Mercedes-Benz	**Supply Specification** **Electrodeposited zinc or zinc alloy coatings for components manufactured from ferrous materials**	**DBL 8451** **BQF available** ☒

Additional Daimler standards required: DBL 8585, DBL 9410, DBL 9440, DBL 9460, DBL 9599, MB Special Terms

Supersedes edition: 05/06

Refer to Section Changes: page 10

Preliminary remark:
In accordance with the EU Directive 2000/53/EC concerning End of Life Vehicles or the German End of Life Vehicle Act, care shall be taken to ensure that components coated with corrosion protection in vehicle classes M1 or N1 in accordance with Annex II, Section A of Directive 70/156/EEC (passenger cars and commercial vehicles up to 3.5 t), which enter service after 2007-07-01, do not contain hexavalent chromium (Cr(VI)).
For this reason the Cr(VI)-free product versions contained in the following table, which shall comply with these statutory requirements, are marked specially with the supplement Cr(VI)-free.

Product versions

Coating	Zinc		Zinc/Nickel		Zinc/Iron	
Parts category	**without thread**	**with thread 1)**	**without thread**	**with thread 1)**	**without thread**	**with thread 1)**
Passivation, Cr(VI)-free, for technical data, see Table 2						
Transparent, Cr(VI)-free, sealer permitted where function not impaired	**.15**	**.16**	**.66**	**.76**		**.96**
Transparent, Cr(VI)-free, not sealed			**.62**	**.72**		
Transparent, Cr(VI)-free, sealed			**.65**		**.86**	
Coatings with Cr(VI)-free final coating, as of 2006-01-01, for technical data, please refer to Table 3						
Silver-colored , Cr(VI)-free, not sealed	**.12 3)**	**.22 3)**		**-**		
Silver-colored , Cr(VI)-free, fast to handling lubrication	**-**	**.26 2) 3)**	**-**		**-**	
Additionally Cr(VI)-free coated with organic finish	**.19 3)**	**.29 3)**	**.69 3)**	**.79 3)**	**-**	**-**
Chromating, (Cr(VI) possible) , technical data see Table 4						
Yellow chromated, (Cr(VI))	**.11 2)**	**.21 2)**	**.61 2)**	**.71 2)**	**-**	**-**
Yellow, fast to handling lubrication, (Cr(VI))	**-**	**.25 2)**	**-**	**.75 2)**	**-**	**-**
Yellow sealed, (Cr(VI))	**.18 2)**	**.28 2)**	**.68 2)**	**.78 2)**	**-**	**-**
Black (Cr(VI))	**-**	**-**		**-**	**.83 2)**	**.93 2)**
Black, fast to handling lubrication, (Cr(VI))	**-**	**-**	**-**		**-**	**.97 2)**
Olive (Cr(VI))	**.14 2)**	**.24 2)**	**-**	**-**	**-**	**-**

see changes 09/08

1): For surface protection of fasteners with metric thread, see DBL 9440; for bolts with microencapsulated liquid adhesive, see DBL 9460

2): Blocked for new designs

3): Cr(VI)-free coatings with identification 3) are already possible. As of 2006-01-01 it is necessary for these types of systems to be delivered chromium (VI)-free in accordance with this DBL, without the functional properties of the components being impaired or altered in any way. For this coating system the numbering of the product versions does not change when the transition is made to Cr(VI)-free.

Abbreviated designations on drawing, in block for surface protection e.g. 8451.62

Change 09/08: Product versions .11, .18, .21, .25, .28 indicated in the table above for which the use of Cr(VI) compounds is allowed are no longer permitted for new designs (see Table 4).

Continued on pages 2 to 14

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Blocking note:
The Cr(VI)-free versions refer to a new type of coating, which has not yet been checked for suitability in every individual case. For this reason, alongside the corrosion protection, attention shall also be paid to any possible changes in surface-specific functional properties in comparison to coatings containing Cr(VI).
For drawing parts the decision lies with EP/CRK, and for standard parts with EP/CRK and EP/EQS with regard to whether the surface treatment corresponds to the current corrosion guidelines or standards. Approval for usage, following testing, shall be decided by each responsible component manager, taking all the aspects that affect the component's function and durability into account.
Surfaces for parts, which are attached to body shells by means of welding, screw-connection or bonding and which together with the body run through the pretreatment and painting process, are not parts of this DBL for the supply of materials.

1 Field of application, general requirements

This DBL describes the special requirements, properties and planning data for parts with electrodeposited zinc and zinc alloy coatings and subsequent post treatment.
Although the End-of-Life Vehicle Act does not currently apply to heavy-duty trucks or buses, for reasons of variant reduction in new designs, consideration should be given to also specifying Cr(VI)-free surfaces for commercial vehicle parts. The function properties shall be checked when changing to Cr(VI)-free surfaces.
For notes on corrosion resistance and recommendations for various application cases, see Tables 2 to 4.

2 Constituents and recyclability

All materials, processes, components and systems shall conform to current statutory requirements regarding controlled substances and recyclability. The EU End–of-Life Vehicle Directive including the requirements with regard to freedom from Cr-VI shall be complied with (for the corresponding identified product versions). In terms of conformity with the provisions of the EU End-of-Life Vehicle Directive, the only decisive matter is whether the material or the component at the time of being put into service as an end product is free from Cr(VI) or not. Here, it is irrelevant whether material containing Cr(VI) was used during the production process or not.
Generally, the DBL 8585 requirements are valid for declarable substances.

2.1 Determination of Cr(VI)

Documented evidence of freedom from Cr(VI) shall be provided by the supplier, and it shall be done on the basis of acknowledged analytical methods. Such evidence shall normally be provided in accordance with DIN EN 15205 (formerly DIN 50993-1).
Possible contamination is permitted according to the exception to the EU ELV Directive (2000/53/EC) up to an amount of 0,1 % by weight relative to the corrosion protection layer (= "homogeneous material"), otherwise the determination limit for Cr(VI) in accordance with DIN EN 15205 has been specified at 0,1 µg/cm^2 based on interlaboratory tests.

3 General properties of the materials, raw materials and supply condition

3.1 Basic materials

The components designated for zinc-coating shall not exhibit any material, machining or surface defects, which could impair the corrosion protection and/or the appearance of the coatings. These are, e.g. for work-pieces made of rolled products, cracks, pore nests, foreign matter inclusions and laminations, for castings sunk spots and cold welds, shrinkage and toe-cracks as well as swirls and shrink holes. If necessary, an agreement concerning surface quality may have to be made.
Any contamination on the surface of the parts to b treated (corrosion products or scale, oil, grease, dirt etc.) must be completely removed during normal application of the automatic cleaning and pre-treatment facility without leaving any residue.

3.2 Material strength

3.2.1 Materials with strengths <1000 N/mm^2

The choice of treatment method is optional insofar as the requirements of this DB for the supply of materials are fulfilled, and the operating properties are not compromised.

3.2.2 Materials in strength range 1000 N/mm^2 up to 1150N/mm^2

When coating components with strengths ≥1000N/mm^2 (possibly also locally restricted, e.g. for case-hardened or cold-formed structures or in weld seam areas) safety takes precedence over delayed brittle fracture (hydrogen embrittlement). The coater shall be notified if material strengths are ≥1000N/mm^2. This also applies if the component strength exceeds this value in some areas only.
Production, joining and surface-treatment methods shall be executed such that any damage through delayed hydrogen-induced brittle fracture can be ruled out with a high degree of certainty. The relevant measures and tests such as minimization of component stresses, selection, composition and checking of chemicals, physical and chemical method limits, type of tests, test frequency, number of specimens etc. shall be documented in process and inspection plans according to the state of the art. The treatment of incorrect coatings (removal of coatings and new coatings) shall be investigated and the resulting consequences specified. Investigations shall be documented.

3.2.2.1 Reduction of hydrogen absorption

The instructions contained in DIN 50969 shall be observed. In addition to this, the coater is expected to assess the process in detail (FMEA) with regard to all sub-stages, in which hydrogen could ingress into the material structure. If necessary, the processes shall be optimized.
Process assessment shall be safeguarded by means of component tests. Measures shall be derived from this which serve to reliably minimize the quantity of hydrogen ingressing into the material during the process, and which enable a regular periodic examination of the efficiency of such measures.

3.2.2.2 Heat treatment

Heat treatments are required as measures to help avoid brittle fracturing; they shall be performed after electroplating for hydrogen effusion and if necessary, to reduce component internal stress before electroplating. Refer to DIN 50969, Section 4.3.1 and Section 4.4.
Care shall be taken to ensure that the properties of the parts are not impaired in this process. The effusion treatment may be carried out following a strike deposit, whereby the plating process shall be continued until the complete metal plating has been applied. Only then shall the heat treatment be carried out. If the heat treatment is performed in the ready plated condition, particular care shall be taken to ensure that the applied metal plating does not act as diffusion barrier and prevent the success of the heat treatment with regard to hydrogen effusion. The effectiveness of the heat treatment shall always be documented. The ideal heat treatment(s) used for a part (temperature, duration, operating sequence) shall be ascertained and stated in the ISIR (initial sample inspection report).

General reference values are provided in Table 1 below:

Dimension (thickness) (mm)	Strength (N/mm^2)	Heat treatment	
		Hours	Temperature (°C)
< 25	1000 to 1150	4	190 to 220
> 25		8	

Table 1: General reference values for heat treatments for hydrogen effusion

When coating components that are potentially subject to hydrogen embrittlement it is also expected that in addition to the measures specified above, additional preloading tests are performed to document the reliable uncritical process cycle.
These include:

- Preloading tests on real-life components that have been zinc-coated in a deformed fixture, in which the component is subjected to stress close to the weld seam through stresses in the yield strength area.
- A sufficient number of in-process preloading tests on suitable hydrogen sensitive samples shall be used as the basis for establishing the suitability of the process for coating critical components. In doing so the use of "excessive“ test conditions (e.g. through extended pickling period and impermissible contaminated pickling compositions) and statistical evaluation methods shall prevent the occurrence of delayed hydrogen-induced brittle fractures when coating production components.

Also refer to DIN 50969 as well as DBL 9599 Section 3.2 "Distortion test“.

3.2.3 Materials with strengths ≥1150N/mm²

Threaded parts with strengths (including local) ≥1150N/mm² shall not be provided with coatings in accordance with this DBL.
Unthreaded parts with strengths ≥1150N/mm² shall be produced with as little hydrogen entrainment as possible. For particularly critical parts, a switch shall be made to DBL 8440 and acid-free pre-treatment.

In exceptional cases unavoidable bolts of property class 12.9 are subject to the property class 12.9 DBL 9599.40 as a replacement for all surfaces acc. to DBL 8451. The threaded parts concerned shall be converted and shall no longer be delivered according to DBL 8451. For safety-critical fasteners, property class 120 acc. to DBL 9599.40 shall be used.

3.3 Corrosion protection coatings

3.3.1 Metallic base coats

Parts shall exhibit a dense, uniform, homogeneous, (dull) glossy coating which bonds well with the base material even under changing service temperatures in the engine compartment and which does not chip off on account of the customary application and mounting torsions. A uniform appearance of the surface shall also be provided in a passivated and, where applicable, sealed condition.
Due to the geometry, it may not be possible to apply the coating to all surfaces, e.g. on the tube inner side. Care shall be taken to ensure that uncoated surface areas do not exhibit any deposits, corrosion products or any other residue formation.

Damage to the coating through improper handling of the parts after electroplating, e.g. throwing or unsuitable transport conditions, shall be avoided.
The parts supplier shall select the coating company. If the coating was not applied by the supplier itself, then we expect that when choosing the contract electroplater, in particular for chromium(VI)-free coatings, companies affiliated to the "Federation of Industrial Coaters" (Fachverband industrieller Beschichter – FIB) are contracted, or companies that can demonstrate a comparable level of know-how and a comparable handling of quality issues as "FIB" affiliated companies. These companies, with their regulated process control and intensive quality assurance measures are most likely to consistently comply with the requirements contained within this DBL.

Before commencement of production deliveries, the coater shall determine and record the complete pre-treatment and coating process, the physical data (treatment periods, temperatures) and the composition of all process chemicals, and, if required, optimize them. Individual process intervention limits as well as the frequency of monitoring and analysis procedures shall be defined. The resulting measures shall be specified by the coater.
The documentation for this process specification shall be submitted to Daimler AG when requested during audits. Confidentiality of the revealed data shall be assured.

Any changes to the production coating process, which - subject to state-of-the-art technology - may exert an influence on the properties of the base material or the coating, shall be notified to Daimler AG immediately and without further request. This will result in the parts having to undergo a new sample delivery.

In contrast to national and international standards, these Supply Specifications do not differentiate between the manufacturing process for barrel or rack coating, because often when determining the surface protection required, the process technology used is not yet known. In many cases, parts with a thread (bolts, nuts) can be coated in the drum. For parts without a thread, the size of the component and its design, along with the technology available at the coater's, will determine whether the coating process should be performed using the less expensive barrel plating method or by rack plating.
For information on the achievable corrosion resistance for barrel and rack parts, refer to VDA specification VDA 233-101. The stated requirement values – transferred to the procedure of this DBL – are in many cases comparable and currently represent state-of-the-art technology.

3.3.1.1 Zinc-nickel coatings (ZnNi)

The most popular electrodeposited zinc-nickel coatings have a nickel content of 12% within the limits of 10 to 15%. The method used and the nickel content (specified and actual values) in the layer shall be indicated in the initial sample inspection report (ISIR).
The significantly higher corrosion resistance of the metallic coating in combination with the less prominent corrosion products compared to pure zinc coatings and the low-alloyed zinc-iron coatings are characteristic of zinc-nickel coatings. Zinc-nickel coatings therefore demonstrate the best behavior of the metallic coatings within this DBL with regard to corrosion protection quality.

3.3.1.2 Zinc-iron coatings (ZnFe)

This method refers to zinc-based alloy coatings with a low iron alloy constituent (Fe 0.4 up to 0.7 %) content. The methods used and the content of the alloy element(s) (specified and actual values) in the layer shall also be stated in the initial sample inspection report (ISIR).
The low-alloy zinc-cobalt coatings formerly available in France are no longer as important, and for this reason they are not included in this DBL. For any parts currently still in delivery phase which have a ZnCo coating, the requirements specified in DBL 8451, edition 07.01, shall apply. The requirements of the EU End-of-Life-Vehicle Directive shall also be observed here, of course.

3.3.2 Aftertreatment for protection of metallic coating

Aftertreatment shall completely cover the electroplating, bond well and, apart from interference colors, be uniform and free of spots.

3.3.2.1 Passivation

A new concept is introduced with the term "passivation". While chromating is produced from solutions containing Cr(VI) and the chromating on the workpiece may therefore also contain Cr(VI), the term passivation refers to chromium(VI)-free corrosion protection.

Passivation treatments are conversion layers and they are created by immersing the components in passivation solutions. By doing so the newly electrodeposited coating reacts with the passivation solution to form a thin film composed of complicated reaction products, which cover the metallic coating. The reaction always causes the coating to dissolve partially (approx. 0,2 to 2 µm). If necessary, this process shall be counteracted by increasing the electrodeposited layer thickness.

3.3.2.2 Chromate coatings

Chromate coatings are usually formed, as with passivation, by immersing the coated component in an acid solution. This in turn causes some of the metallic coating to be dissolved, and a chromate coating is formed consisting of the various chemical constituents in the coating and the chromating solution ingredients.
Whereas for colored chromate coatings (yellow, black, olive) one can assume that they contain Cr(VI) compounds, this is not assured for transparent or blue chromate coatings. Here, systems containing Cr(VI) and ones that are Cr(VI)-free, are available in parallel on the market. To be certain that Cr(VI)-free products are used a conversion to the special product versions of this DBL is necessary. For PVs .12, .22, .26 the time limit of the Cr(VI) content is valid.

3.3.2.3 Sealings

Sealings serve to increase corrosion resistance and are generally permissible, if the coat thickness is not increased by more than 1 to 2 µm and if the functional properties of the component such as transition resistance, weldability, compatibility with operating fluids, bonded connections are not impaired. Top coats or subsequent paintwork with higher layer thickness shall not be used as sealings.
During the sealing process the still wet passivation/chromate coating (low film formation) has substances integrated into it to increase the corrosion and temperature resistance. This usually also serves to remove any interference color.
Whereas formerly sealing was mainly performed using organic resin dissolved in water, recent developments have seen products used which contain nanoscaled SiO_2, partly in combination with organic resin.
When sealing, special care shall be taken to ensure that the inner surfaces of tubes fulfill residual contamination requirements, or that they are compatible with the operating fluids.

Sealings for product versions .18, .28, .68, .78, .65 and .86 are a mandatory specification
Products that can be removed using cold cleaning solvent, e.g. oil, grease, or wax-based, are not permitted for sealing.

For components which are glued and/or pressed in (e.g. core hole covers), particular attention shall be given to the influence of the layer structure and/or sealant on the assembly and functional properties. The use of special products may become necessary in this respect. The use of sealants with integrated lubricants which may have an effect on the sliding properties of the finish is not permitted in principle with regard to these components. Any deviations shall be agreed and documented separately.

Parts that subsequently undergo electrophoretic dip coating (cataphoretic dip coating, anodic dip coating) shall not be sealed. The coater shall be notified of this.

3.3.2.4 Organic finishes (product versions .19, .29, .69, .79)

These product versions apply to electrodeposited zinc and zinc-alloy coatings on ferrous materials, which have also been coated with a thin organic paint finish. The coatings are used for corrosion protection under the most stringent of requirements and for deep-black coloration. Pure zinc coatings, and high-alloy zinc-alloy coatings (ZnNi) are used for metallic base coatings. Parts are generally coated in barrels, baskets, trays or on belt and rack technology. Because of their temperature resistance these coatings are also suitable for loads in which temperatures up to 180 °C can occur.

These types of coating systems are standardized as "duplex coatings" in DIN 50923. However, the standard is not valid for fasteners with threads.

The applicability of these types of coating systems shall be ascertained in each case by means of suitable investigations. For reasons of size, parts with metric threads of <M6 are not suited for this method.

The type of additional coating is subject to agreement. For standard parts, department EP/EQS shall also be notified. The methods and products used shall be indicated in each case in the ISIR (initial sample inspection report) as part of the initial sample process.

3.4 Tolerances

Following electroplating, parts shall be within the specified tolerances stated on the standard sheets or drawings, taking thread sizes into special consideration.

3.5 Significant areas

There is a possibility that on some parts corrosion protection requirements may not be sufficiently fulfilled on all areas of the surface to be electroplated, for example due to design reasons. In such instances, the areas significant for surface protection shall be specified.
Significant areas shall be designated on a drawing by means of a dot-and-dash line. The requirements contained within this DBL apply to these areas only.

3.6 Coefficients of friction

The coefficients of friction required for threaded parts and their determination methods are specified in DBL 9410. For product versions .25, .26, .75, and .97; the coefficients of friction shall be set by means of an antifriction agent treatment using fast-to-handle products. The requirements of MBN VDA 235-101 shall apply, Lubrication of Threaded Parts, but excluding blue coloration of the lubricant. Screws, bolts and nuts with coarse-pitch or fine-pitch thread, which are manufactured according to this DBL and not according to DBL 9440, should always be treated with antifriction agent, insofar as this is not ruled out by other reasons, for example the need for an additional coating with adhesives.
Otherwise the use of fast-to-handle lubricants for threaded parts shall be examined.

4 Technical data and requirements

The complex requirements described below are presented in tabular form. The abbreviations used there, and the information on exceptions and on corrosion resistance are explained in Tables 5 and 6.

4.1 Cr(VI)-free metallic coatings

Table 2 defines the requirements pertaining to Cr(VI)-free metallic coating systems. At the time this DBL was compiled two exhaustive VDA (Association of the German Automotive Industry) interlaboratory tests were conducted and evaluated. These showed that:

- Cr(VI)-free aftertreatment can provide high-quality corrosion protection coatings,
- thermal loads do not damage the corrosion protection quality of the coatings to the same degree that chromating does,
- zinc-nickel coatings are superior, particularly with regard to protection against base material corrosion
  Note: Times generally achieved during testing as per DIN EN ISO 9227 NSS for base material corrosion are distinctly higher than the test times stipulated by this DBL of 720h. This limitation of the test time serves to justify the request for reasonably acceptable test times.
- the real-life coating quality may still be subject to significant fluctuation (process capability must undergo further optimization).

4.2 Coatings with Cr(VI)-free top coat as of 2006-01-01

Cr(VI)-free coatings for product versions .12, .22, .26, .19, .29, .69, .79 can already be achieved today when the coatings specified in Table 3 are used. However currently there are no specifications which ensure that such layers do not contain additives with Cr(VI) content. As of 2006-01-01, it is therefore necessary for these types of systems to be delivered chromium (VI)-free in accordance with this DBL, without the functional properties of the components being impaired by it or altered in any way. For these coating systems, the numbering of the product versions does not change when the transition is made to Cr(VI)-free.

4.2.1 Silver-colored passivated surfaces

These (product versions .12, .22, .26) are anti-corrosion systems with low corrosion resistance, which are currently defined by the designation transparent (chromium colored) chromated. One assumes here that today a major portion of these layers are supplied as Cr(VI)-free. To indicate that these product versions are used chromium(VI)-free, it will be necessary in future (at the latest as of 2006-01-01) to use the designation "silver-color passivated“.

4.2.2 Cr(VI)-free metallic coatings with organic finishes

Table 3 also contains the requirements for duplex coatings, consisting of a metallic base layer and an organic finishing coat (product versions .19, .29, .69, .79). These types of coatings have been specified since 1984 with substrates made of pure zinc and since 1989 with base coatings made of zinc-nickel in DBL 8451 and standardized since 2004 in DIN 50923.
Chromium (VI)-compounds could be used in the past in the intermediate layer between the metallic coating and an organic finish. It is possible, however, to substitute products containing Cr(VI), and DIN 50923 also specifies that corrosion protection layers be free of Cr(VI).
As of 2006-01-01, this DBL therefore requires that these types of systems be delivered chromium (VI)-free in accordance with this DBL, without the functional properties of the components being impaired by it or altered in any way. This should serve to ensure that for these systems too, the changeover to Cr(VI)-free should be possible without any need to change the drawing.

4.3 Metallic coatings containing Cr(VI)

Table 4 specifies the requirements for coating systems, in which Cr(VI) may be a constituent of the corrosion protection ("previous systems"). These product versions may therefore only be used where the prohibition of Cr(VI)-compounds in corrosion protection coatings is not of relevance to the selected components (see hereto also the notes in Section 1 of this DBL).

5 Tests

5.1 Corrosion resistance test

All parts shall be degreased prior to the corrosion test in petroleum ether (e.g. petroleum benzene, ultrapure, DAB, Merck no.100909).

Following the required test period as per DIN EN ISO 9227 NSS, remove the component from the test cabinet, rinse with demineralized water and then dry before the assessment, e.g. by gently blowing off with compressed air.

The corrosion resistance test is deemed to have been passed when each respective requirement in the tables of this DBL is complied with. The approximate minimum coat thicknesses of the metallic coatings as shown from previous experience are indicated.

Note
Due to changes to long-established test standards, the following substitute standards shall apply:

Withdrawn German standard	Applicable substitute standard
DIN 50021SS	DIN EN ISO 9227 NSS
DIN 50017 KK	DIN EN ISO 6270-2 CH

5.1.1 Testing Cr(VI)-free coatings

Each of the Cr(VI)-free coating systems in Table 2) shall be tested with and without heat treatment (24h, 120°C) before the corrosion exposure as per DIN EN ISO 9227 NSS.

5.2 Coating adhesion test (thermal shock resistance, blistering)

Store test specimens for 30 minutes at 220 ± 10 °C and quench them immediately afterwards in water at a temperature of 15 °C to 25 °C. No chipping and blistering of the coat is allowed. Bending of the components is recommended as an additional adhesion test, as far as practicable.

5.3 Test for susceptibility to brittle fracture

Evidence shall be provided by means of suitable preloading tests in accordance with DIN 50969 or, for fasteners, in accordance with EN ISO 15330, that the complete process has been carried out successfully for parts with strength ≥1000 N/mm^2.

5.4 Requirement exceptions

Corrosion resistance is impaired by any forming after the surface treatment.
For chromium (VI)-free coatings, the coating corrosion in the area formed after coating the component surface is generally not evaluated. Requirements for the base material corrosion protection also apply to these areas, however. Deviations from this Specification shall be stated on the component drawing. Furthermore, the following information applies: If in Tables 2 to 4 the values are given in parenthesis (e.g.) (2), then these are apply in addition. If no requirements are listed (n.r.), as in Table 4 (n.r.), then the characteristics of the formed components areas are not assessed. The standard requirements apply to surface areas not impaired by the forming process.

With regard to screws and bolts, these requirement exceptions ( ) are generally applicable to the shank and thread. In accordance with one requirement, 3 (2) then means 3 cycles of corrosion freedom for the head or the wrench area and 2 cycles for a bolt's shank and thread.

The corrosion behavior of the inner areas of a tube following the laboratory corrosion tests is not assessed. Temporary safety precautions (corrosion protection oil, packaging, where applicable by way of the sealings used) shall be used to ensure that iron rust products do not occur on the inner areas of the tube during treatment, storage and transport of the tubes up to the point of installation.
The compatibility of the temporary corrosion protection materials with the operating fluids used during driving shall be assured.

5.5 Special requirement exceptions

When assessing screws and bolts with a length in excess of 10 x d and screws bolts with a thread pitch p<1, the special requirement exceptions, values in brackets [ ], apply to the bolt's shank/thread area.

6 Duties of the supplier

Refer to MERCEDES-BENZ SPECIAL TERMS Nos. 13 and 16

7 Samples

Refer to MERCEDES-BENZ SPECIAL TERMS No. 13.
The ISIR (initial sample inspection report) shall contain details on the electroplating shop (supplier and/or sub-supplier). The product actually used for the creation of the passivation (designation, manufacturer) shall be indicated. Where sealants are used, the product employed shall also be indicated (designation, manufacturer). Where several coaters are concerned, each electroplating shop shall submit initial samples with the ISIR, and particular attention shall be given to identical functional and/or assembly properties of components which are finish-plated in different plants. This normally also requires the use of identical products (base chemicals) for the creation of the layer.
The testing body (supplier and/or sub-supplier and/or independent testing institute) shall be named.
Pertinent data accessible to Mercedes Benz will be treated confidentially and not revealed to third parties.

8 Deliveries

Ongoing deliveries shall correspond to the approved samples.
Otherwise refer to MERCEDES–BENZ SPECIAL TERMS No. 13.
In the event of any changes regarding the coater or the process or significant parts of the process (see 3.3.1) or the layer-forming products, renewed initial sampling of the surface quality shall be performed. For production deliveries, the supplier shall conduct an in-process quality inspection and make the values available on request.

9 Marking

Refer to MERCEDES-BENZ SPECIAL TERMS No. 24.

10 Packaging

Components shall be protected against the effects of corrosive media.
Otherwise refer to MERCEDES–BENZ SPECIAL TERMS No. 30.

11 Storability

Refer to MERCEDES-BENZ SPECIAL TERMS Nos. 29 and 30.
All parts shall be delivered without corrosion products. When storing parts until they are required for further processing or assembly, preservation or special storage conditions may be required.

12 Special instructions

Observe special instructions on the order.

13 Complaints

Refer to Mercedes-Benz Special Terms No. 16 and Purchase Conditions for Production Materials and Spare Parts for Motor Vehicles.

14 Environmental protection regulations/Industrial safety

Refer to Mercedes-Benz Special Terms No. 30, No. 36 and DBL 8585 Negative substance list for material selection.

15 Other applicable standards

Purchase Conditions for Production Materials and Spare Parts for Motor Vehicles.
Tandem Konkret, Nos. 13, 16, 24, 28, 29, 30,
as well as
DBL 8400, DBL 8440, DBL 8585, DBL 9410, DBL 9440, DBL 9460, DBL 9599, DIN EN ISO 6270-2 CH, DIN 50018, DIN EN ISO 9227 NSS, DIN 50923, DIN 50933-1, DIN 50961, DIN 50969, DIN EN ISO 15330, VDA 233-101

Changes as against previous edition 07/01

- DBL completely revised.
- Requirement values for chromium (VI)-free layers adapted to state-of-the-art technology.
- Incorporation of new product versions (PVs) for systems, made of chromium (VI)-free materials (.62, .72, .65)
- Use of duplex coatings containing Cr(VI) and chromating process for transparent coating terminated.
- ZnCo alloy coatings no longer part of specifications.
- Ban on use with parts of $\geq$ 1150N/mm^2 and property classes 12.9 with change notice to DBL 9599.
- The following product versions have been removed: .13, .23, .17. Parts which still have this surface protection applied to them are subject to the requirements of DBL 8451 Edition 8.94. These product versions may no longer be used as of 2007-07-01 on vehicles which are subject to the EU End-of-Life-Vehicle Directive.

Changes as against previous edition 07/05

- Permissible limit of Ni content for ZnNi coatings according to DIN 50962 increased to 15%.
- Handling of tube inner surfaces specified.
- Acceptance requirements in Table 4 according to DIN EN 12329 defined and faulty reference removed.
- Comment on coater selection modified

Changes as against previous edition 11/05

- Exclusion of lubricants changing the friction coefficient in sealants for components which must be pressed or glued in, and reference to particular attention to functional properties
- Requirement for concrete indication of substance of passivating and sealing agents used by the supplier in the ISIR
- For the event of several coaters involved, reference to requirement of identical properties of component surfaces
- Reference to DBL 8840 omitted
- Reference to heat treatment for hydrogen effusion updated

Changes as against previous edition 05/06

- Product versions under Table 4 which were still permissible for the commercial vehicles unit are now barred for new designs
- Specifications on Cr(VI) analysis and hydrogen effusion revised
- Change 09/08 inserted in DBL text
- Corrosion testing standards updated

Table 2 **Cr(VI)-free electrodeposited coatings; technical data and requirements**
The friction coefficients required for threaded parts are defined in DBL 9410

PV	Coat-ing metal	Finish	Cr(VI) Yes No	Sealing	Parts category with or without thread	**Recom-mended layer thickness (µm)**	Acceptance requirement *) DIN EN ISO 9227 NSS (h)		Acceptance requirement DIN 50018 KFW 2,0 S cycles up to Fe corrosion	Corrosion resistance (Kb)	Remarks
							up to Zn corrosion	up to Fe corrosion			
.15	Zn	Trapas	No	All	none	10 to 12	168	360	5	IV	For KTO: blind rivets
.16	Zn	Trapas	No	All	with	6 to 8	96	240	3	III	
.86	ZnFe	Trapas	No	Yes	none	10 to 12	360	600	5	V	
.96	ZnFe	Trapas	No	All	with	6 to 8	120	480	3 (2) [1]	III to IV	
.66	ZnNi	Trapas	No	All	none	10 to 12	240	720	2	V to VI	
.62	ZnNi	Trapas	No	No	none	10 to 12	240	720	2	V to VI	E.g. for tubes
65	ZnNi	Trapas	No	Yes	none	10 to 12	360	720	2	V to VI	
.76	ZnNi	Trapas	No	All	with	6 to 8	120	720	1	IV to V	For KTO: rivet nuts
.72	ZnNi	Trapas	No	No	with	6 to 8	120	720	1	IV to V	

*) Each of the product versions (PVs) specified in this table shall be tested with and without heat treatment (24h, 120°C) before the corrosion exposure as per DIN EN ISO 9227 NSS.

Table 3 **Cr(VI)-free coatings in which the product versions are retained and Cr(VI) freedom for supply of samples and production deliveries as of 2006-01-01 is required; technical data and requirements**
The friction coefficients required for threaded parts are defined in DBL 9410

PV	Coat-ing metal	Finish	Cr(VI) Yes No	Sealing	Parts category with or without thread	**Recom-mended layer thickness (µm)**	Acceptance requirement DIN EN ISO 9227 NSS (h)		Acceptance requirement DIN 50018 KFW 2,0 S cycles up to Fe corrosion	Acceptance requirement: No blisters, no Zn or Fe corrosion; load as per DIN EN ISO 6270-2 CH via	Corrosion resistance (Kb)	Remarks
							up to Zn	up to Fe				
							corrosion					
.12	Zinc	Silpas	No*)	All	none	10 to 12	48	120	5 (3)		II	For decorative purposes only
.22	Zinc	Silpas	No*)	All	with	6 to 8	24	72	3 (2) [1]		II	For decorative purposes only
.26[1)]	Zinc	Silpas, yc	No*)	All	with	6 to 8	24	72	3 (2) [1]		II	For decorative purposes only
.19	Zinc	Duplex	No*)	No	none	10 to 12	240	480		240 h	V to VI	black
.29	Zinc	Duplex	No*)	No	with	8	168	240		240 h	IV to V	black
.69	ZnNi	Duplex	No*)	No	none	10 to 15	480	720		240 h	VI	black
.79	ZnNi	Duplex	No*)	No	with	6 to 8	360	720		240 h	VI	black

1) Banned for new designs
*) Required is Cr(VI)-free supply of samples and production deliveries as of 2006-01-01. Cr(VI) may be contained in the coating systems up to this deadline.

Table 4 **Only use coatings containing Cr(VI), if the EU End-of-Life-Vehicle Directive is not relevant to the component**
Technical data and requirements (values identical to DBL 8451, Edition 08.94
The friction coefficients required for threaded parts are defined in DBL 9410

PV	Coat-ing metal	Finish	Cr(VI) Yes No	Sealing	Parts category with or without thread	**Recom-mended layer thickness (µm)**	Acceptance requirement DIN EN ISO 9227 NSS (h)	Acceptance requirement DIN 50018 KFW 2,0 S cycles up to Fe corrosion	Corrosion resistance (Kb)	Remarks
.11[1)]	Zinc	Yechrom	Yes	All	none	10 to 12	96 Zn*	5 (3)	III	
.21[1)]	Zinc	Yechrom	Yes	All	with	6 to 8	72 Zn*	3 (2) [1]	III	
.61[1)]	ZnNi	Yechrom	Yes	All	none	10 to 15	240 Zn* (360) Fe*	2 (n.r.)	V	
.71[1)]	ZnNi	Yechrom	Yes	All	with	6 to 8	168 Zn*	1	IV	
.25[1)]	Zinc	Yechrom, FL	Yes	All	with	6 to 8	72 Zn*	3 (2) [1]	III	
.75[1)]	ZnNi	Yechrom, FL	Yes	All	with	6 to 8	168 Zn*	1	V	
.18[1)]	Zinc	Yechrom	Yes	Yes	none	10 to 12	168 Zn*	9	IV to V	
.28[1)]	Zinc	Yechrom	Yes	Yes	with	8	120 Zn*	5	IV	
.68[1)]	ZnNi	Yechrom	Yes	Yes	none	10 to 15	360 Zn*,Wb* (360) Fe*	2 (n.r.)	V to VI	
.78[1)]	ZnNi	Yechrom	Yes	Yes	with	6 to 8	240 Zn*	1	V	
.83[1)]	ZnFe	Blkchrom	Yes	All	none	> 8	216 Zn*	5 (n.r.)	V	
.93[1)]	ZnFe	Blkchrom	Yes	All	with	6 to 8	120 Zn*	3 (2) [1]	IV	
.97[1)]	ZnFe	Blkchrom, FL	Yes	All	with	6 to 8	120 Zn*	3 (2) [1]	IV	
.14[1)]	Zinc	Olchrom	Yes	All	none	10 to 12	120 Zn*	5 (3)	III	For identification only
.24[1)]	Zinc	Olchrom	Yes	All	with	6 to 8	72 Zn*	3 (2) [1]	III	For identification only

1)	Banned for new designs

Table 5: Legend and explanation of abbreviations used in Tables 2 to 4

Trapas	Transparent passivated	Zn*	Without Zn corrosion
Silpas	Silver-color passivated, formerly: transparent chromated	Fe*	Without Fe corrosion
FL	Fast-to-handling lubrication	( )	Requirement exception, see Section 5.4
Yechrom	Yellow chromated	[ ]	Requirement exception, see Section 5.5
Blkchrom	Black chromated	Wb*	Heat treatment, 8h at 120°C
Olchrom	Olive chromated	(n.r.)	No requirements for formed surface areas
All	Allowed when function not impaired		

Table 6: Classification of corrosion resistance (Kb)

Kb I	Transport and storage protection, installation in oil gallery
Kb II	Very low corrosion resistance, installation on non-corrosive areas
Kb III	Low corrosion resistance, for parts, which may alter visually through corrosion
Kb IV	Medium corrosion resistance, for parts, in areas subject to a low level of corrosion
Kb V	High corrosion resistance, for parts in visible area, or where corrosion must be excluded for functional reasons
Kb VI	Extremely high corrosion resistance