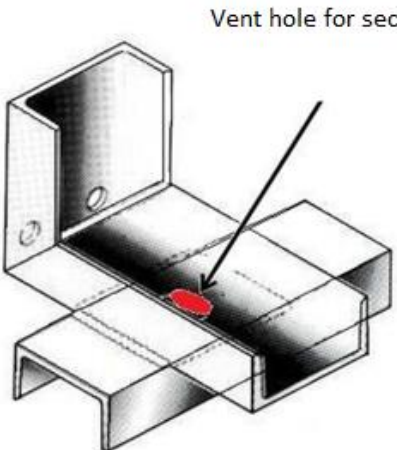
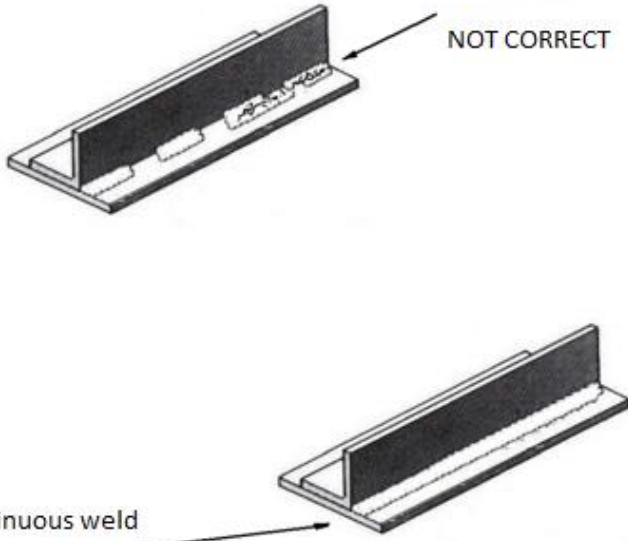
<p>Overlapping surfaces may be deformed by increased air pressure</p>	 <p>Vent hole for section contact surfaces</p>
<p>Incorrectly executed welds cause leakages after galvanizing</p>	 <p>Rough and non-continuous weld NOT CORRECT</p> <p>Continuous weld CORRECT</p>

TABLE 5 – Spatial constructions

The design of the structure shall take into account the technological aspects of galvanizing

Galvanizing of spatial elements is more difficult

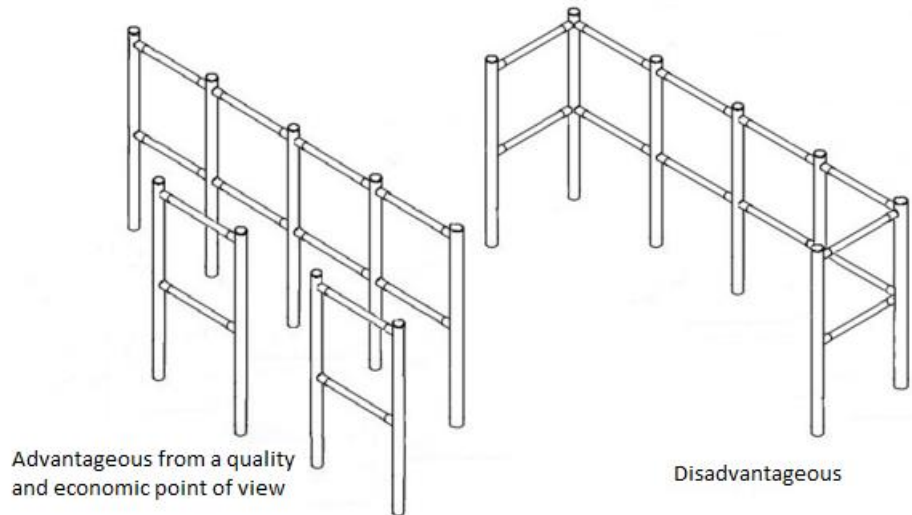






TABLE 6 – an example visualization of the influence of the elemental composition of steel on the appearance of the coating.

Steel groups	Silicon content (%)	Hot-dip zinc coating (appearance)	
Low silicon	<0,03		Silvery, shiny
Sandeline	0,03>0,14		grey, dull, rough, brittle
Sebist	0,14>0,25		silvery-shiny to dull-grey
High silicon	>0,25		dull, gray, brittle

HOLE DRILLING INSTRUCTIONS

In the preparation of the structure for galvanizing, the HOLE DRILLING is **absolutely the most important** issue.

The correct hole drilling lies **on the side who supply** the construction.

The correct hole drilling ensures:

- high quality of the zinc coating and **high aesthetics** of the product.

The wrong hole drilling can be cause of:

- poor quality of the coating
- lack of continuity and spots treated with zinc paste
- lack of aesthetics, lack of durability;
- costs related to the opening and shutdown of the Galvanizing Plant
- costs related to the repair of a damaged structure - deformation, "profile swell"

The main assumptions of the hole drilling:

- each element is suspended at the maximum angle and holes (their location) have to be prepared for such suspension
- every closed element (e.g. square profile) must be drilled at **BOTH ends**
- any place that may cause the flow of **zinc and ashes** to stop or be obstructed must be bored
- any hole through which the zinc will flow must be placed at the very end of the component of the structure in question = after diagonal suspension this hole must be at the lowest point, so that all the zinc flows out.
- each vent must be located at the very end of a component of the structure in question = when suspended at an angle, this hole must be located at the highest point in order to ventilate the structure and for all the ash to escape.

WARNING: The density of zinc is **7x** greater than the density of water!

The hole drilling is to ensure the fastest possible immersion in zinc and the free flow of any media (acids, flux, zinc) and ashes.

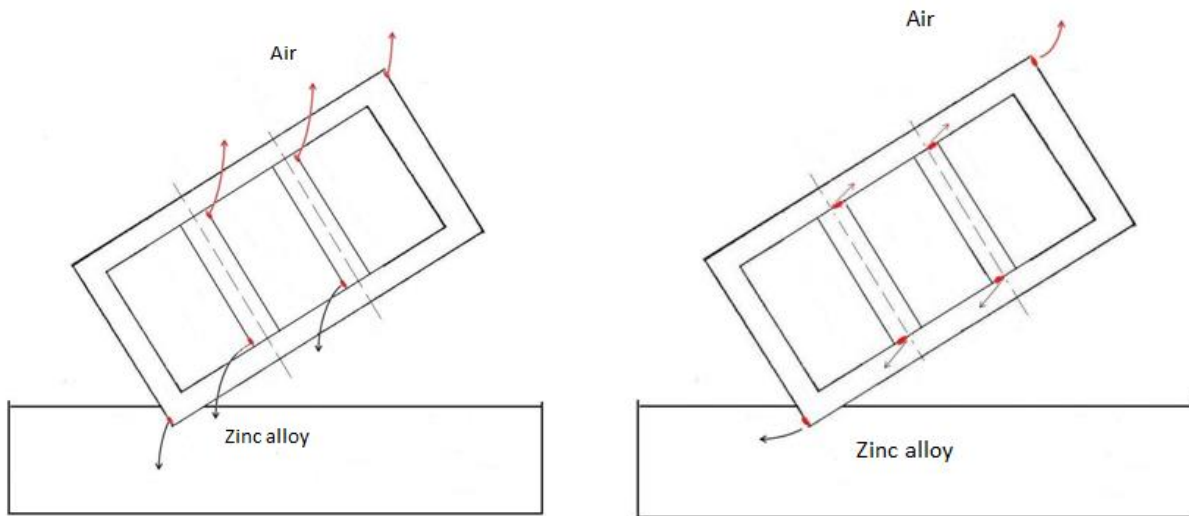
Places such as joints of channels, I-beams, angles, all places where so-called semi-closed pockets are formed, preventing the flow of media and **causing ashes to stick**, should also be drilled.

Galvanizing Plant suggestion:

Minimum permissible openings are fi 12mm;

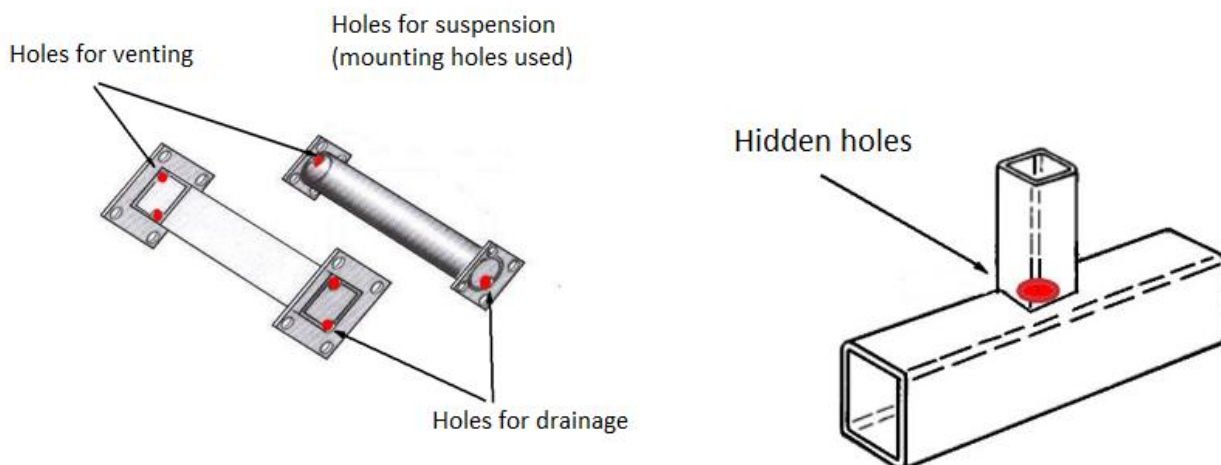
Exception: fi 10mm are profiles 40x40 and smaller

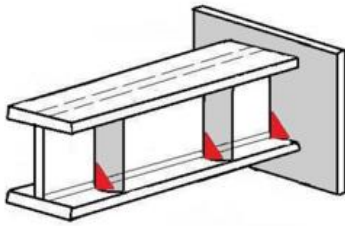
For cross-sections of 100x100 and more, the openings must be increased accordingly to 16-30mm, depending on the size of the cross-section. It is advisable to make two holes at each end of the element.



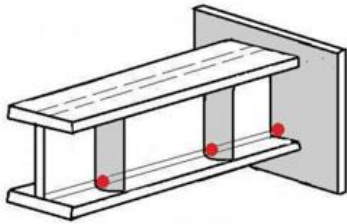
Holes at the lowest points for pouring (after suspension at an angle) and at the highest points for aeration.

Axial holes should not be used unless their diameter coincides with the profile dimensions.



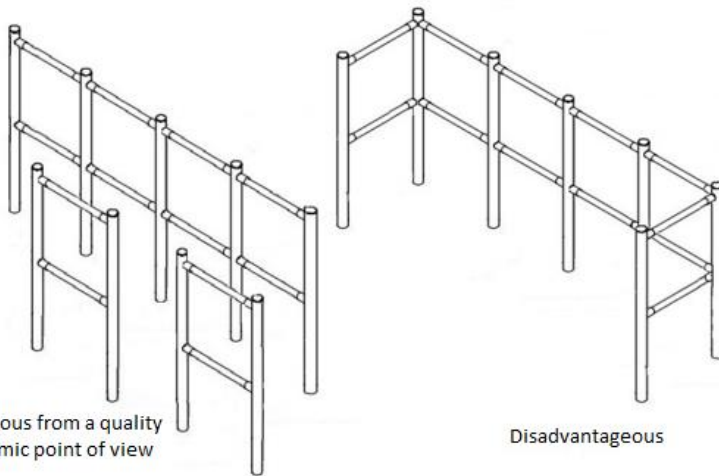
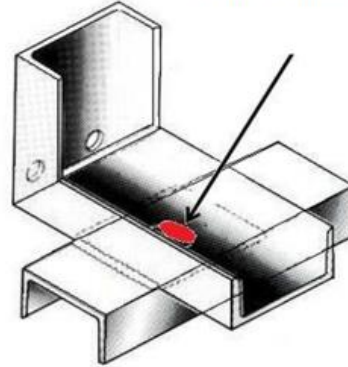


Notches for drainage and venting



Holes for drainage and venting

Vent hole for section contact surfaces

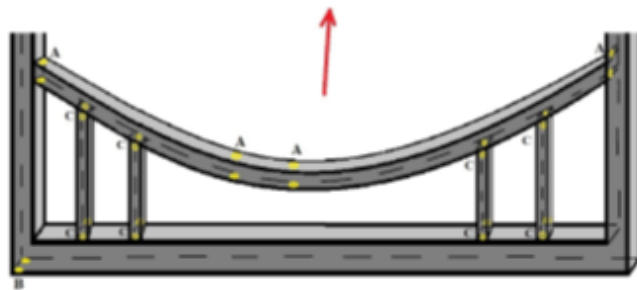
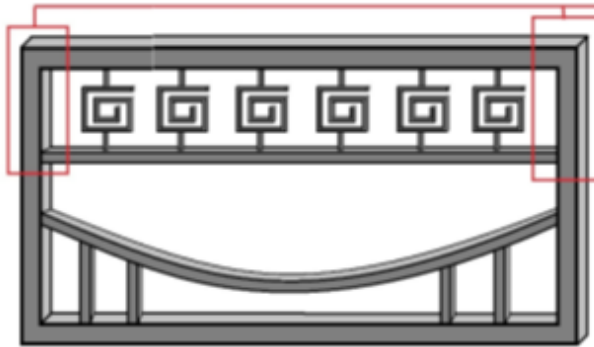


Advantageous from a quality and economic point of view

Disadvantageous

The price is generated primarily by the weight of the batch, so we encourage the supply of flat products/structures, not spatial ones. In addition, it should be noted that for spatial structures it is more difficult to obtain an angle in the second plane, which may result in poor quality.

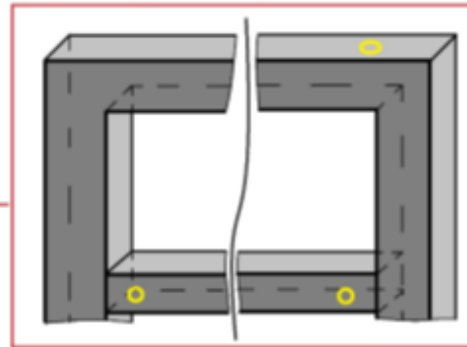
FENCE SPAN - EXAMPLES OF HOLE ARRANGEMENTS



B MAIN HOLES - THROUGH THESE HOLES THE BAY FRAME WILL BE FILLED WITH ZINC. THE WHOLE FRAME HAS A LARGE CAPACITY SO IT MUST BE A MINIMUM OF 2X FI 12. REMEMBER TO PLACE THEM AT THE CORNERS AND EDGES)

A HOLES IN THE CURVED PROFILE. HOLES AT THE ENDS ON BOTH SIDES ARE NOT SUFFICIENT. THERE MUST BE HOLES IN THE MIDDLE OF THE PROFILE AS WELL AS WITH A SLIGHT OFFSET IN THE DIRECTION OF THE BAY ANGLE. WITHOUT THESE HOLES THE BAY WILL NOT SINK. THE ZINC WILL PUSH THE BAY UPWARDS. IT IS BEST TO ARRANGE THE HOLES EVERY 1/4 OF THE DISTANCE.

C VERTICAL PROFILES (CROSSPIECES) - HOLES THROUGH TO THE VERY EDGES. AS AN OPTION, ONE HOLE EACH FROM THE TOP AND BOTTOM, MAKING SURE THEY ARE AT THE VERY EDGES.

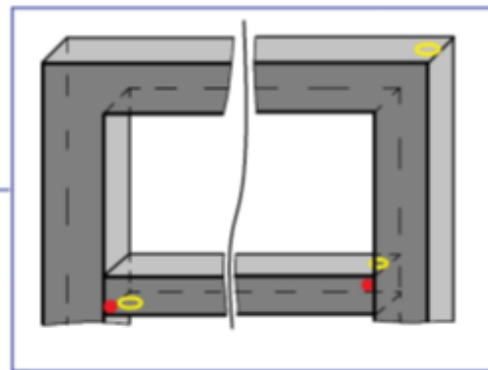


WRONG

THE HOLES ARE PLACED IN THE MIDDLE FROM THE FRONT. THERE WILL BE A LOT OF ZINC LEFT IN THE PROFILE. ON THE OTHER SIDE THE PROFILE INSIDE WILL NOT VENT.

WRONGLY VENTED FRAME PROFILE

IN ADDITION, BEFORE GALVANIZING, FLUX WILL BE LEFT INSIDE THE PROFILE, WHICH WILL HAVE A NEGATIVE IMPACT ON THE QUALITY OF THE COATING (APPEARANCE OF STREAKS, BLISTERS AND DIRT)

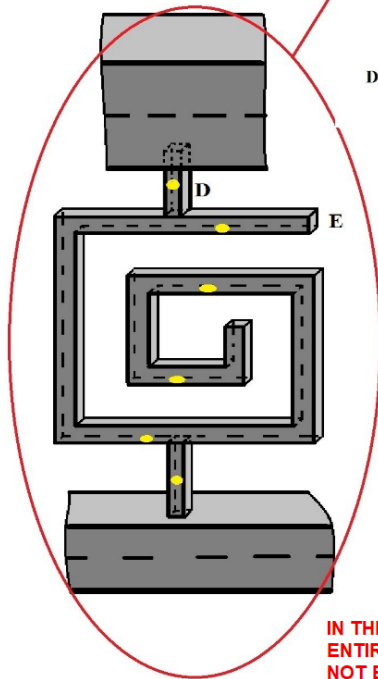
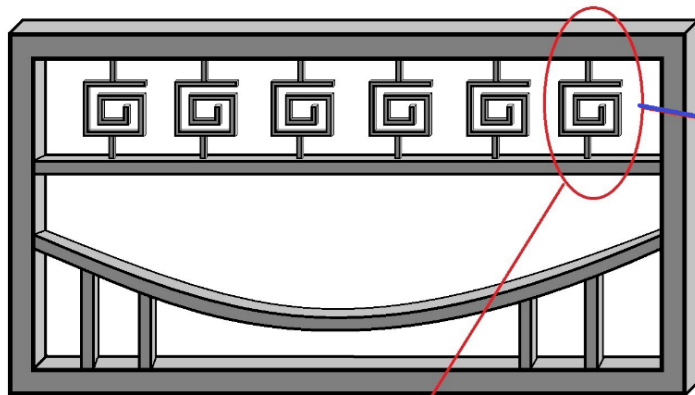


GOOD

THE HOLES IN THE TRANSVERSE PROFILE ARE CORRECTLY DIAGONALLY ARRANGED (YELLOW). THE PROFILE WILL DEAERATE, ALL THE ZINC CONTENT WILL DRAIN OUT OF THE INTERIOR

ALTERNATIVELY (RED) CAN BE DRILLED FROM THE FRONT. USE FOR SMALL PROFILE CROSS-SECTIONS.

FENCE SPAN - EXAMPLES OF HOLE ARRANGEMENTS, CONTINUATION

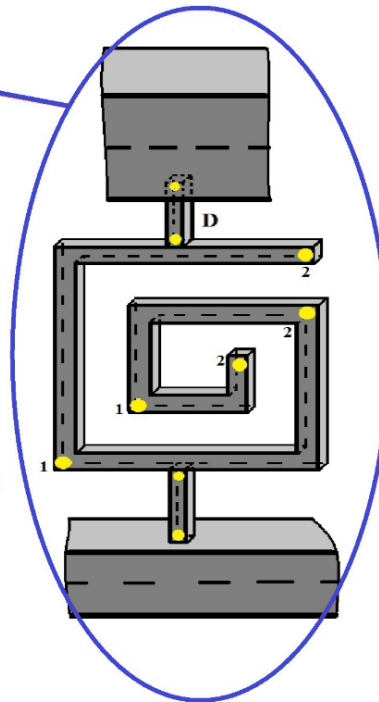


WRONG

D IN VERTICAL PROFILES THE HOLE DOES NOT FULFIL ITS FUNCTION. THE PROFILE WILL NOT VENT, THERE WILL BE ZINC LEFT IN THE MIDDLE AFTER GALVANIZING. BEFORE GALVANIZING, FLUX WILL BE DEPOSITED INSIDE WHICH WILL HAVE A NEGATIVE IMPACT ON THE QUALITY

E IN THE "GREEK" PATTERN HOLES POORLY SPACED. EVEN IF THE BAY IS IMMERSED IN THE ZINC BATH, A VERY LARGE AMOUNT OF ZINC WILL REMAIN INSIDE.

IN THE CASE WHERE THIS PATTERN IS A MAJOR COMPONENT OF THE ENTIRE BAY, WITH THIS TYPE OF HOLE ARRANGEMENT THE BAY WILL NOT BE IMMERSED.



GOOD

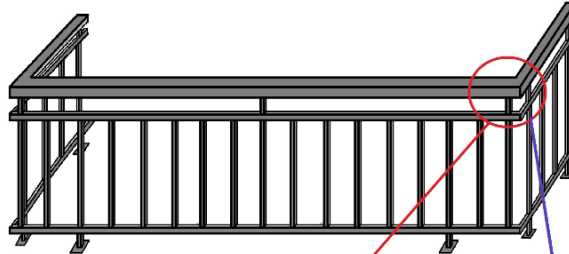
1 HOLES THROUGH WHICH THE ELEMENT WILL BE FILLED WITH ZINC. REMEMBER THAT THEY SHOULD BE DRILLED IN THE VERY CORNERS. BEFORE GALVANIZING, THE FLUX WILL BE DEPOSITED IN THE NOOKS AND CRANNIES. AFTER THE GALVANISING PROCESS, THE ZINC WILL FLOW OUT OF THE INTERIOR.

2 THE HOLES WILL VENT THE COMPONENT SO THAT NO AIR CUSHIONS ARE FORMED AND THE COMPONENT CAN SINK FREELY

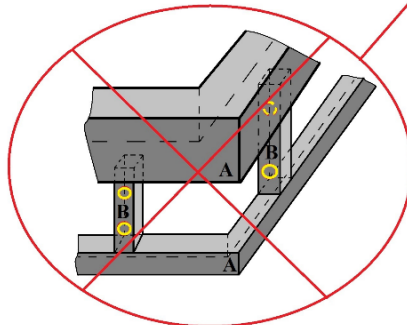
D THE HOLES IN THE VERTICAL PROFILES ARE CORRECTLY POSITIONED AT THE VERY EDGES

P.S. THE LOCATION OF THESE HOLES DEPENDS ON THE PLACE WHERE THE BAY WILL BE FILLED WITH ZINC (PREVIOUS PAGE, POINT B)

HOLES IN SPATIAL RAILINGS



BAD

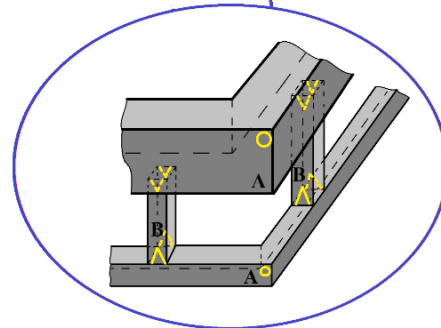


INCORRECT POSITION OF HOLES

- A** IN THE HORIZONTAL HANDRAIL THERE ARE NO VENTILATION HOLES. THE RAILING WILL NOT SUBMERGE AS SOON AS ALL THE HOLES ARE UNDER THE RAILING.
- B** HOLES IN THE PROFILES ARE TOO FAR FROM THE EDGE, THE UPPER PART OF THE PROFILE WILL BE SEALED, AND IN THE LOWER PART A LOT OF ZINC WILL REMAIN

WITH SUCH AN ARRANGEMENT OF THE HOLES IN THE PROFILES, FLUX RESIDUES WILL REMAIN WHICH, WHEN IMMERSSED IN THE ZINC BATH, WILL BURN OFF RESULTING IN UNDESIRABLE IMPURITIES AND BLISTERS.

GOOD



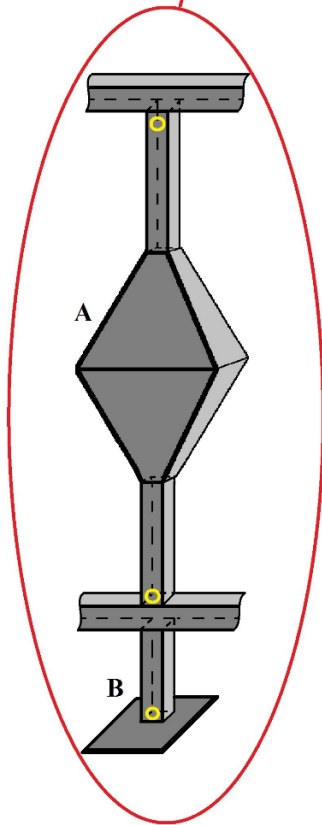
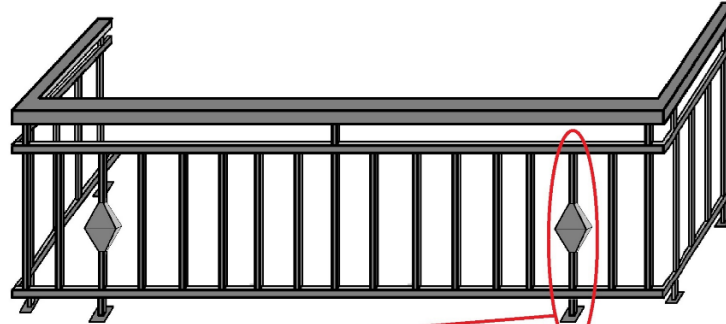
CORRECT POSITIONING OF THE HOLES

- A** THE HANDLE AND THE HORIZONTAL CROSSBAR ARE VENTED AT THE HIGHEST POINTS.
- ALTERNATIVELY, IN THE CASE OF SMALLER CROSS-SECTIONS, A BOTTOM VENT CAN BE USED IN THE SCABBARD 1 HORIZONTAL PROFILE. HOWEVER, CARE MUST BE TAKEN TO POSITION IT AS CLOSE AS POSSIBLE TO THE CORNER.

- B** THE PROFILES ARE PROVIDED WITH NETS ON BOTH SIDES

IN THE CROSSBARS, HOLES CAN BE DRILLED, BUT CARE MUST BE TAKEN TO POSITION THEM AS CLOSE AS POSSIBLE TO THE EDGE OF THE JOINT

EXAMPLE OF INSERTING A COMPLETE DECORATIVE ELEMENT IN THE CENTRE OF A PROFILE

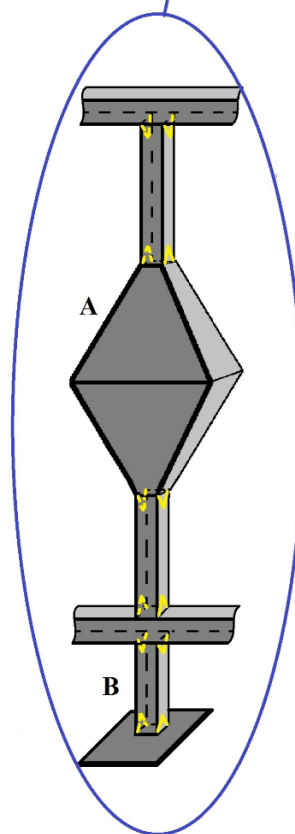


WRONG

HOLES ARE MISSING AT THE CONNECTION OF THE PROFILE TO THE DECORATIVE ELEMENT (A)

NO HOLES IN THE FOOTPLATE (B)

THE HOLES SO PREPARED DO NOT ALLOW THE ELEMENT TO SINK INTO THE ZINC BATH



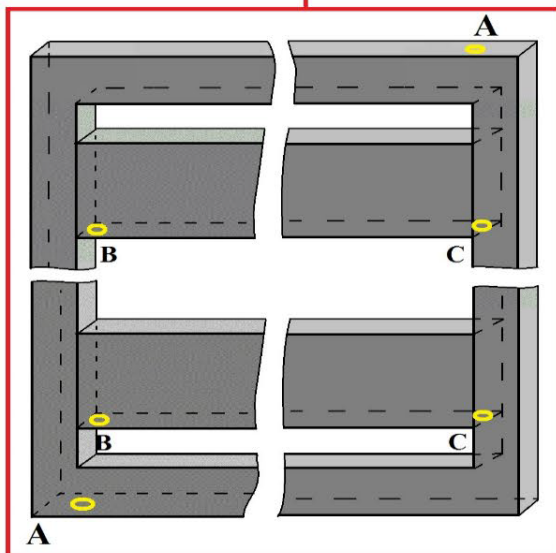
GOOD

THE HOLES HAVE BEEN MADE CORRECTLY. AT THE EDGES OF THE CONTACT BETWEEN THE PROFILES AND THE DECORATIVE ELEMENT (A) THE HOLES HAVE BEEN DRILLED

HOLES ARE PROVIDED IN THE FOOTPLATE FOR VENTILATION.

IN THE CASE OF SMALL PROFILE CROSS-SECTIONS THE HOLES CAN ALTERNATIVELY BE DRILLED. REMEMBERING TO LOCATE THE HOLES AT THE VERY EDGES

SPAN - HIGH PROFILE FILLING, WALL HEIGHT FROM 60MM AND MORE (THE MOST COMMON ERROR)

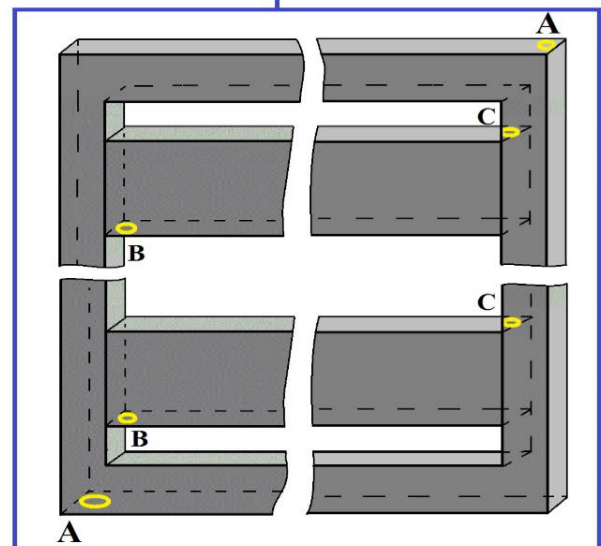


WRONG

A FILLING AND VENTING HOLES IN THE BAY FRAME AT A CONSIDERABLE DISTANCE FROM THE EDGES. A LOT OF ZINC WILL BE LEFT AT THE BOTTOM, AN AIR CUSHION WILL FORM INSIDE FROM THE TOP.

B THE FILLING HOLE IN THE FILLING PROFILE IS PLACED IN THE RIGHT POSITION, THE ZINC WILL COMPLETELY POUR OUT OF THE INSIDE OF THE PROFILE.

C WRONGLY PLACED VENT HOLE IN THE FILLING PROFILE. THE LOCATION FROM - DOWNWARDS IN COMBINATION WITH SUCH A PROFILE HEIGHT WILL PREVENT THE SPAN FROM BEING IMMERSED IN THE ZINC BATH. THIS IS THE MOST COMMON MISTAKE MADE BY CONTRACTORS. GALVANIZING PLANT RETURNS MATERIAL FOR RE-PROCESSING



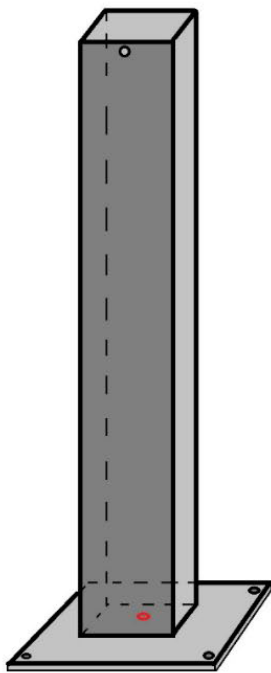
GOOD

A FILLING AND VENTING HOLES IN THE BAY FRAME PLACED AT THE VERY EDGE. THE ENTIRE ZINC CONTENT WILL POUR OUT FROM THE INSIDE, THE UPPER PART PROPERLY VENTED

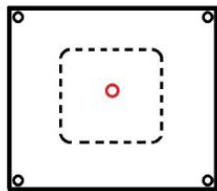
B FILLING HOLE SUITABLY POSITIONED

C THE VENT HOLE IN THE HIGH FILLING PROFILE IS AT THE HIGHEST POINT ON THE RIGHT. THIS POSITION ENSURES ADEQUATE VENTING AND CORRECT IMMERSION.

PILLAR WITH A FOOTPLATE

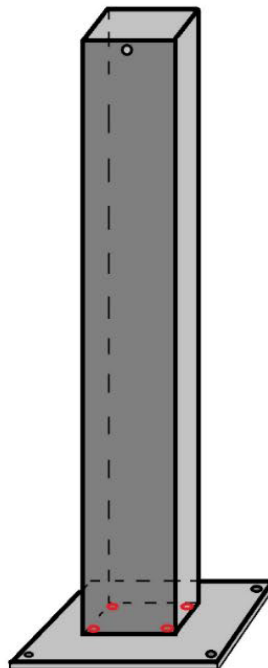


BAD

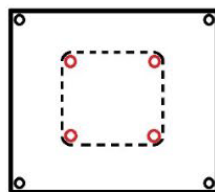


THE HOLE IN THE MIDDLE OF THE FOOT DOES NOT FULFIL ITS FUNCTION. FLUX RESIDUES WILL BE LEFT INSIDE THE POST WHICH WILL CAUSE A REACTION DURING GALVANIZING THAT WILL HAVE A NEGATIVE EFFECT ON QUALITY.

AFTER THE PROCESS, A LARGE ZINC SURPLUS WILL BE LEFT INSIDE THE POST.



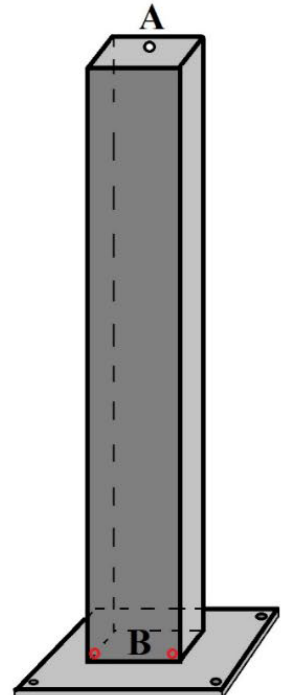
GOOD



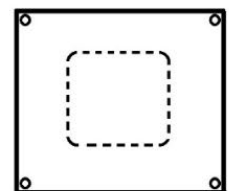
THE CORRECT POSITIONING OF THE HOLES

NO FLUX RESIDUE WILL REMAIN IN THE POST

THERE WILL BE NO ZINC LEFT AFTER THE GALVANISING PROCESS



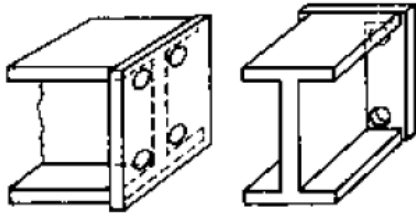
ALTERNATIVE



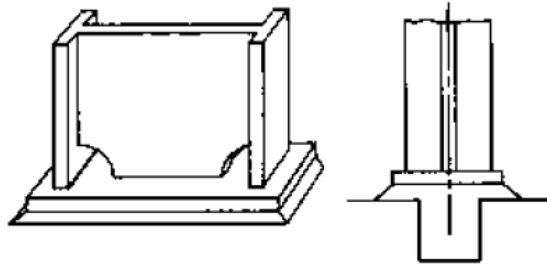
NO HOLES IN THE FOOTPLATE. THE HOLES ARE LOCATED ON THE WALL OF THE PROFILE.

REMEMBER THAT THE HOLE FOR THE SUSPENSION (A) MUST BE MADE DIAGONALLY TO THE "RUN-OFF" HOLES (B)

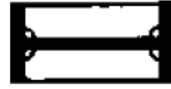
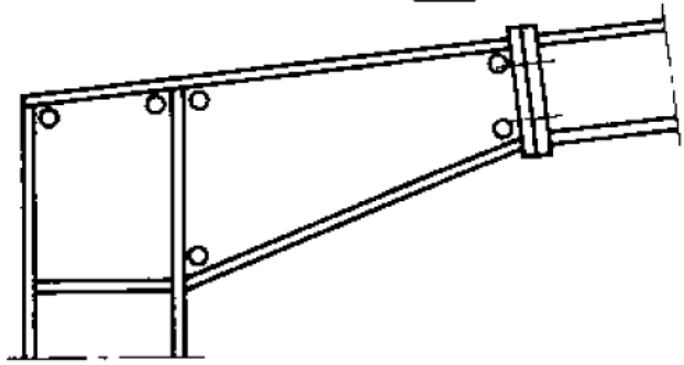
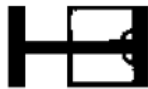
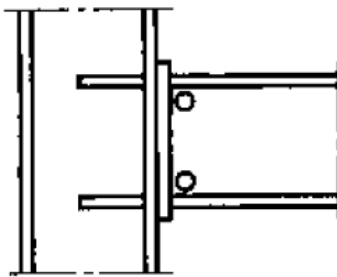
BEAM CONNECTION



SUPPORTING FOOT



FRAME CORNER

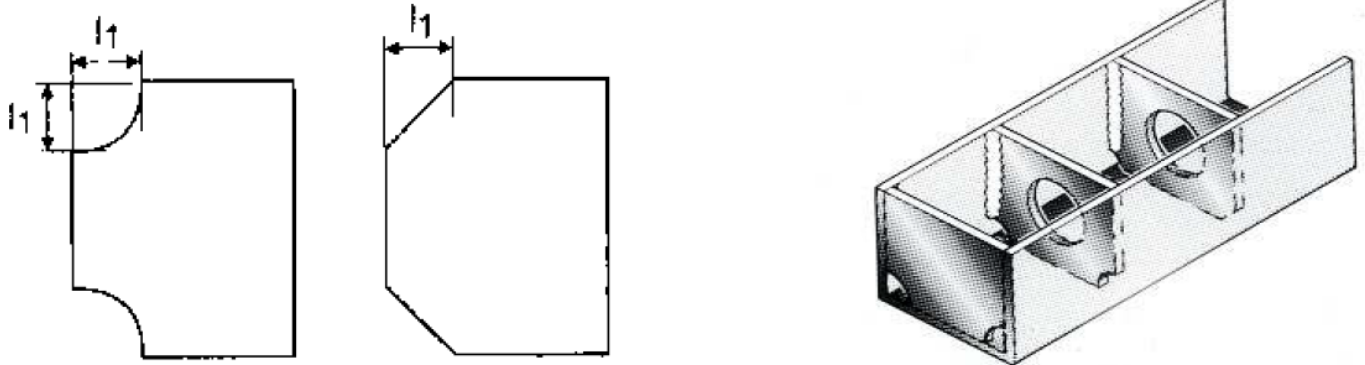


Any "semi-closed pocket" or area that impedes the free flow of zinc or ash must be drilled out as above.

Below: **LACK OF THROUGHNESS OF THE STRUCTURE:**



Minimum dimensions of open punches



L > 20 mm for profiles up to 300 mm

L > 30 mm for profiles with cross-section more than 300 mm

Dear Customer!

We are absolutely committed to the best possible quality of the galvanizing service,

but the quality of the coating and its aesthetics also depend on you!

We keep our fingers crossed for a proper hole drilling.

The team of FAM Sp. z o.o.
Wrocław, October 21, 2020

ZINC COATING PERFORMANCE STANDARDS

In order to meet your requirements, we have introduced standards for corrosion protection coating by hot-dip galvanizing.

Standards are divided into:

A - Acceptance variant for galvanized material without treatment.

B - Treatment and appearance of the zinc coating in accordance with TAC specifications.

C - individual customer requirements for the coating and/or packaging of products

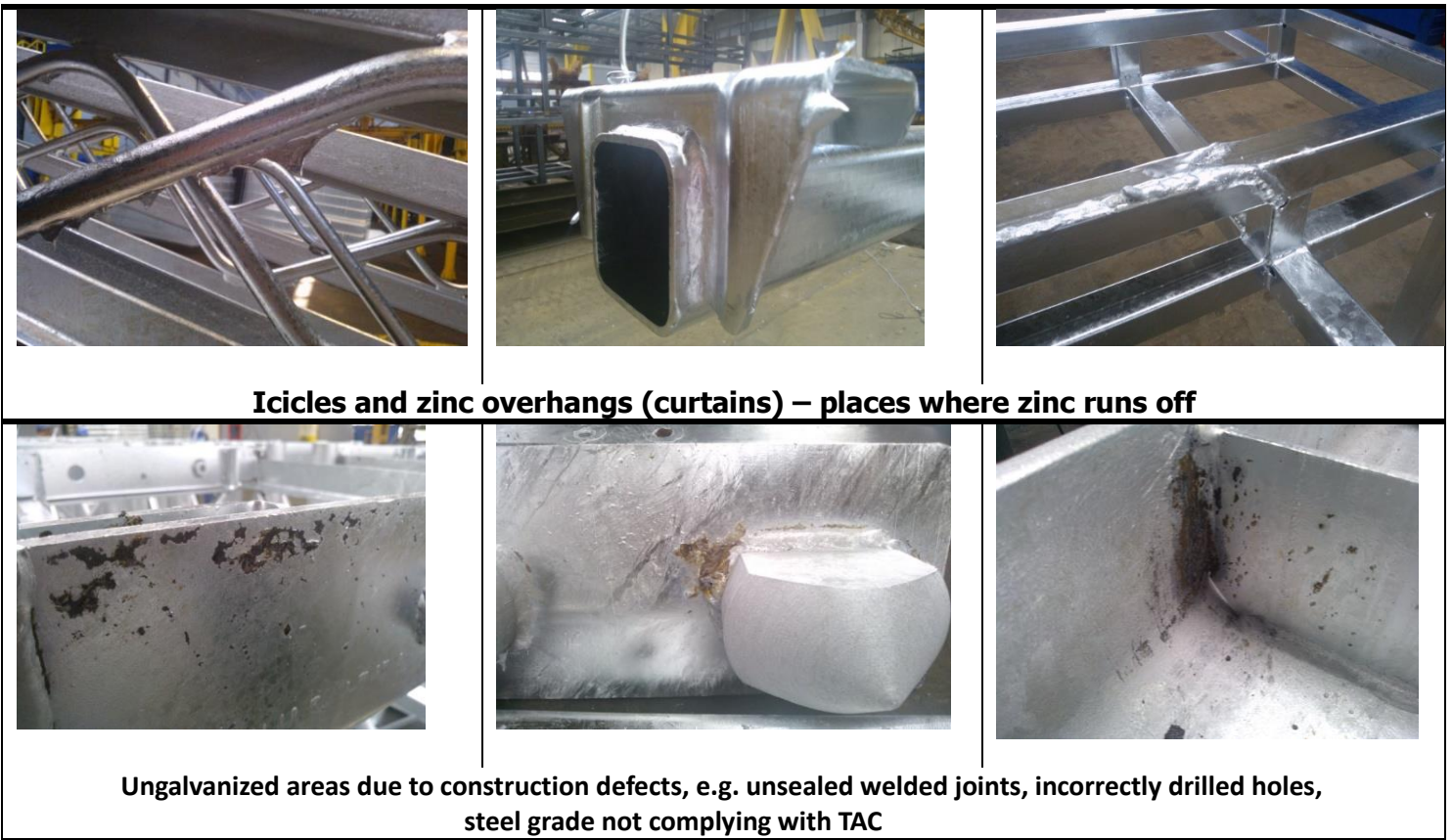
A – Acceptance variant for galvanized material without treatment.

1. The following are not removed: zinc infiltration, icicles, overhangs, sharp edges.
2. Touch-ups are not used.
3. Mounting wire marks are not to be treated.
4. Roughness and changes in surface structure resulting from the steel grade used will not be treated by grinding.

The galvanized structure is only post-treated to the following extent:

- removal of ashes

Examples of galvanized material made in standard A - without treatment.





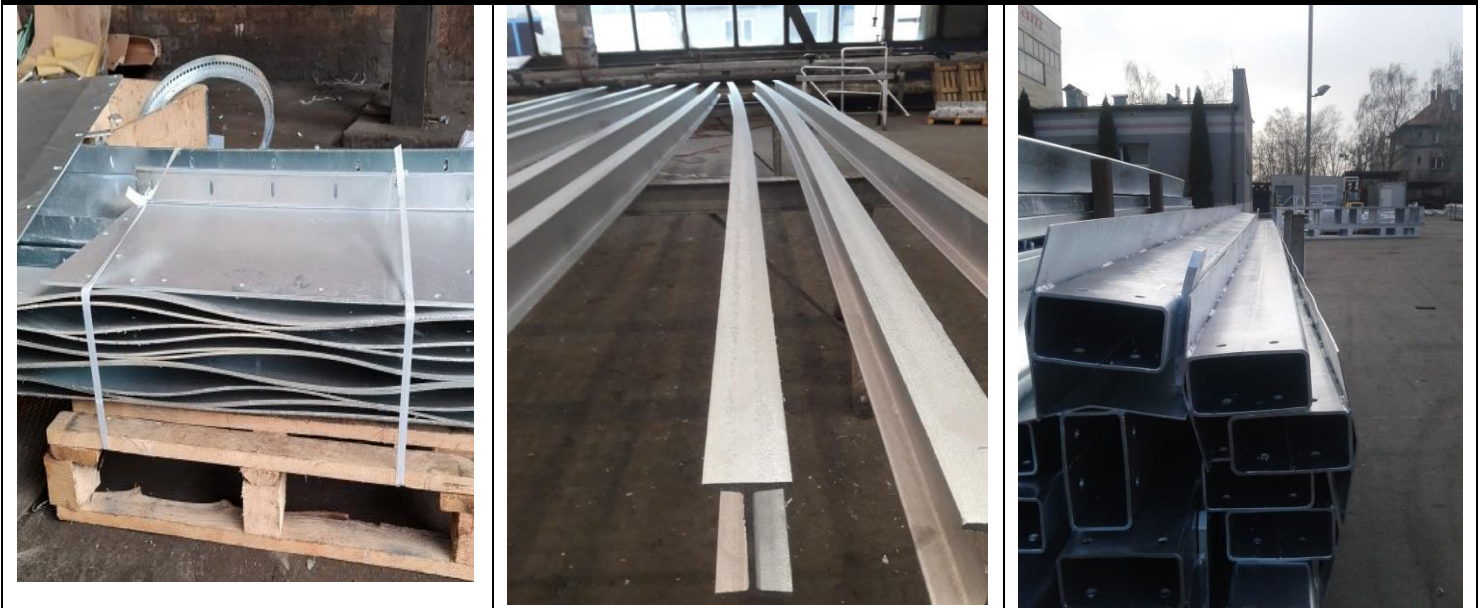
Impurities on steel, sticker marks resulting in lack of zinc plating – remain unpainted



Sling (wire) marks, ash marks – are not treated



Precipitated aluminum – scum – is not removed



In case of inherent stresses in the structure, deformation of the product shape is possible due to heating in the zinc bath to 450°C. Sheet-metal parts or sheets which are part of larger structures may become wavy.



Coating structure resulting from the steel grade



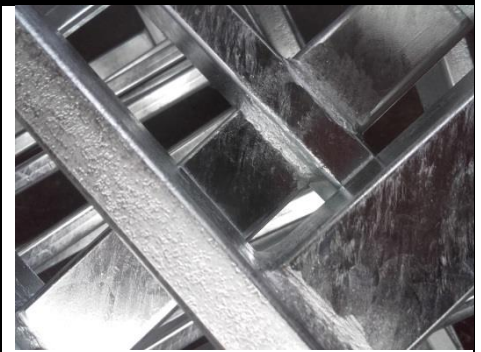
Untight welds – blow-outs and leaks are not sealed



Incorrectly prepared holes result in zinc flashes, numerous lacks in zinc plating (the material will not dip into the furnace, it will get air in) and profile ruptures dangerous for galvanizing plant workers.



Material delivered to the galvanizing plant should be properly packed. Material without pallets or racks is exposed to damage during unloading, loading and internal transport



Heavily corroded, recycled material can result in lacks in zinc plating or uneven (pitted) zinc surface.

B – Treatment and appearance of the zinc coating in accordance with TAC specifications

The surface of the coating should be continuous and free from defects that prevent the product from being used. The sum of the individual ungalvanized areas must not exceed 0.5% of the total surface area of the object.

A single spot with a defect, i.e. a lack of zinc coating, must not be larger than 10 cm².

In case of defects of the zinc coating arising due to the fault of the technology of construction by the customer, the galvanizing plant is not obliged to repair them.

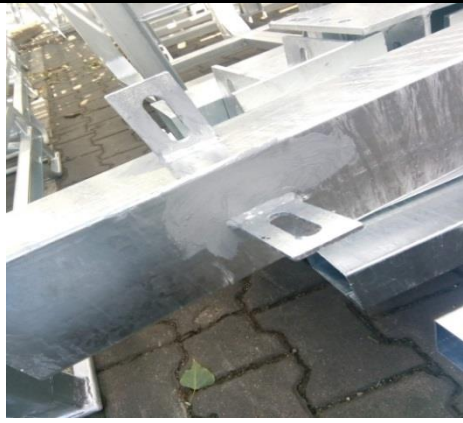
FAM does not perform cleaning and calibrating operations on holes and threads and operations to straighten parts that have been deformed during the galvanizing process.

For galvanized surfaces to be painted, it is necessary to prepare them properly. The preparation of the zinc coating for painting (such as washing, grinding, polishing or any other preparation required for the various painting methods) is the responsibility of the customer.



Rough surface structure in compliance with the standard.

WARNING: Surface roughness is not always the cause of hard zinc inclusions. This may be due to the reaction of the material with the zinc bath as well as to too small utility penetrations. Please note that this does not affect the anticorrosive properties of the coating and its appearance is of secondary importance.



Coating to be repaired according to item 5 TAC



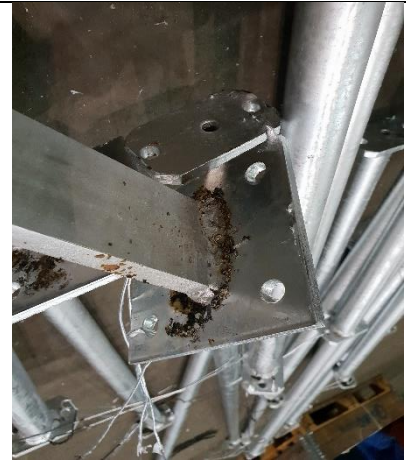
A common defect after the galvanizing process are ungalvanized areas that result from improperly made welds. The galvanizing plant will treat these areas with zinc paint even though the cause is not due to an error in the galvanizing process. In the case of galvanized products to be painted, touch-up painting is not performed.

WARNING! In case of the occurrence of the above-mentioned problems in many places and in subsequent deliveries, the Galvanizing Plant reserves the right to refrain from pasting such places. The galvanizing plant will notify the customer accordingly.



In the case of discontinuously welded or spot-welded components, leakage of flux residues or zinc ash is possible, resulting in dark streaks on the zinc coating at the joints.

An improperly made weld can cause structural damage – cracking of the joint.

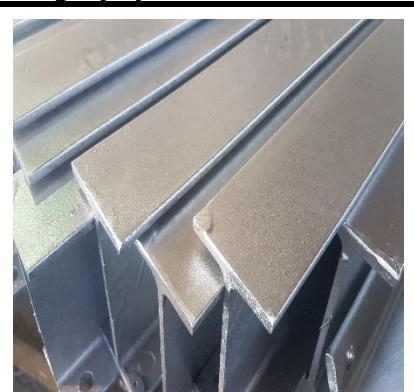
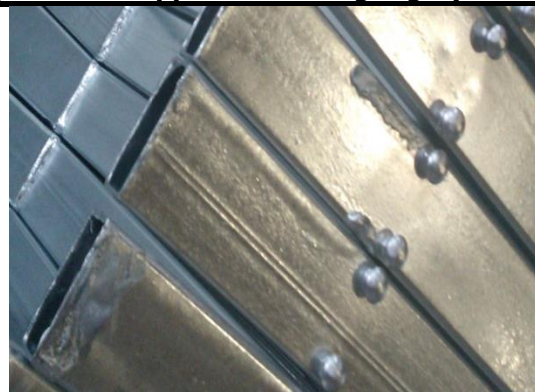


**Another defect is also the result of welding construction – the use of high-silicon welding wire. The problem is not always noticeable immediately after galvanizing
Residues of the anti-scratch agent cause numerous undergalvanization**



White corrosion on the coating is not a cause for complaint as long as the minimum required thickness of the zinc coating on the products is observed.

White corrosion may have the appearance of light grey and dark grey spots



It is permissible for there to be overflows in the areas of zinc dripping. Sharp zinc icicles are not permitted. An icicle is a thickening of the zinc up to a height of 5mm with dulled edges, an icicle is a sharply finished icicle.



Surface irregularities of the substrate material, e.g. rolling slag pits, grooves, depressions in the weld face, corrosion pits, rolling or delamination may remain visible or become apparent after the hot-dip galvanizing process.



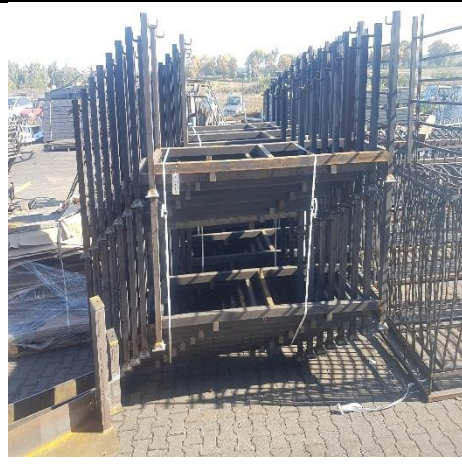
In cold-formed profiles, the zinc coating may be striped, but this does not reduce the corrosion protection of the coating.



Due to the inhomogeneity of the external surface of the object to be galvanized /chemical composition, surface structure and others/ the zinc coating on the same object may be formed differently and may look different.



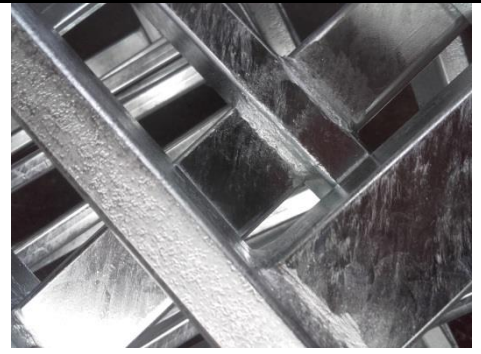
In case of inherent stresses in the structure, deformation of the product shape is possible due to heating in the zinc bath to 450°C. Sheet-metal parts or sheets which are part of larger structures may become wavy.



Material delivered to the galvanizing plant should be properly packed. Material without pallets or racks is exposed to damage during unloading, loading and internal transport



Incorrectly prepared holes result in zinc flashes, numerous lacks in zinc plating (the material will not dip into the furnace, it will get air in) and profile ruptures dangerous for galvanizing plant workers.



Heavily corroded, recycled material can result in lacks in zinc plating or uneven (pitted) zinc surface.



In the case of grid-type construction, it is possible to leave light overhangs called curtains.



Light flooding may remain at the corners of wire joints in the mesh construction. It is recommended that they are left in place – removal may lead to discontinuation of the coating.

C – individual customer requirements

By arrangement with the Customer Service Office, we meet additional requirements for the hot-dip galvanizing service.