



STRONGER THAN EVER

**HUS4 corrosion resistant
undercut screw anchor
Also for outdoor fastening**



DESIGN FLEXIBILITY THAT LASTS

HUS4-HF and HUS4-AF corrosion resistant screw anchor

Hilti is taking next step by developing the fourth generation screw anchor.

HUS4 with two times bigger portfolio and easier handling and setting in concrete is now also available with double-layered corrosion protection.

New HUS4-HF and HUS4-AF screws are an ideal alternative to stainless steel screws for outdoor applications with low pollution.

APPLICATIONS

- Indoor applications with temporary condensation
- Outdoor fastenings in moderate corrosive environment (see table on next page)

ADVANTAGES

- Double layer protection for optimal corrosion resistance
- Cost-effective alternative to stainless steel
- Highest load values in combination with smallest edge and space distances
- Load values equal or better than stud anchors (metal expansion anchors) under all concrete conditions
- Tested and approved adjustability process
- Hexagonal head for neat appearance
- HUS4 has easier handling and setting in tough concrete conditions with less blocking thanks to new thread design

HIGHLIGHTS

The HUS4-HF and HUS4-AF are made of a hardened carbon steel base with successive layers of a zinc alloy for cathodic protection and a top coat for chemical resistance.

Tested protection

Thanks to extensive research in close cooperation with renowned universities and laboratories, designers can trust and rely on the Hilti HUS4-HF and HUS4-AF coating as a durable corrosion protection. Laboratory and field tests are performed to assess the expected lifetime and technical safety aspects for various Hilti anchors.

The new coating of HUS4 was tested in neutral salt spray according to DIN EN ISO 9227, which is the most commonly used accelerated corrosion test for corrosion assessment. This test is suitable for quality assessment but does not reflect real environmental conditions. In contrast, cyclic corrosion tests like ISO 16701 reproduce and accelerate corrosion mechanisms that occur under real environmental conditions. This test is well adapted for lifetime assessment under moderate atmospheric conditions. The anchors are subjected through cycled climate conditions such as temperature variations, humidity and dry periods as



well as corrosion attack through salt. Results of laboratory tests are verified by mid- and long term field tests in natural climatic conditions.

Internal corrosion test

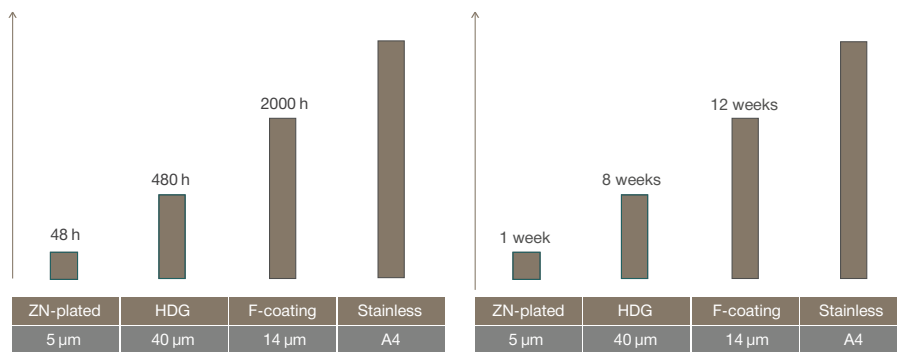
During the setting process, the head of a screw anchor is subjected to strong impacts. To ensure that the corrosion resistance of the anchor remains intact, Hilti performs all corrosion tests on HUS screws in real conditions and are set in concrete with an SIW impact screw driver.



HUS4-HF corrosion test



HDG stud anchor corrosion test



F-coating



HDG

Neutral salt spray test

HUS4-HF and HUS4-AF are subjected to a neutral salt spray test according to DIN EN ISO 9227. Under this test, the corrosion resistance of HUS4-HF and HUS4-AF is significantly higher as compared to hot dip galvanized (HDG) systems with at least 40 μm coating thickness. Grade A4 stainless steel systems remain stable under this test and withstand corrosion due to passive surface.

Cyclic corrosion test

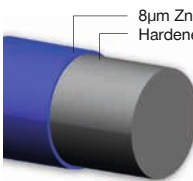

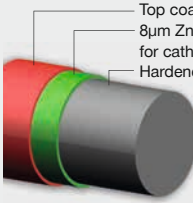

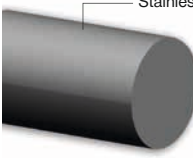

The cyclic corrosion test gives a more realistic assessment of corrosion resistance under natural environments. Under this test, the corrosion resistance of HUS4 is comparable and even higher than HDG systems. Grade A4 stainless steel systems also remain stable under this cyclic corrosion test.

Atmospheric long term corrosion test










The multi-layer coating used on new HUS4 is long term tested under very aggressive coastal environments. This test confirms the higher corrosion resistance of the multi-layer coating as compared to HDG.



HUS ANCHORS AND CORROSION RESISTANCE

Corrosion Resistance	Category	Screw	Material and corrosion protection	Surface appearance
Low	Zinc plated	HUS4-H/C/A HUS2 HUS3	 <p>8µm Zn-electroplating Hardened carbon steel</p>	
Medium	Multi-layer coating	HUS4-HF/AF HUS3-HF	 <p>Top coat for chemical resistance 8µm Zn-alloy electroplating for cathodic protection Hardened carbon steel</p>	
High	A4 stainless steel	HUS4-HR/CR	 <p>Stainless steel A4 (e.g. 1.4401)</p>	

MORE SECURE SOLUTIONS

HUS corrosion resistant undercut screw anchor portfolio	HUS4-H/C/A HUS3 HUS2	HUS4-HF/AF HUS3-HF	HUS4-HF/AF	HUS4-HR/CR
Approval	ETA-20/0867	ETA-20/0867	Hilti recommendation*	ETA-08/0307
Environmental conditions	50 years	50 years		50 years
 Dry indoor	■	■	■ 50 years	■
 Indoor with temporary condensation	-	-	■ 50 years	■
 Outdoor with low pollution	-	-	■ 25 years	■
 Outdoor with moderate concentration of pollutants	-	-	■ 25 years	■
 Coastal areas	-	-	-	■
 Outdoor, areas with heavy industrial pollution	-	-	-	■
 Close proximity to roads	-	-	-	■
 Special applications	-	-	-	-
				

■ Suitable - Not recommended

* From a technical point of view, HUS4-HF screws are suitable for indoor applications with temporary condensation as well as outdoors with low pollution (similar to category C3 according to EN ISO 9223) with certain lifetime and application restrictions. This is based on Hilti internal and external corrosion tests performed in laboratories as well as exposure tests performed outdoors under real environmental conditions. The use of HUS4-HF in these environments however is currently not covered by the European Technical Approval (ETA) of anchors, where it is stated that only anchors made of stainless steel grade A4 or higher can be used in structures subject to outdoor conditions based on an assumed working life of the anchor of 50 years.

ENVIRONMENT CATEGORIES

Applications can be classified in various environment categories, taking the following main factors into account:

Indoor applications



Dry indoor environments

(heated or air-conditioned areas) without condensation, e.g. office buildings, schools



Indoor environments with temporary condensation

(unheated areas without pollutants), e.g. storage sheds

Outdoor applications



Outdoor, rural or urban environment with low pollution

Large distance (> 10 km) from the sea



Outdoor, rural or urban environment with moderate concentration of pollutants

and/or salt from sea water

Distance from the sea 1-10 km



Coastal areas

Distance from the sea < 1 km



Outdoor, areas with heavy industrial pollution

Close to plants < 1 km (e.g. petrochemical, coal industry)



Close proximity to roadways treated with de-icing salts,

Distance from roadways < 10 m

Special applications



Special applications

Areas with special corrosive conditions, e.g. road tunnels with de-icing salt, indoor swimming pools, special applications in the chemical industry (exceptions possible).



Important notes

The ultimate decision on the required corrosion protection must be made by the customer. Hilti accepts no responsibility regarding the suitability of a product for a specific application, even if informed of the application conditions. The tables are based on an average service life for typical applications.

For metallic coatings, e.g. zinc layer systems, the end of lifetime is the point at which red rust is visible over a large fraction of the product and widespread structural deterioration can occur – the initial onset of rust may occur sooner.

National or international codes, standards or regulations, customer and/or industry specific guidelines must be independently considered and evaluated. These guidelines apply to atmospheric corrosion only. Special types of corrosion, such as crevice corrosion or hydrogen assisted cracking must be independently evaluated.

The entire Hilti HUS screw portfolio is not approved and not recommended for applications in all kinds of natural rock incl climbing applications in natural rock.

The tables published in this brochure describe only a general guideline for commonly accepted applications in typical atmospheric environments. Suitability for a specific application can be significantly affected by localized conditions, including but not limited to:

- Elevated temperatures and humidity
- High levels of airborne pollutants
- Direct contact with corrosive products, such as found in some types of chemically-treated wood, waste water, concrete additives, cleaning agents, etc.
- Direct contact to fresh/young concrete (less than 28 days old)
- Electrical current
- Contact with dissimilar metals
- Confined areas, e.g. crevices
- Physical damage or wear
- Extreme corrosion due to combined effects of different influencing factors
- Enrichment of pollutants on the product
- Nature of fastening part: fastener must be made of a more noble material or the same material than the fastened part; HUS4-HF and HUS4-AF is suitable for fastening parts like HDG, aluminum, or painted carbon steel.

