



moment

Standards

Discussion about legal regulations at construction sites

Logistics

Significance of digital security in the supply chain

APPLITEC

Safe design engineering

Safety

The conflict area between quality requirements and cost pressure



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- >> Production hall 4.0

Editor
 EJOT Holding GmbH & Co. KG
 Im Herrengarten 1
 D-57319 Bad Berleburg
 Phone +49 2751 529-0
 www.ejot.de

Editorial staff
 Andreas Blecher
 Andreas Wolf
 Annemarie Bremer
 Christian Kocherscheidt
 Daniel Herr
 Heinrich-Georg Homrighausen
 Matthias Möldner

Design
 conception GmbH,
 Siegen

Print
 Vorländer GmbH & Co. KG,
 Siegen

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 Torch Tower in Dubai, picture alliance/dpa

Dear partners of the EJOT Group,

In June we were confronted with terrible images of a burning high-rise building in London. More than 80 persons lost their lives in the burning Grenfell Tower. But those were not the only terrible pictures we had to see this year. Terror and natural catastrophes also added to this sad picture. Nevertheless, like many of our employees, I was particularly touched by the fire in London. After all, it was a burning façade and fastening technology for the building envelope is one of our core applications.

EJOT stands on two strong pillars – the Industrial Fasteners Division and the Construction Fasteners Division, which deals with fastening technology for buildings. So, what caused this disaster? Have standards been disregarded or was it an unfortunate combination of things? We don't know yet. The incident is currently under investigation, and the results from this will certainly contribute to the further development of safety standards in the construction industry.

We all know the tense relationship between safety and costs. What is necessary? Where are costs saved (wrongly)? Where does “over-engineering” start? A constant issue – not only for construction, but also for wider industry and even our private decisions. We took this opportunity to address safety issues in this edition of moment. Where does safety affect us when designing a screw joint, at the construction site or in production and availability? What is the role of standards and how do they evolve?

This year a completely different aspect of safety has affected our company group. My father, who has managed and strongly influenced the fate of this company for more than 57 years, died suddenly a half year ago. In addition to the personal sorrow for our family, our employees have also lost a foundation. Now it is up to us, the management, the shareholders and the advisory board, to compensate for this loss of “safety”.

This text poses many questions – and answers are needed. We want to try to contribute to this.

Kind regards,

Christian F. Kocherscheidt
 Managing Director



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FAKUMA 2017

Hot spot of industrial plastic material processing

From 17 to 21 October the “who’s who” of the plastic processing industry will meet in Friedrichshafen for the 25th time. More than 1,700 exhibitors present their international product range and offer a comprehensive overview of all plastics technologies. Under the motto “The new lightness of EJOT”, EJOT will present a wide range of customised fastening solutions for different plastic-based lightweight materials. The EJOT exhibition presence is completed by the presentation of innovative software solutions for the pre-dimensioning of joints in various materials. Hall B3, stand 3114
www.fakuma-messe.de



ONLINE-SHOP

“Classics” of direct fastening into plastic now also available online

The German customers of the EJOT Industrial Division can now directly purchase products from a selected online range. The new shop starts with the established screw duo DELTA PT® and PT®, the specialists for reliable self-tapping in thermoplastics. Furthermore, the DELTA PT® is the optimal choice for direct assembly in highly loaded thermoplastic materials. A continuous assortment expansion of the online shop is planned.
www.industrie.ejot.de

Modern standards for new production facility in Poland

With the new plastic production at EJOT Ciasna in Poland another important construction project has been finished. The plant has been designed according to the latest standards and offers room for growth for the production company EJOT Polska. The result is a complex of buildings, which meets the challenges of the 21st century, also with regard to energy efficiency.

The new building has a total area of 4,000 square meters, and houses a production and storage hall, as well as a three-storey social and office building. The production hall offers space for a lot of injection moulding machines. The warehouse has room for up to 1,500 pallets for semi-finished products and raw materials, as well as for transfer docks. Next to the building there are three double-chamber silos with a capacity of up to 150 tonnes of plastic. Heat recovery from the technology processes is used for the heating system of the building.

Automatic material supply systems, machine cooling systems, IT systems, fire protection systems, heating control systems, LED lighting and exterior blinds are integrated into the BMS (Building Management System), which monitors and manages all devices and systems in the building and its surroundings. BMS allows to react in real time to changes in external and internal conditions to ensure optimal energy consumption. It improves the range of functions, the safety and the comfort of the employees.

ADJUSTtec accomplishes the technical balancing act

The observance of uniform minimised clearances on the car body is perceived as an important quality indicator. This applies all the more to vehicles from the premium segment where these details make the difference in the customers’ perception.

This is where the EJOT ADJUSTtec adjustment elements come in. These little marvels of flexibility allow an optimal adjustment of add-on parts to the car body. A typical case for this product category are rear lights, which need to be finely adjustable in their position to adjacent vehicle components.

Furthermore, modern car concepts require an assembly of large plastic components to the car body, for example rear spoilers at station wagons or SUVs. The combination of different materials requires new solutions because they expand differently under the influence of changing temperatures. The joint must therefore be sufficiently strong, but nevertheless movable due to the linear



expansion. For this technical balancing act, we have developed the 3D adjustment element, which can be adjusted over three axes, compensates for the linear expansion and ensures tight fastening of the plastic add-on part to the supporting part. The result: a multifunctional premium solution for premium customers!



With great sadness, we announce the passing of our senior boss

Hans Werner Kocherscheidt

Retired attorney and notary public
 * 7 October 1928 † 14 April 2017

The end of an era

His entrepreneurial ambition, paired with the richness of ideas from his employees, turned our small screw manufacturing company in South-Westphalia into a well-known global specialist for fastening technology. His energy and his gift to inspire people for his ideas helped him to reach this ambitious goal. He had the heart of an entrepreneur through and through and never stood still. For decades Hans Werner Kocherscheidt demonstrated that economic success and social responsibility belong together. The Christian education of his parental home made him a thoughtful person, who cared deeply about his employees and those around him.

With his passing the EJOT Group not only loses a remarkable personality, but also a great man who listened to his staff and their concerns. Hans Werner Kocherscheidt was highly respected and adored by all staff members. With great respect and thankfulness we bow to Hans Werner Kocherscheidt and his lifetime achievement. His attitude and his will to reach the top of our industry will be obligation and incentive for all of us. We extend our deepest sympathies to the family.

General management, advisory board, staff and works council of the EJOT Group
 EJOT Holding GmbH & Co. KG
 Im Herrengarten 1, 57319 Bad Berleburg



New assembly tool

Fastening of insulation anchors now even easier

E = ergonomic! In this respect, the assembly tool for the screw-in anchors of the STR family has been optimised and can now convince with additional processing advantages.

Installing screw-in anchors in ETICS facades is now even easier, more reliable and more economic with the new ejothem STR tool 2GE because a rotatably-mounted washer significantly reduces the surface connection torque.

One-hand assembly is also possible with the new tool. The countersunk installation of the anchors according to the STR principle becomes even more user-friendly and ensures trouble-free and homogeneous surfaces.

EJOT teams are also the 2017 German champions

Triathletes have not been beaten in Bundesliga matches since 2012

With two more championship titles, the women's and men's teams of the EJOT team impressively confirmed their superiority in the German triathlon. In the season finale of the 1st Bitburger 0.0 % Triathlon Bundesliga in the Baltic sea resort of Binz on Ruegen, the top star in the EJOT team, Richard Murray, crowned a successful season. The superiority of the EJOT team ran like a thread through the previous Bundesliga matches in Kraichgau, Muenster, Tuebingen and Grimma.

This year's German Championship is already the 8th title which the men's team has won. And the EJOT team has not been beaten in Bundesliga matches since 2012. An impressive record. It should be emphasised that the home-grown junior triathlete Jonas Hoffmann has successfully been integrated in the Bundesliga team. Hence, the youth development work also bears fruit.

Concerning the EJOT women's team, it was a close run until the successful title defence due to strong competitors in the league. With a very narrow lead, the ladies started the final match in the Baltic sea resort of Binz. They performed excellently in all three disciplines and took the places 2, 3, 4 and 6 – a great team result. Thus, the women of the EJOT team won the sixth championship in a row.



Photo: Oticon Medical

Maximum performance with a minimum of space



Hard to imagine: A DELTA PT® screw with a nominal diameter of only 1 mm is used in the fixing of micro-circuit boards of state-of-the-art Cochlea implant systems which go far beyond the performance of conventional hearing aids. This illustrates the extraordinary performance of these fastening solutions in the micro range. And their application range is constantly growing, since the trend towards miniaturisation of components continues across all industries. Every gramme and every millimetre that can be saved are of paramount importance to the manufacturers. These micro screws can be used flexibly in final assemblies. This ranges from manual assembly to automated serial assembly, which is already standard in the numerous industrial micro applications. EJOT micro screws are available for fastening into plastic, light metal, steel and as metric versions.



The perfect place for perfect products

Ribbon-cutting ceremony of the production hall 4.0 at EJOT site Bad Berleburg

The official opening of the new production hall 4.0 at the EJOT site in Bad Berleburg is a significant development in the history of the company. The support-free hall has a length of 120 meters on a production area of 3,600 square meters with a heavy load floor, which carries a concentrated load of 60 tons at each position. Also near perfect are the integrated adjoining rooms with a total area of 2,000 square meters. A new learning workshop for education and training has also been integrated.

The new production hall was designed to manufacture products that are as perfect as possible in an effective and economical way. The decision for the new building, as well as the machine allocation, is closely linked to the success of the EJOFORM® product family, which in recent years has developed into an important and expansive building block of the EJOT product portfolio. These products are very complex, high-precision cold-formed parts with virtually unlimited functional diversity, which are produced individually for the customer.

The new building was designed by the architects Monika Weber-Pahl and Prof. Burkhard Pahl, who have been planning and building for EJOT for almost 30 years and who are very important for the EJOT brand.

NEW TEAM MEMBERS



Erich Koch has been the new technical general manager at EJOT Fastening Systems in Taicang since April. He has many years of experience concerning China.



Pavel Sniegon has been the new general manager of EJOT Switzerland AG Dozwil since August. After many years of successful management of EJOT CZ, Pavel Sniegon worked as a Business Development manager for the Construction Division after his return to EJOT.



Thorsten Lauber will be the new head of business unit EJOSYST in Tambach-Dietharz as of September. He has many years of experience in the field of engineered plastic components and has been the general manager of EJOT Switzerland for the past few years.



Photo: picture alliance/dpa

Fire protection for high-rise buildings in discussion

Can this catastrophe also occur in Germany? While the fire at the Grenfell Tower is being investigated in London, fire brigades, associations and government agencies are discussing the causes. Conclusion: German high-rise buildings are better protected against fires, according to the assessment of the experts.

>>Text: Andreas Wolf

The fire disaster at the Grenfell tower in London, where more than 80 people were killed in June, has also sparked a controversial discussion on building standards and regulations in Germany. Do the fire protection requirements in Germany have to be tightened? Associations of the housing industry as well as homeowners demanded the reduction of construction costs and the limitation of safety standards already in 2015.

While the conference of the Ministers of Construction rejected the demands of the associations for a relaxation of building standards, the voices are now increasing again to continue safe building practices with the current standards. The main association of the German construction industry argued not to lower the high requirements on building safety and construction product safety. Fire catastrophes like the one in London are not imaginable in Germany, due to requirements such as

- prohibition of inflammable façades from a height of 22 meters,
- automatic sprinkler systems,
- firefighters lifts,
- ventilated safety staircases
- and much more

It is therefore all the more important to counteract the trend towards reducing safety requirements for buildings and construction products.

In residential buildings up to high-rise buildings, the requirements for fire protection in Germany depend on the size of the building and the number of residential floors. The differentiation is done according to building class. The principle applies: the larger and higher the buildings, the higher the fire protection requirements. In this context, the German Insurance Association as a whole is calling for the expansion of fire protection requirements to include existing buildings.

In Germany, only non-combustible construction products may be used for buildings with a height of more than 22 meters, and in particular for façades. This rule applies without exception. Furthermore, the requirements for building material, escape routes, safety requirements, etc. are defined in the model high-rise guideline (German: Musterhochhausrichtlinie / MHHR). The federal states have included this into their regulations. In individual cases, deviations in accordance with the building inspectorate and the fire brigade are permitted, whilst maintaining the defined safety level.

The head of the fire brigade Frankfurt, Reinhard Ries, told the newspaper Frankfurter Neue Presse (FNP) that German high-rise buildings are better protected against fires than those in other European countries. German high-rise regulations are the best, says Ries. "Great Britain and France do not have such regulations. We are the only ones in Europe" Ries is cited in the FNP. The façade of a German high-rise building would probably not burn as quickly as the one in London. **E**

Building safety after the Grenfell tower fire: What is the role of standards?

What are many people afraid of today? Terror attacks, bombs, plane crashes – these are the dangers that many people fear. The catastrophe in the residential tower in London shows, that simply being in a building can also be a risk. The fire at Grenfell tower spread over the outer façade very quickly, causing over 80 deaths. It also made the huge residential house uninhabitable.

Events like the one in London, once again raise questions about building safety: What can be learned from these catastrophes? How can standards contribute to safety and how are they being enforced?

Moment spoke with Ralf Pasker, Managing Director of the European Association for ETICS (EAE) and the Verband für Dämmsysteme Putz und Mörtel (VDPM), two industrial associations from the field of building materials for use in façade systems. A central task field of both associations is the cooperation in standardisation committees, also with the concern to place safety issues at the centre of construction standards.

How high ranks the importance of the European harmonisation of technical specifications in the construction industry?

Ralf Pasker: It is an essential prerequisite for the creation of a functioning European single market. This does not only apply to construction products. However, the unhindered delivery of goods between EU countries is only one requirement for a positive economic development. Only when the products may actually be used in each member state, the single market can have its full effect. For construction products, the EU Construction Products Directive describes how this should work.

What is stipulated in this regulation?

Ralf Pasker: First of all, a uniform valuation basis for construction products is required. These are either European harmonized standards or European technical assessment documents. Both describe which properties are tested and which test methods are used. The results are documented and guaranteed by the manufacturers in a service declaration and the CE marking. This

uniform assessment is important, because the definition of the requirements for buildings is within the scope of responsibility of the member states. Minimum requirements may be applied, to ensure national safety requirements. Planners and craftsmen can compare the values in a service declaration with the national minimum requirements, in order to determine whether or for which type of building, for example in Germany, a construction product may be used. European harmonized specifications are also an opportunity to set standards with possible radiant power on other economic areas. This is in the interest of European companies active throughout the world.

Regarding the safety and quality of construction products: Do you see a need for action?

Ralf Pasker: The individual member states are responsible for setting minimum requirements for buildings. If the minimum



Standardisation jungle in Europe

Photo: iStock

requirements can not be met with a construction product, or if a manufacturer does not provide any information on an essential property, the product may not be used. In the future, it will be important for EU member states to take account of the quality and safety of buildings, because the national approvals lose their validity after a transitional period, as soon as a European standard has been issued. In addition, at the start of a standardization process, member states must ensure that their requirements with regard to relevant product characteristics are included.

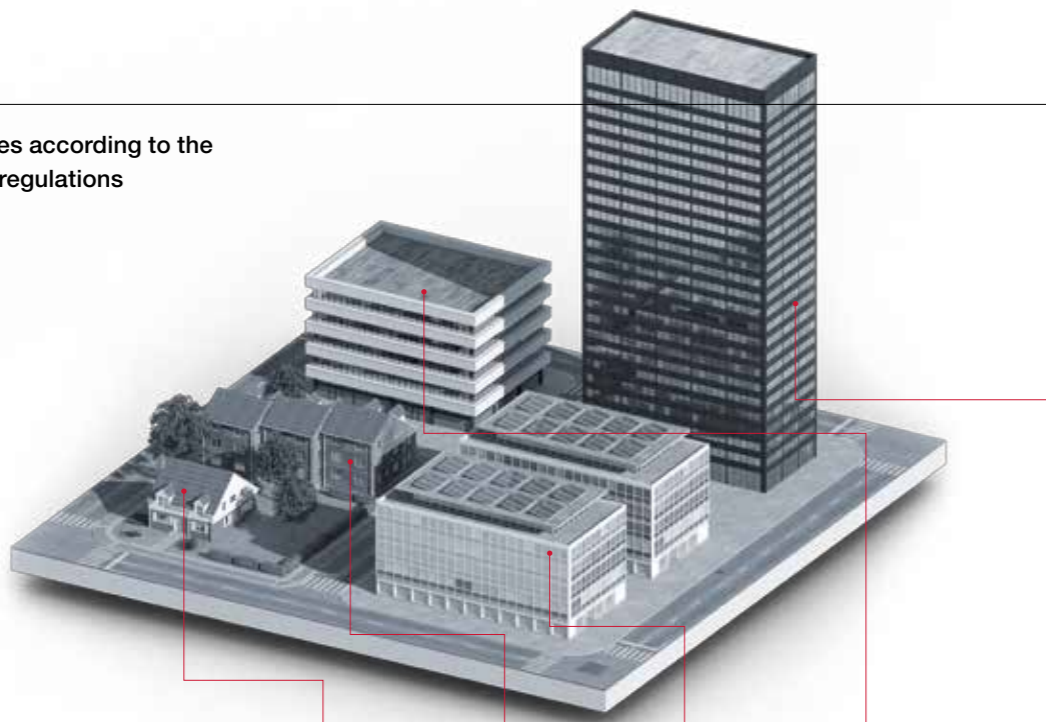
Why must product requirements (approvals, specifications, standards) be high in the construction industry?

Ralf Pasker: In Germany and in other countries, the requirements for buildings are set up under risk aspects and in a



Model houses made of steel components, which are particularly earthquake-proof due to their design

Building classes according to the state building regulations



Building class	1	2	3	4	5
Type of building	Freestanding buildings, freestanding agricultural and forestry buildings	Semi-detached buildings	Other buildings detached or attached	Buildings detached or attached	Other buildings and underground buildings
Building height	< 7 m	< 7 m	< 7 m	< 13 m	unlimited
Building size	< 400 m ² (total)	< 400 m ² (total)	unlimited	< 400 m ² (respectively)	unlimited
Units	max. 2	max. 2	unlimited	unlimited	unlimited
Building size	Buildings of low height	Buildings of low height	Buildings of low height	Buildings of medium height	High-rise buildings, special buildings

differentiated way. For example building height and building use play an important role, because the number of users or residents, as well as their options for self-rescue, vary in the event of a fire. Since buildings in Europe usually have a decade-long useful life, the durability of the structure and construction products is of great importance.

Regulations and standards create safety. What can be learned from the fire at Grenfell tower in London?

Ralf Pasker: As long as there are no official investigation results, most things are speculation. What is certain, however, is that the building was not fitted with an External Thermal Insulation Composite System, but instead with insulation comprised of panels made of a flammable aluminium composite material. It is still unclear to what extent the façade cladding used in London was in compliance with the valid regulations. In Germany this kind of façade cladding would not have been allowed for use on a high-rise building.

Do uniform regulations exist throughout Europe?

Ralf Pasker: The requirements for fire protection of exterior wall cladding are a good example of different and still non-

harmonized regulations, in the EU member states. According to German building regulations, regular flammable systems may be used on buildings with low heights (up to 7 m to the upper floor edge of the highest accessible floor); in the case of buildings of medium height (7 m to about 21 m), flame retardancy is required. Above the high-rise limit (depending on the federal state this is slightly differently defined, but a maximum of 21 m applies), the standard guideline for high-rise buildings has been applied since the 1980s. This guideline allows only incombustible external wall cladding.

What regulations apply in the UK?

Ralf Pasker: In the United Kingdom, the high-rise limit is higher. In addition, combustible insulation material may be used on façades if a suitability test has been provided through a fire test. The test according to British Standard is carried out with a significantly higher fire load than the proof of flame retardancy according to DIN in Germany. From this it is often concluded that the fire regulations in England are stricter than in Germany. But in reality the standards in Germany are actually higher, because no combustible insulating materials may be used at all in the case of high-rise buildings.



MPA Dresden GmbH facade test stand (left inner view with test stand) with a height of up to four full floors.

Photos: MPA Dresden GmbH

Is a single European solution in sight?

Ralf Pasker: A European harmonized façade fire test is currently being carried out. The objective is to establish various fire protection classifications. The member states can then determine the minimum level for a building. For example, the high-rise limit can still be defined differently. However, in the future, the manufacturers no longer have to carry out several tests according to different national standards for the same product. It will be sufficient to have a European certificate for the planners to reconcile the permissibility of the product for certain applications.

What about the enforcement of safety-relevant regulations in the international environment?

Ralf Pasker: Market control in the member states is very different. The German institute for structural engineering (DIBt) is the German licensing authority which grants general building authority approvals (abZ) for construction products and building types and it issues European Technical Assessments (ETA) for construction products and building kits. On a European level, the DIBt is in competition with the European rating agencies. The institute is active for companies with markets in Germany,

Europe and internationally. The member states of the EU maintain systems for market surveillance. In most cases, random checks are carried out or suspicious cases are followed up. Fines or other sanctions may be imposed. In practice, it is more likely that a solution is sought with the affected manufacturer to ensure quality and safety.

Which processes during construction planning and in the implementation phase actually increase building security?

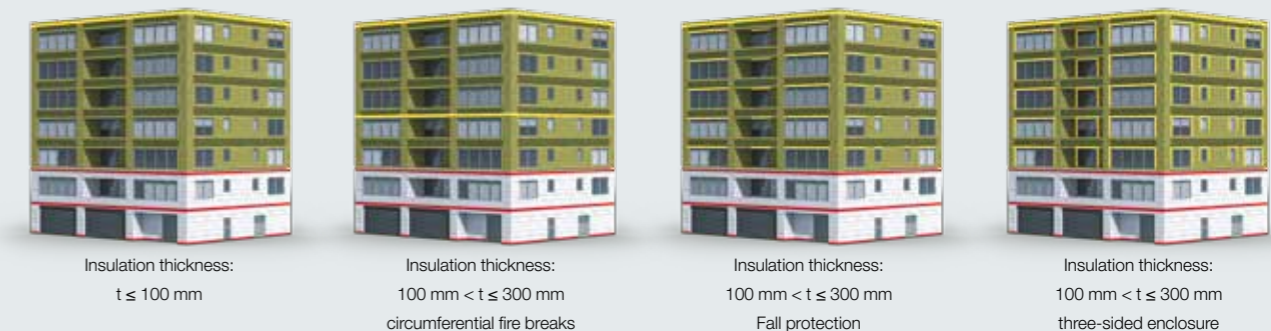
Ralf Pasker: The quality of the building products (product development and quality assurance), quality of the planning (reconciliation of requirements for buildings, taking into account the product characteristics) as well as the quality of the execution (qualification, process monitoring, documentation). The entire process chain determines the end result – this also applies to a construction site. One should always bear in mind, that the lifecycle of a building is usually over 80 years. This puts costs into perspective, when building materials are used which cover more than just the minimum requirements with their performance. In addition, higher-quality solutions often lead to lower operating costs of a building, for example by lowering the maintenance expenditures or increasing the energy efficiency. **E**

Fire protection zones on façades



Protection zone room fires + Protection zone foundation = Protection zone façade

Constructive fire protection measures for higher buildings (example)



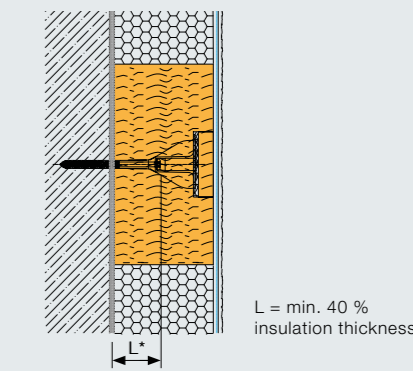
Insulation thickness: t ≤ 100 mm; Insulation thickness: 100 mm < t ≤ 300 mm circumferential fire breaks; Insulation thickness: 100 mm < t ≤ 300 mm Fall protection; Insulation thickness: 100 mm < t ≤ 300 mm three-sided enclosure

Fixing of fire breaks

>>Text: Carina Grebe

German construction law requires External Thermal Insulation Composite Systems with an insulation made of polystyrene rigid foam, to feature protective measures which prevent a progressive, cross-storey spreading of flames in the insulation layer. To achieve this objective, certain “protection zones” were derived. These are essentially limited to the place of occurrence of the fire. The different protection zones are “room fire” (fire from the inside) and “foundation fire” (fire from the outside).

expansion element of the anchor should penetrate at least 40 % into the insulation material in order to provide additional safety in the event of a fire. This recommendation can also be found in the Technical System Information (Compendium ETICS and Fire Protection) of the professional ETICS or VDPM association.



The protection zones are designed with additional fall protection or circumferential fire breaks made of mineral wool or mineral wool lamella, and ensure the flame retardancy of ETICS with EPS. The German institute for building technology (Deutsche Institut für Bautechnik/DIBt) has published information on the basic design for circumferential fire breaks. Amongst other things, this also regulates the fixing with approved ETICS plastic anchors with an expansion element (nail or screw) made of steel.

With a focus on a balanced ratio between Chi value (the least possible amount of steel) and high load carrying ability (the highest possible amount of steel), EJOT already offers suitable products for fire breaks in the screw-in anchor and hammer-set anchor product range.

Further discussion and additional, detailed fire tests have also dealt with expansion elements made of steel and the following recommendation has been issued: The steel



Ralf Pasker



- is Managing Director of the Association for Insulation Systems, Plaster and Mortar (VDPM), which is based in Berlin.
- The business manager is responsible for the areas of Technology Insulation Systems and Europe. The Association for Insulation Systems, Plaster and Mortar (VDPM) represents the leading manufacturers of façade insulation systems and their accessories, exterior and interior plaster, brickwork and screed.
- Ralf Pasker is also director of the European Association for ETICS (EAE).
- EAE is the European umbrella organisation of ETICS associations from 12 European countries, the six major European associations of the supplier industry and eight leading manufacturers and research institutes. EAE represents more than 80 percent of the European market for ETICS and ETICS components.



Construction site safety

Buildings should meet the highest safety standards. Which material and which products may be installed is governed by legal regulations. Model building regulations, state building codes, standards, European Technical Assessments or the CE marking.

>>Text: Michael Hellwig

During the construction phase, the interests of those involved are very different: the building owner wants the highest quality and aesthetics at the lowest price. The building material supplier wants to achieve a high profit margin through cheap sourcing and high-priced resale. The contractor wants high-quality construction materials and products that work, even under the most difficult conditions and which are easy to process, at the lowest prices.

Above that is the legislator, which has written down its interests in the state building code of the 16 federal German states. Paragraph three of the model building regulation, on which the regional building regulations are based, summarises it under the heading:

§3

General requirements

(1) "Installations must be arranged, set up, modified and maintained in such a way as to ensure that public safety and order, in particular life, health and natural resources, are not endangered ...".

In order to meet the protection objective, i.e. public safety and order, minimum requirements are imposed on products, building

materials and components. The minimum requirements are laid down in European product standards.

European Technical Assessment before market introduction

But if you imagine a world where everything is standardised, you will quickly see that there is no room for innovations and changes. Standards are "sluggish" regulations and never able to regulate all the products and processes that exist in the construction industry. For example, the innovation that is part of an EJOT construction screw is not represented in any standard.

In order to give an innovative company the opportunity to bring a product into the market before a standard changes, it is possible to introduce a controlled construction product or design into the market through a European Technical Assessment (ETA). An ETA is a generally recognised proof of the technical usability of a construction product in the sense of the Construction Products Regulation in the member states of the EU. The technical evaluation centre designated for Germany is the DIBt (Deutsches Institut für Bautechnik).



If a company submits an application for an ETA, the product is tested and evaluated according to a European Assessment Document (EAD) published at www.eota.eu. The EAD takes into account all essential requirements for the fulfillment of public security objectives. Anchoring and fastening elements from EJOT, e.g. plastic anchors and self-drilling screws are regulated by European approvals and may bear the CE mark for free trade in Europe on the basis of ETA. The acquisition of an ETA is associated with high costs and, in some cases, also with a great deal of time. Always with the awareness, that it serves the preservation of life and limb. **E**





Errors during the construction phase with serious consequences

The screw head suddenly breaks off. For no apparent reason. The consequences are incalculable damages to the building. Falling parts can endanger human lives. The cause is the so-called hydrogen-induced brittle fracture, which often occurs with a time lag after installation. Today, we know that there are three coherent factors: a critical hydrogen charge, a critical material state, and a critical stress state.

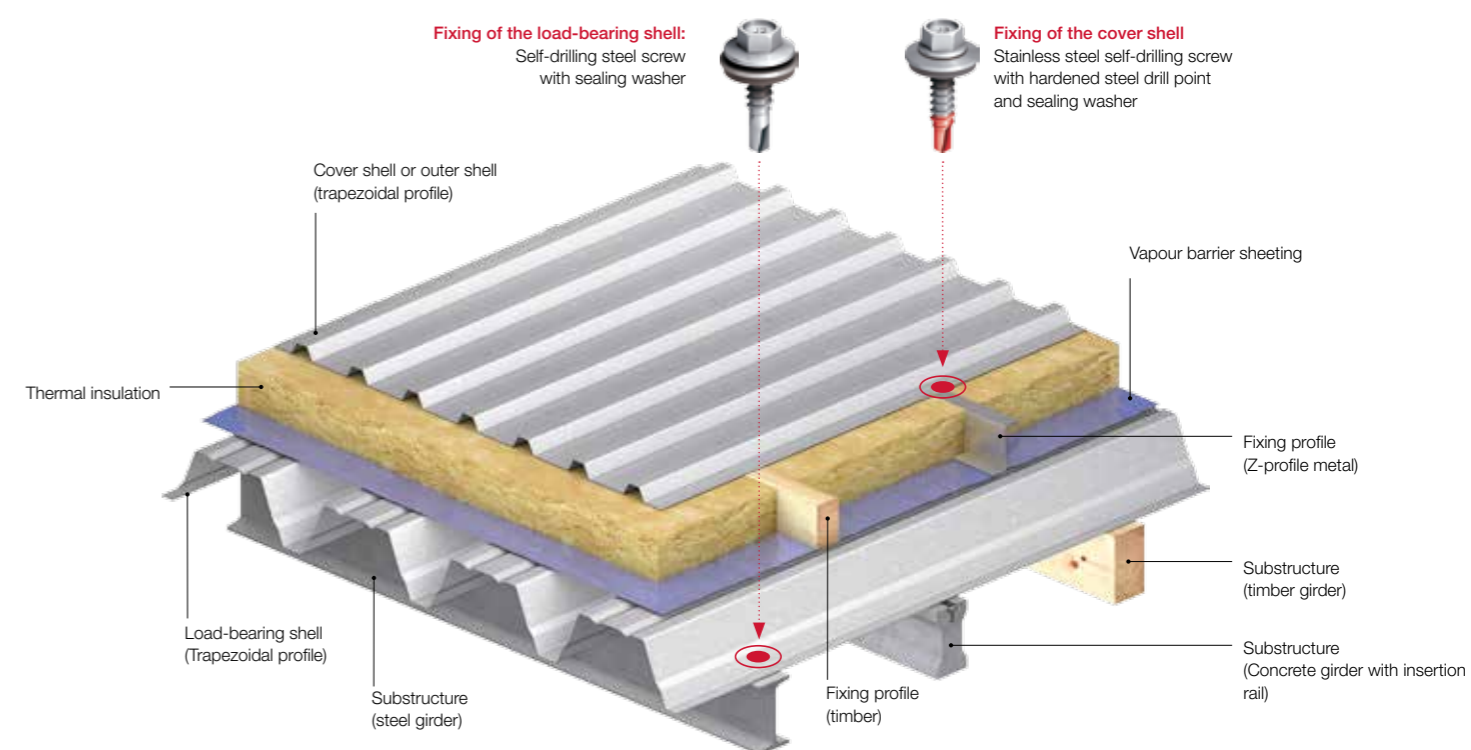
>>Text: Daniel Wagner / Matthias Möldner

Steel profile sheets which are not exposed to the elements, may be fixed in industrial lightweight construction using screws made of case hardened steel. Under certain conditions however, there is the risk of hydrogen-induced brittle fracture, in which the screw head breaks off without a recognisable reason. Through the use of sealing washers, brittle fracture can be effectively avoided.

Industrial and commercial buildings, which are manufactured in lightweight construction, generally consist of steel skeleton constructions that are planked with trapezoidal profiles of different thicknesses. The steel profile plates are screwed directly

to the steel girders with self-drilling or thread-tapping screws. Screws made of case-hardened, zinc-plated carbon steel can be used for fastening of the supporting elements and the load-bearing shell. A higher grade material, such as corrosion resistant stainless steel, is not necessary, since the load-bearing shell is usually still provided with an insulating layer and then closed with a cover shell. As a result, the screw joint is permanently protected from weather influences.

In the daily routine, many construction sites do not run as originally planned: delivery delays, changes in planning or difficult weather conditions often lead to unintentional delays between





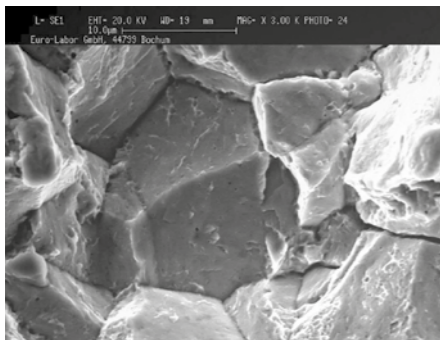
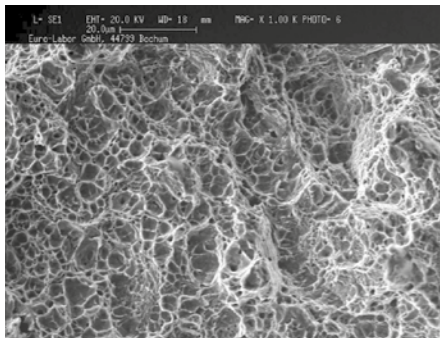
Fastening without sealing washer



Brittle fracture



Fastening with sealing washer



Top: SEM image of the fracture surface of a low-deformation fracture of a micro screw in the region of the under-head radius.

Bottom: In the detailed view of the upper picture, gaping grain boundaries, intercrystalline split fractures and zones with linear residual ductility (crow's feet) are visible on the split fractures

the individual construction phases. In detail this could mean, that the steel screws are weather exposed over several days or weeks, even though the material is not optimised for this. Things become dangerous when the screws have been fastened in the steel girder with a high tightening torque or are fixed at an angle. Then the failure of the screw happens without previous visible deformations or corrosion. Therefore, it is not possible to predict the time of fracture. Damages can occur months after completion of the construction work. The often serious consequences might include closed construction sites, high complaints costs and damages to the company image. In addition a danger to human life, by falling components, can not be ruled out.

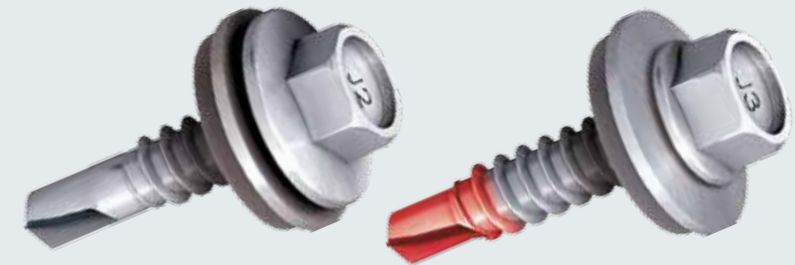
The collapse of the Berlin Congress Hall is one of the most spectacular damage cases caused by so-called hydrogen embrittlement. In 1980 the 600 ton southern roof brim above the main entrance of the hall collapsed. Many people were injured and a 27-year-old man was killed in the accident. In the analysis, experts discovered a whole series of design errors in the construction. **E**



How does hydrogen-induced brittle fracture occur? – Influencing factors and avoidance measures

Prerequisites for hydrogen-induced brittle fractures are

- the presence of a hydrogen supply
 - during the manufacturing process
 - while using the screw at the construction site
- the material condition
- the mechanical loading of the screw



The risk of a hydrogen-induced brittle fracture is only present when all three parameters are critical.

Optimisation in the manufacturing process (at the EJOT plant)

The risk of the hydrogen-induced brittle fracture is reduced or can be detected early, amongst other things, by the material selection, exact process parameters and production-accompanying tests. In the case of galvanically applied zinc layers, however, the risk potential of a hydrogen-induced brittle fracture can never be excluded 100 %, according to the state of technology (for example, DIN EN ISO 4042). In addition, there is usually no conclusion possible about the exact supply of hydrogen in operation.

In simple terms, the release of hydrogen is minimised in the finishing process during surface treatment. The heat treatment ensures optimum core and edge hardness as well as sufficient toughness of the material. In addition, the hydrogen loading is further reduced by hydrogen annealing. Before delivery, the screws are subjected to a load test to minimise the risk.

Optimisation of the processing at the construction site

An efficient measure to reduce the risk of hydrogen-induced damage is the use of sealing washers. EJOT offers versions with pre-assembled sealing washer for all self-drilling and self-tapping screws of the JA, JZ and JT families.

Increased safety during installation

Sealing washers reduce the mechanical load and limit pretension force or tensile stress of the screws. The visible compression of the sealing washer during fastening allows a controlled tightening of the self-drilling screw. Tearing off of the screw head or stripping of the screw thread during installation is effectively avoided.

Increased safety after installation

Surface protection layers of the profiled sheets, which are damaged by the fastening process, can be safely covered with the sealing washers. The vulcanised plastic is characterised by high weather and UV resistance. This way the screw connection point is protected from weather influences until completion of the construction work. Due to the enlarged contact surface of the sealing washer, the values of the pull-through capacity are also increased.

Tests to prevent component failure

The age of buildings extends to ancient times. The construction method, the building materials and the appearance have changed constantly over time. These changes are constantly creating new demands on the products used for joining the parts. The stability of a building and the parts attached to the building, is achieved with reliable anchors, joints and fastenings.

>>Text: Michael Hellwig



Permanent load tests in the laboratory monitor the product quality

The European series of standards in construction provides a variety of calculation methods to determine the load bearing capacity of joints. But not everything can be calculated. Everything that can not be calculated is experimentally determined by experiments.

Depending on the intended use of the results, experimental load-bearing determinations (tests) can be carried-out with varying effort. A typical example is the anchoring of a sub-structure for rainscreen (German: vorgehängte, hinterlüftete Fassade or VHF) or the securing of External Thermal Insulation Composite Systems (ETICS) on brick wall walls. The variety of stones with different raw densities, geometries and strengths is enormous. Unless it is a new building project, there is usually no meaningful documentation about the used stone available.

Test data on holding force, torque profile and assembly time

In order to determine reliable load-bearing capacity values, the anchor is installed into the original stone on the structure, and the load capacity is measured with an anchor extractor. Test results are recorded, statistically evaluated and made available to the planner. Pull-out tests on the structure are also used for the application of test loads in injection systems or for determining the load-bearing capacity of fastening elements in flat roofs.

Manufacturers of components such as windows, profile boards or substructure systems are trying to optimise and test the load bearing capacity of the individual connection, in cooperation with EJOT. For this purpose, the components are fastened and loaded in the application laboratory. Typical test data are, in addition to the holding force, the torque curve, the installation times or also compatibility tests with other materials. The data obtained are used to measure or continually improve components and are summarised in the form of a test report.

Independent tests for European Technical Approvals

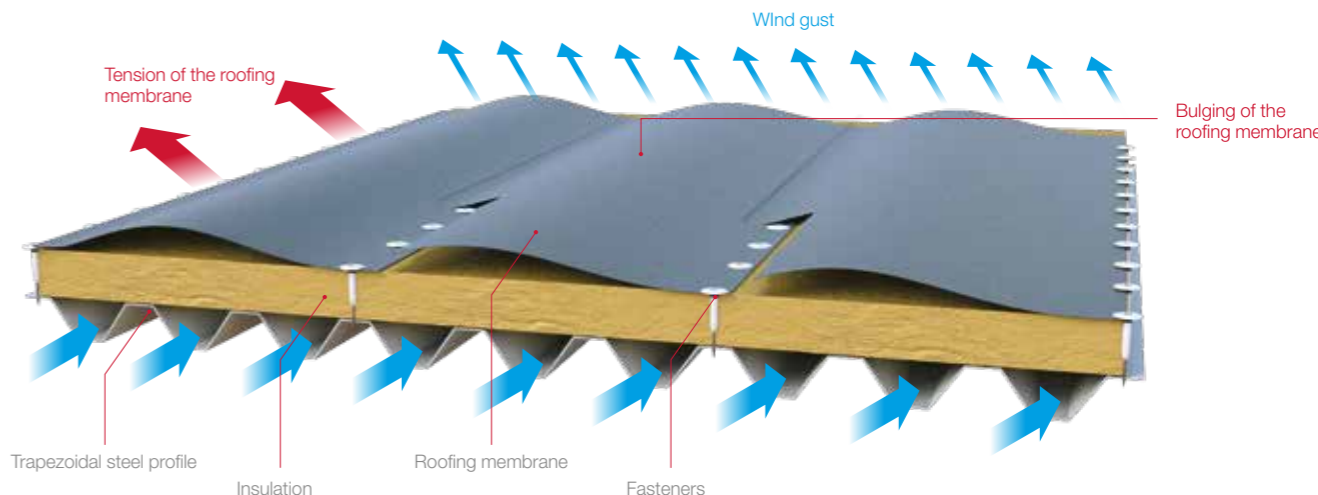
European Technical Approvals or evaluations require independent testing. The required tests are carried out at so-called notified test centres, evaluated and then handed over in the form of an expert report with recommended rating values. In order not to finance unnecessary failing attempts, an approval experiment is usually carried out beforehand in the EJOT laboratory.

The test evaluation is carried out on the basis of approval guidelines or, if there is no regulation, on the basis of the Eurocode. The result is a characteristic load-bearing capacity which represents a theoretical load-bearing value: it is the failure load which leads to the loss of function, only when both the fastening element and the components have been manufactured at the lower limit of their manufacturing tolerances and the worst 5 % of a batch have been installed.



Anchor pull-out tests at the construction site to determine the right fastener

Image of a wind uplift





A drone is already successfully used for the delivery of packages.

Logistics in digital change

In many cases the hotel industry has already handed over direct customer contact to high-performance platforms, where customers can quickly and easily access an overview of current offers, but also book these offers efficiently and securely.

Concerning mobility, the change is in full swing. Flixbus only owns one single bus, but was nevertheless able to become the market leader for long-distance bus tours in Germany because the business model and digitization competence are good.

>>Text: Prof. Dr.-Ing. Uwe Clausen

If all areas of Deutsche Bahn were to function as well as the DB Navigator app, the company would presumably have been able to significantly increase its market share. In the manufacturing industry, the discussion about Industry 4.0 is in full swing and in many areas, new forms of decentralised control lead to new demands on the ability to provide information not only of persons and IT systems, but also of goods or loading units which more and more carry "their data" with them. This development is driven by the availability of technologies which allow the recording and processing of information in production and assembly, in incoming and outgoing goods departments, in vehicles, at containers, in handling and sorting installations, at much lower prices than before. Another key driver is the individual human being in his roles as an employee and as a customer who acquires digital competencies and brings in expectations. These experiences and ideas are transferred to other areas and we can imagine the situation and the resulting benefit if we have access to all relevant information concerning the good, the customer's demands or the downstream process at every point of the supply chain. Logistics has always been planning and controlling the flow of goods and information. But what is currently changing is the velocity of the development and the penetration of all processes by digitization.

At the same time, the safety of the supply chain becomes more and more important. The manufacturing company mainly focuses on the reliable supply of its production. Dangers to this reliability result from disturbances after accidents, traffic jams, regional or national extreme weather conditions or natural disasters, but also from quality defects at service providers and real security problems such as terror or – much more frequently – criminality. The global division of labour, the concentration on core competencies and the allocation of logistics services has on the one hand contributed to the success of many companies, but on the other hand increased the importance of transport and logistics services including the risks in supply chains. Even though there have been several achievements due to security initiatives, the involved persons are sensitised very differently concerning transport safety.

A superior and process-oriented view is necessary and helps to effectively meet the requirements of protection against terror and theft (daily challenge to transport) by integrating safety aspects into an effective process management – as the case may be in conjunction with the quality management. For example, the manual for the research project SefLog (www.sifo.de/de/seflog-sichere-und-effiziente-logistikprozesse-praevention-identifikation-und-1817.html) provides a comprehensive overview of the integration of safety concepts into efficient processes.

New transport technologies are a broad field for innovation. Electromobility has been used for more than 100 years – on the road and on the rail – but due to current conditions, it becomes more and more important. Not only due to the electrification of current car types, but also due to new concepts. The Streetscooter for mail and parcel delivery is an example for light commercial vehicles. In the case of larger vehicles, the high energy density of diesel is indicative of the fact that combustion engines will presumably continue to exist for many years, but other solutions, for example for the pre- and on-carriage in combined transport, will have market opportunities. We also see such



The streetscooter for mail and parcel delivery



A transport robot that delivers small packets in cities across the walkway.

opportunities for a transport robot that delivers small consignments in urban areas by using the sidewalk with not much more than walking speed and thus will make new service characteristics of a “delivery on call” easier on the last mile. A drone is also successfully used by Amazon or DHL for deliveries. There are a few reasons for the drone to stay a means of transport for the niche, but it can be used to take over a whole range of other functions, especially through its optical recognition functions in large storage or plant areas – this is also an element of digitization.

Future traffic will also be much more automated. Technically, this is already possible today, as is evident from the Daimler truck to the assistance systems of the luxury-class passenger cars. It is also obvious that, in addition to the technical questions which are still open – especially in the areas of infrastructure which are less well-designed and marked than a federal motorway – this is still a legal issue which has not yet been solved. In pilot tests, the Fraunhofer IML works for example on automation projects in plant areas which enable meaningful and necessary steps in the optimization of the systems before the level of full automation in the public sector is justifiable.

There is much evidence that the human factor for the interpretation of data and the usage of leeway in decision-making will become more and more important. In trading, it is possible that information

concerning the availability of goods will be more closely involved in the consultation of customers and vice versa, information derived from customer demands will be incorporated into forecasting or marketing tools, if this is supported by a few pushes on a button. In the transition of production to distribution, up-to-date knowledge about which customer is waiting where for which product is integrated into the processes of dispatch control.

The distribution is enriched with value-added services, if information on previous customer sales, the service life or maintenance intervals of these products or innovations which concern the customers' needs are made easily accessible. It is conceivable that suppliers also ask for old equipment when delivering new products, if they are informed and have ecological reasons and economic incentives for a return. Recycling management and logistics are an exciting field in which digitization increasingly triggers the pick-up of commercial waste depending on the demand, and the invoicing as well as the issuing of the required documentation are automated.

In the interaction of people with machines, and also with vehicles, an exciting new era begins and digitization is a key driver for the logistics of the future. If we combine the areas of production, procurement and distribution with regard to information flows, think holistically and take digitization as an opportunity, we can successfully shape this future. **E**



Prof. Dr.-Ing. Uwe Clausen

- Institute Leader, Fraunhofer Institute for Material Flow and Logistics (IML)
- Chairman Fraunhofer alliance for traffic
- Institute Leader, Department of Transport Logistics at the Dortmund University of Technology

Interview

Safe flow of goods around the globe

Questions for Markus Rathmann,
Head of Supply Chain Management at EJOT



Modern supply chains are networked and increasingly agile, will they also be more susceptible to disruptions?

Markus Rathmann: In our supply chain, many actors are closely linked (for example, suppliers, our plants, transport and logistics service providers). Particularly at the interfaces, the information flows have to work well in order to avoid disturbances. Supply safety is important to us, so we consider delivery risks at every stage and look for measures to reduce them.

Can you name an example?

Markus Rathmann: One year ago we implemented a risk management system for our suppliers. With this system we evaluate our most important suppliers according to specific risks and derive specific measures where required.

Wire in different variants is the most important raw material at EJOT. How do you secure the availability?

Markus Rathmann: We have a portfolio of qualified suppliers in all areas. We are actively counteracting single-sourcing so that in the worst case we can always rely on at least one other source to ensure supply security.

A major safety risk is production downtime at one location. What kind of compensation options do you have and how quickly can they be implemented?

Markus Rathmann: We can produce the same products at several production sites around the world. In case of damage at one location, we could relocate products. If a machine failure occurs, it is possible to manufacture the product on an equivalent





Picking of the goods at the EJOT logistics center in Bad Berleburg.

machine. A number of qualified and audited suppliers in the field of heat and surface treatment is available in case of a failure in the area of our hardening and electroplating plants.

Supply chain management

- „Supply Chain Management is the cross-company coordination of material and information flows over the entire value-added process, from raw material production to the individual finishing stages up to the end customer, with the aim of optimising the overall process both with regards to time and to costs.“ (Scholz-Reiter, Jakobza 1999, P. 8).
- For EJOT this includes the areas of Purchasing, Planning/Control/Disposition and Distribution Logistics.

The planning and control of a production order is a complex process. Can you describe the process?

Markus Rathmann: From the start of a production order to its completion, depending on the complexity, it takes up to several weeks, as an order passes through several production stages, sometimes even including external processing (for example, for heat or surface treatment). A lot can change during this time. Approximately 5,000 production orders are running in parallel, in our German screw production alone, as a consequence a number of reciprocal influences arise. Our principle of dynamic order control combined with maximum transparency of the current order status, which is obtained by the operator by scanning the order, is used to minimise the risk of delays and to serve urgent customer requests.

How do you organise the storage of goods?

Markus Rathmann: Our finished product stocks are deliberately redundant in different storage levels. In the central warehouse of the construction division, the inventories are protected by a powerful sprinkler system. The new automatic small part warehouse (AKL) of the industrial division is protected by the



Interaction between distribution centers and central warehouses

highest standards through neutralisation, in this oxygen-reduced atmosphere no fire at all can ignite. The IT connection of the central warehouse is secured by a backup line.

How do you ensure EJOT's international supply chain?

Markus Rathmann: We are working on a future international logistics concept with regional distribution centres. First pilot projects have already started. In the future the distribution of the stock and the interplay between central warehouses, regional distribution centres (for a geographic region and several countries) and the warehouses in our subsidiaries will further increase security in the supply chain.

Ensuring the flow of goods depends on many factors. Where do you see the biggest challenges for companies in the future?

Markus Rathmann: We would like to push ahead with digitization in the supply chain and, for example, have constant availability of information along the chain, from the delivery status of the raw material to the digital delivery document of the package at our customers. **E**



Safe design engineering

The design of complex assemblies often includes numerous fastening elements. When developing such components, their functionality is usually the focus of attention. The influence of the fastening elements is often underestimated though, since they are seen as “subordinate” components but they fulfil a special function. The fasteners keep the entire design together over their complete life cycle and ensure a safe, maintenance-free operation.

>>Text: PD Dr.-Ing. habil. Ralph Hellmig

In order to achieve this, a design engineer also needs to consider the very complex topic of fastening technology. Practical experience repeatedly shows, that a connection is more than the screw or the functional element that ultimately keeps the parts together.

A fastening solution has to provide safety in several respects. On the one hand, the fastening element must fulfil the function intended by the designer, i.e., a clamping force which is sufficiently great under all operating loads over the complete service life of the components. On the other hand, in industrial practice, especially when it comes to series-ready products, process reliable screw connections are required, which can be carried out in a very short time with high repeatability. Finally, the joint is also used in various

environments or fluids, so that questions of corrosion prevention may also play an important role.

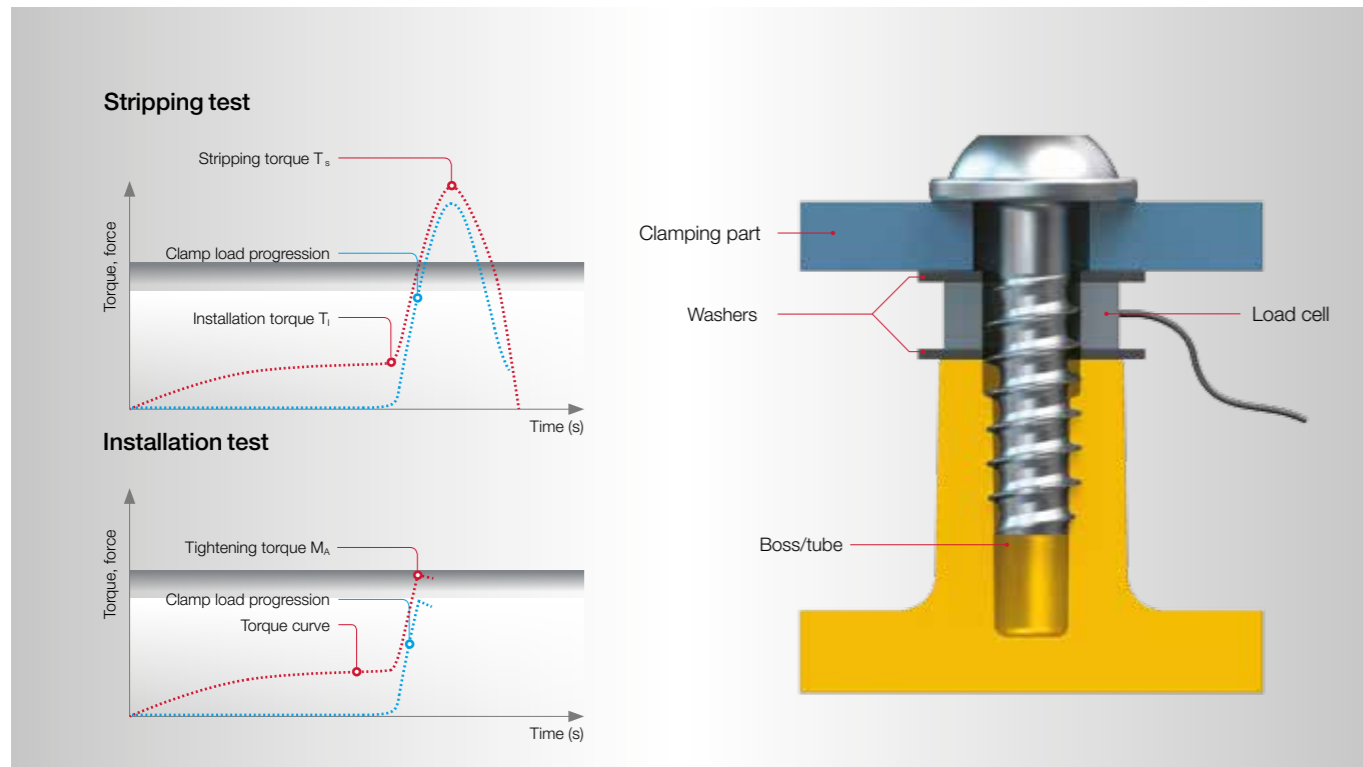
Many risks need to be determined in advance during the development and design phase and in turn avoided as far as possible. How can this be realised for the fastening technology?

EJOT can support a design engineer throughout the complete development phase with fastening technology know-how in order to prevent possible pitfalls.

The first step is to find out which requirements a joint must fulfil to function properly. If the basic data is known, it is possible to pre-dimension the joint using the respective prognosis

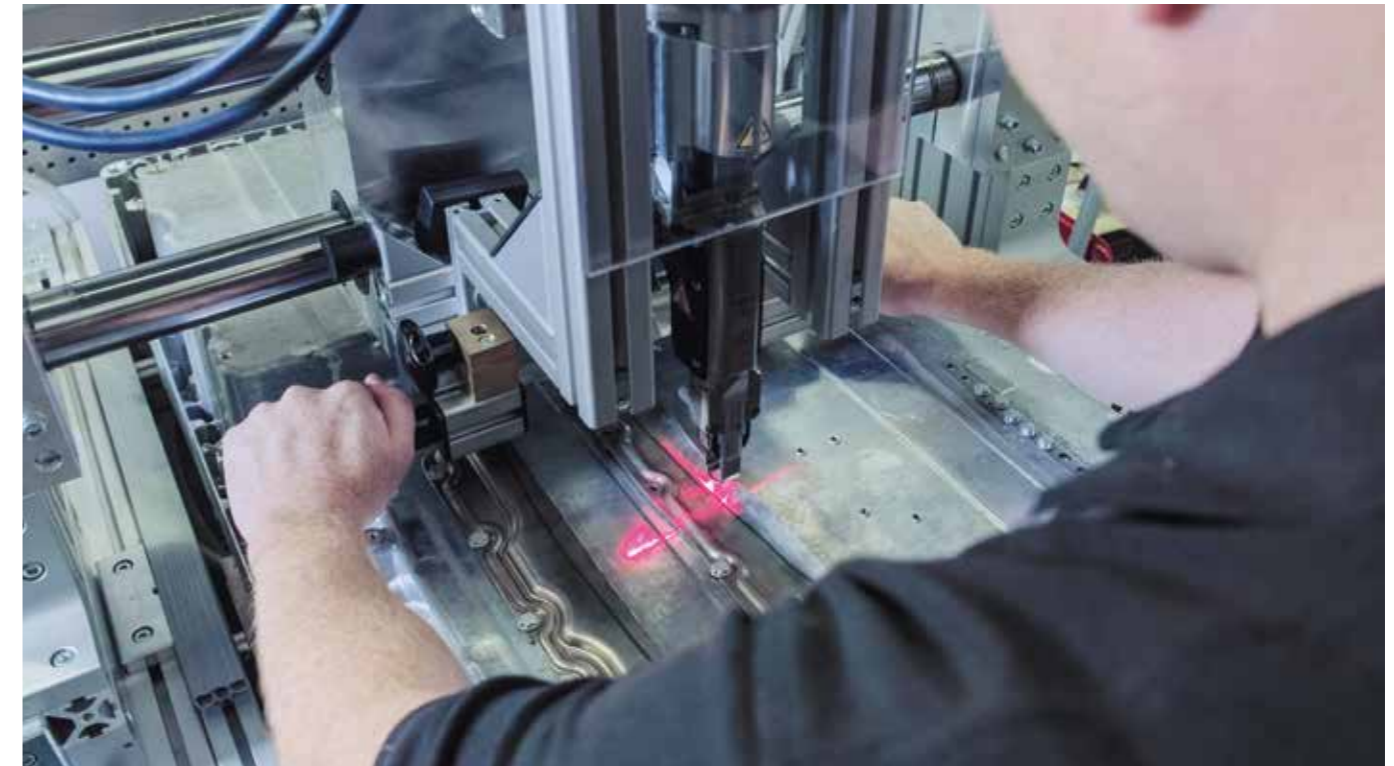


Prognosis programs support the design engineer with the dimensioning of the joint



Typical curve of torque and clamp load over time, in the case of a plastic direct installation in the stripping test (top) and in the assembly test (bottom).

Test setup for determining the clamp load



Pre-production tests with materials or customer components

programs DELTACALC® or ALtraCALC®. With these programs the material selection and possible tolerances are already incorporated, as they have an important influence on the joint properties.

Through pre-dimensioning it is also possible to obtain important information about the required clamp load, as well as the associated geometric design of the joint. In this phase, the component can already be adapted for the design of the joint. The resulting design can then be realised in the prototype phase.

If this step is skipped, as often observed in practice, a screw must ultimately “save” a failed design. When trying to avoid subsequent costs caused by a possible redesign, some solutions are extremely questionable with regards to safety.

During the prototype phase the EJOT APPLITEC test laboratory can already offer intensive support, for example with determining complete fastening properties on samples and also original customer components. Not only the fastening parameters are verified for the series application, but also the behaviour of the joint can be experimentally determined under various influences (for example temperature). Through intensive support and a detailed test report, the strengths and weaknesses of a design

can be examined again, in order to generate an optimal fastening solution – completely safe for function and assembly.

In addition to prototype studies, the support of the test laboratory includes feasibility studies, statistical analysis to verify process safety, as well as the special use of test benches directly built for customers (e.g. for leak tests).

Such a study in the prototype phase, protects against subsequent damage, as all limits of a connection are intensively tested. During this phase of a project, it might still be possible to make a cost-effective adaptation to optimise the joint and its safety.

In the course of the examination further questions, which go beyond just the screw joint, can also be clarified. For example corrosion tests, to evaluate the risk of premature failure of the joint during the application.

Here are two examples where even a late intervention ultimately led to a solution.

An automotive supplier manufactures a die cast add-on part. Through a heterogeneous selection of intermediate elements,

various metallic materials are in contact with one another, which tends to lead to contact corrosion in case of moistening with electrolytes. Fortunately, the outer cover of the add-on part is made of plastic to form a splash guard. Nevertheless, premature corrosion occurred when the finished sample was tested. A detailed analysis showed that, for processing reasons, the plastic component showed a small gap on the screw hole, through which splash water could enter. This meant that the design of the individual components was correct, but in combination with a fixing point it was insufficient. In the end the problem could only be solved by an expensive geometry change.

In the field of direct fastening into plastic, a pre-dimensioning of the fastening points is essential. A negative example for this was a case where sample components produced by the customer featured screw domes that already failed during the fastening process, because the dimensions were designed too small. The result was that a complete re-design of the injection moulding tools was required.

In order to achieve the greatest possible safety in fastening technology, it is essential to consider the entire chain from the design stage through the production to the serial application.

The solutions offered by EJOT accompany a designer from the pre-dimensioning with precise forecasting programs, through the first practical testing and verification under application aspects, up to the complete process reliable fastening process in serial production – for a secure connection for the entire service life. **E**

The power of micro particles

Technical cleanliness is an important safety factor
We are moving at high speed on busy streets and are used to the fact that, whether electronically or mechanically, everything works with maximum safety.

>>Text: Heinrich Georg Homrighausen



The mobile phone conversation with the family or the transmission of complex data via smartphone happens automatically between the LTE cell sites and in normal cases the user does not even notice it. Our cars reach dynamic values that were unimaginable in the past. They also monitor, regulate or decide and we simply acknowledge this, perhaps with occasional respect, but mostly with a certain self-evidence.

But the systems do not simply work in this matter-of-fact way. Before the development of new products, countless experts define functionality, durability and safety against malfunctions and failures. The components become smaller, more complex and more heavily loaded. An increasing number of components have to ensure the function continuously over hours or even longer periods of time, and a failure could have dramatic consequences.

Let's come back to the above-described example of the vehicle on a busy street again. While the driver may be thinking about his next appointment or is interested in the news on digital radio, the electronic stability control permanently compares sensor-relevant data of the vehicle behaviour. The central vehicle safety system receives information of up to 150 reference values per second, delivered from the sensors for rotation speed, yaw rate or acceleration. Within seconds it decides, whether and how the driving situation can be restored to safety, for example by deliberate deceleration of individual wheels or by an intervention in the engine power.

Suddenly, an obstacle on the road forces abrupt deceleration. Everyone is able to imagine what can happen in this moment if the security systems, we all so blindly trust, are not operating flawlessly.

In order to make such a failure of the system unlikely, the development engineers analyse the possible errors and their influence on the functional safety. This is how the researchers have found out, that even the smallest contamination can lead to functional impairment.

These small contaminations, called particles, might block a valve in the brake fluid circuit for example. Three areas of such a particle contamination have been identified as possible hazards. The contamination from the outside via components that are installed at the customer's premises. For example also cold-formed components or fastening elements. The particle contamination in the process chain, and the accrument of particles in the process itself. Within the scope of technical cleanliness, particles between 15 and 1,000 μ have been considered. 1 μ corresponds to a 1,000th of a millimeter.

Special cleaning baskets are transported to the cleaning line over protected transport lanes for further processing. Hydrocarbon-based industrial cleaners provide a material-preserving but cleaning-intensive process with ultra fine cleaning to achieve the required product purity. Such a cleaning system cannot be controlled precisely to a permissible particle size, but



The safety component decides in a fraction of a second how the vehicle must react.



Vacuum packaging to avoid abrasion during transport.

Extraction process of a cleanliness test according to VDA 19 / ISO16232



requires experience with regard to the necessary process parameters in order to economically meet the residual dirt requirements.

As a manufacturer of parts that are increasingly used in cleanliness-sensitive products, EJOT has been involved at an early stage in the topic of "technical cleanliness" for products and processes. Technical cleanliness specialists will advise the customer of coherent concepts on how to design clean components and how to prevent the entry and formation of particles. They will pinpoint which types of packaging prevent contamination caused by movement of the elements, or how to feed and fasten the parts in the assembly. The methods for determining the contamination and the statistical evaluation of the results are now standardised. Part of the EJOCLEAN® department, which deals with technical cleanliness, is a laboratory for close examination of the cleaning results.

The future will require even more safety. When cars drive autonomously we will rely entirely on the technology. Every movement, every change of direction is done by safety-relevant systems, which must not tolerate any error. New functions for improved comfort or additional safety aspects are constantly being integrated into the modules, seemingly without taking up any more space in the vehicle. The components are becoming smaller, the electronics shrink with them and must be protected even more strictly from particle contamination. Vehicles are networked with the communication technology and with each other. Ultimately, the consumer's acceptance of all these technologies also depends on his ability to feel safe with these devices. Be it the vehicle, which delivers a taxi independently to a selected destination, or his house alarm system, which he supervises from vacation. Safety is at the top of the list. **E**

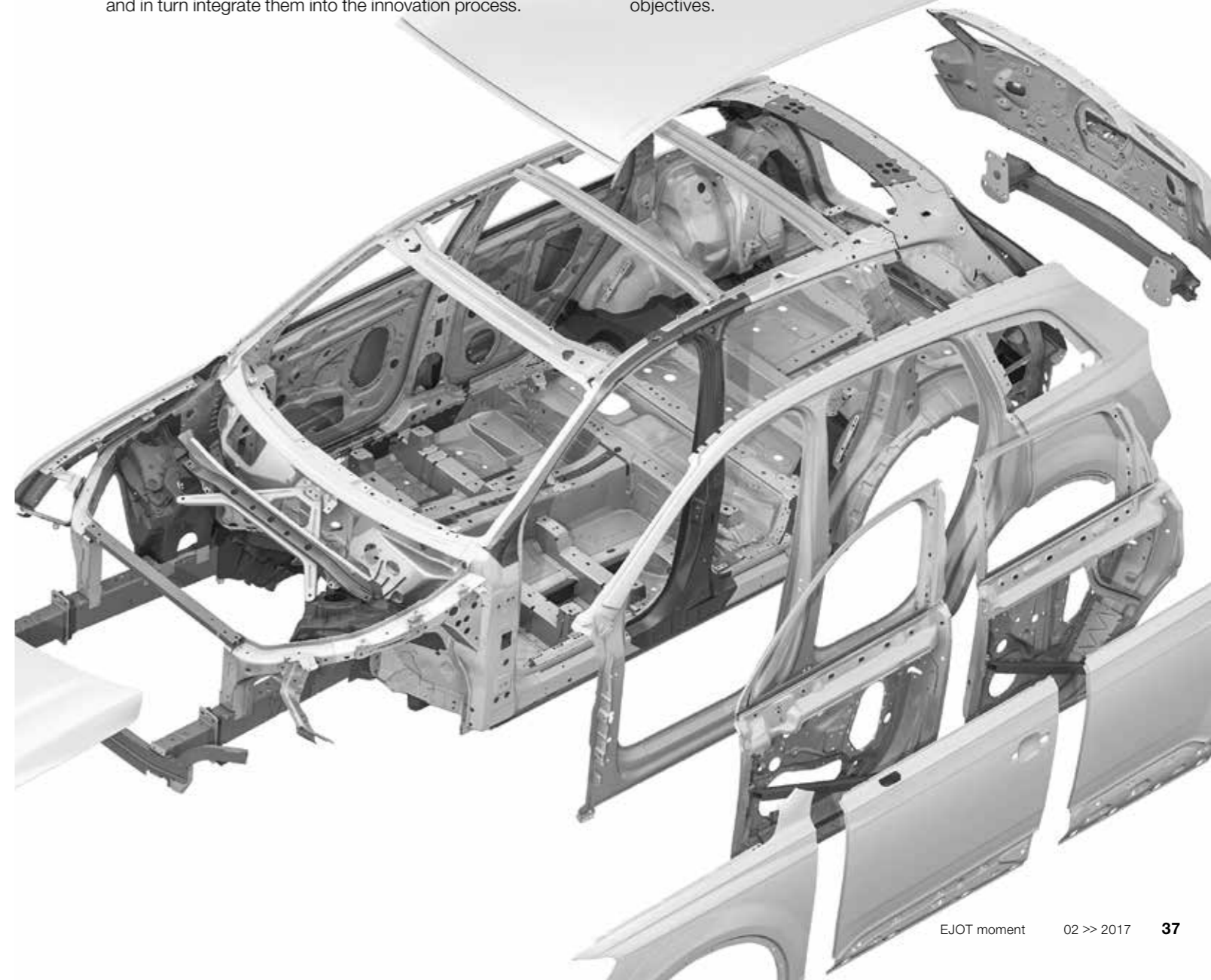
Safety on the dot

The automobile has made it into the headlines of almost all media over the last months and years. Unfortunately, most of the time not with news about innovations that help us move forward in our drive for mobility, but instead with bad news, which usually means guaranteed global front page news.

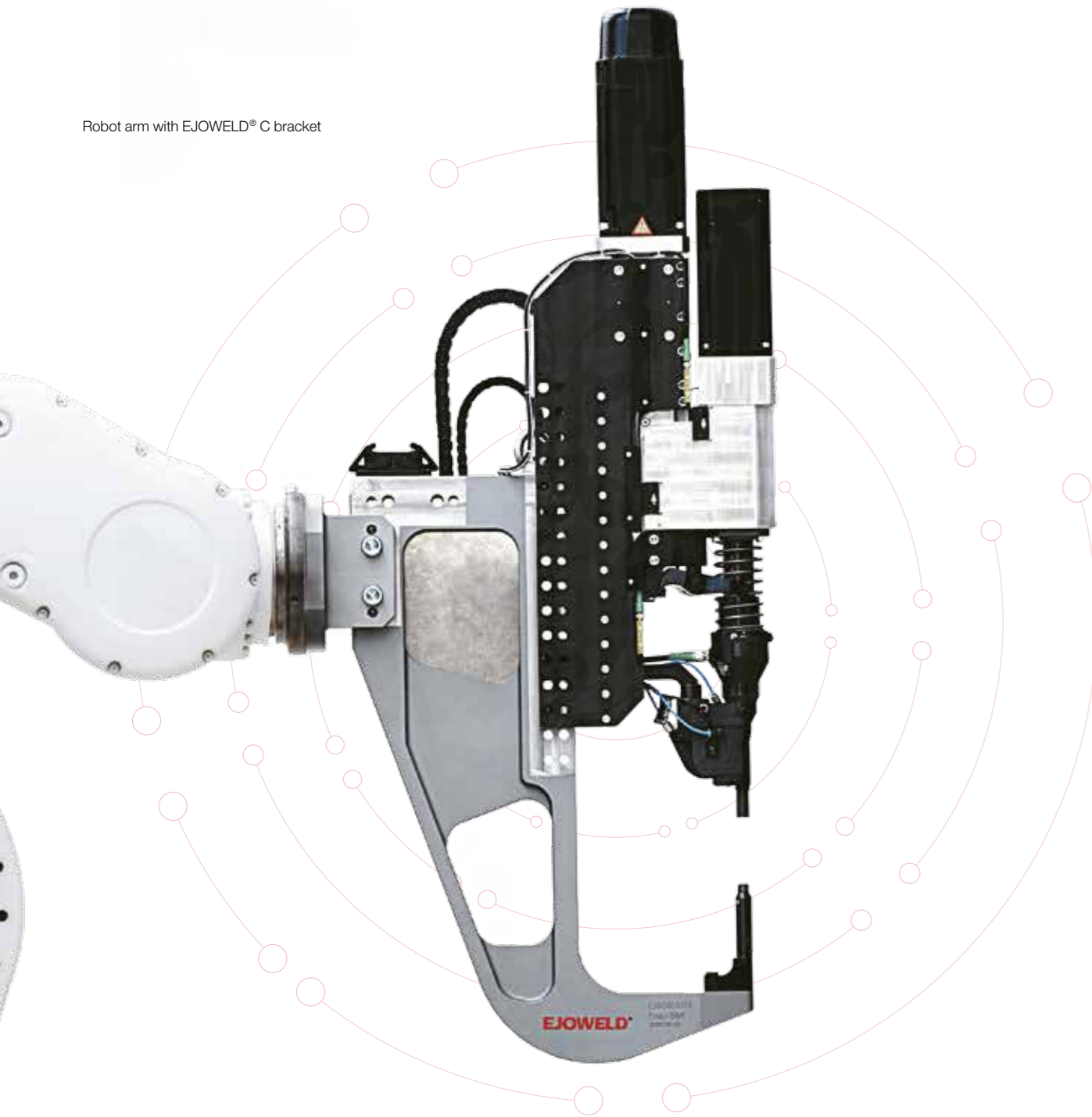
>>Text: Heinrich Georg Homrighausen

At no time in the history of the automobile have so many future-oriented, revolutionary approaches existed as the ones currently discussed. Electromobility, autonomous driving or the development of lighter vehicles are just some of the current topics, which also fascinate and challenge the suppliers and in turn integrate them into the innovation process.

Automotive lightweight construction continues to be of particular importance. The car bodies of electric cars must also become lighter because of the considerable weight of a battery, in order to keep the overall weight of the electric cars low. Cars in general have to be lighter to achieve the ambitious environmental objectives.



Robot arm with EJOWELD® C bracket



However, the safety of cars in operation and also in the process of vehicle production is set and not negotiable. In addition, the motor vehicles of the future are expected to provide even greater safety with regards to dynamic load bearing capacity. Battery ranges will also become more acceptable, with ranges of around 400 km for vehicles with an electric drive. Part of the successful development will be to find the right material in the required strength for the right place, e.g. in the car body. This multi-material strategy is of great importance especially for safety-relevant components which are often realised with advanced high-strength steel. In

order to connect these materials, which are extremely different in strength, in a series-compatible manner, EJOT has developed the friction element welding EJOWELD®.

Since there is a very strong dependency between the fastening process and the plant technology, it was decided to develop the complete fastening system, which consists of the fastening elements and the robot-based setting technology, in-house and establish it in the market. This means that EJOT acts as a system supplier for the customers.

In order to integrate such a new technology in an automotive manufacturer's serial application, extensive preliminary testing and safety checks are required to ultimately qualify the process. The robustness and process reliability of this joining technique had to be verified and statistically proven.

The core of the system is the control of the friction welding process. The entire process with its characteristic values is recorded, analysed and documented in real time. Continuous recording of the data ensures the traceability and the safety for the customer. The specially developed software ensures the friction welding process on the one hand, and also the plant technology on the other hand. Software protection mechanisms such as time, force and electric current monitoring prevent overloading of the drives and damage to the mechanics due to collisions.

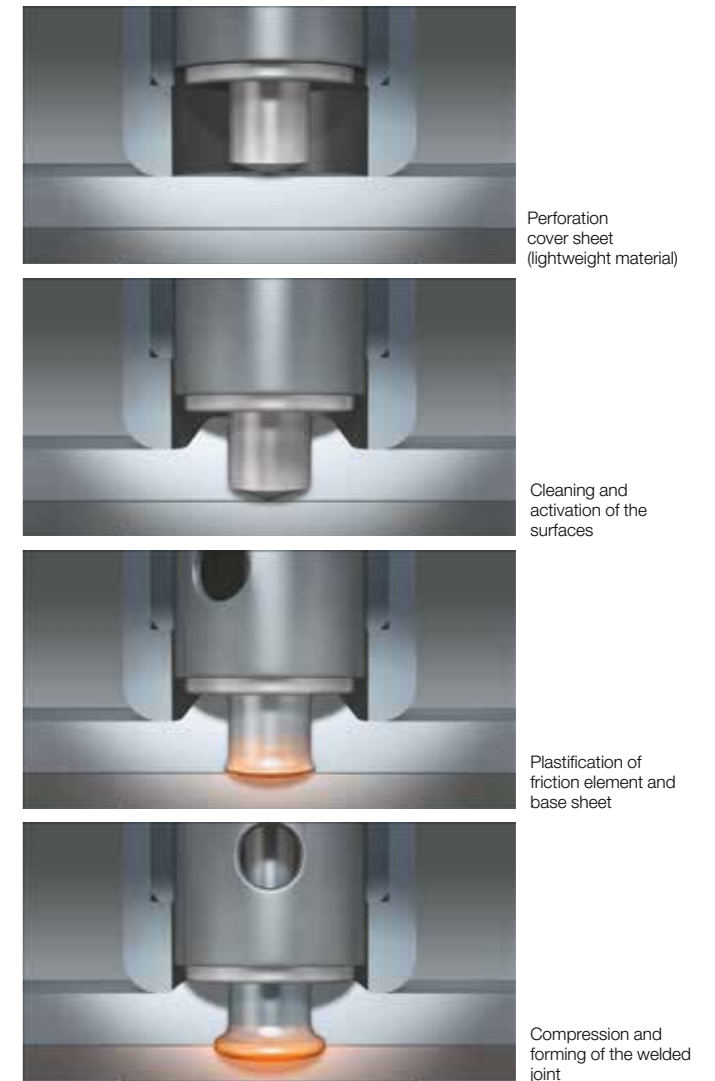
The safety concept also includes investigating possible errors as well as developing strategies for the prevention of these sources of error. One option is the protection against incorrect operation and parts mix-up. The system detects faulty friction elements and prevents fastening errors.

Due to the international orientation of the concept, it was necessary to take into account the relevant guidelines of all possible countries and to implement them in the fire protection and electrical engineering concept. Also taken into account are possible effects on the machine operator and his work environment. By shielding the welding point, and the fact that the process does not emit any pollutants, material or radiation, the friction element welding method is considered to be exemplary in this respect.

In addition to the safety of the welding process the economic aspect is a true advantage for the customer. How stable is the process, what is the operating concept, how high is the electricity consumption and other substances necessary for the operation? All are values which are used for the overall assessment of a new fastening concept.

Furthermore, it is necessary to achieve an acceptable overall plant efficiency, which is stipulated in the customer's specifications, also for the series application. This describes to what extent the system, made up of setting technology and product, fulfills the specifications and the performance rate without errors. Both, the product properties and the plant performance, contribute to this. A technical availability beyond 99 % and a quality rate well above 99.9 % are generally expected.

Ultimately, the accessibility of the service team also translates into security for the customer. Every minute of a standstill in the automobile production costs a lot of money and so the system provider is expected to be available at any time, to provide assistance in case of problems. It goes without saying that this service and this security are part of EJOT's range of services. **E**



Perforation cover sheet (lightweight material)

Cleaning and activation of the surfaces

Plastification of friction element and base sheet

Compression and forming of the welded joint

On the way towards 4.0



**WE
OUR** **SHAPE
FUTURE**

Self-steering, fully networked processes, maximum flexibility, and ambiguity of future tasks – these parameters are indicative of the challenges for implementing future digital production structures. In the new production hall 4.0 and the production of complex, high-precision EJOFORM® cold-formed parts, EJOT already sets the course for the production of the future.

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EJOT®