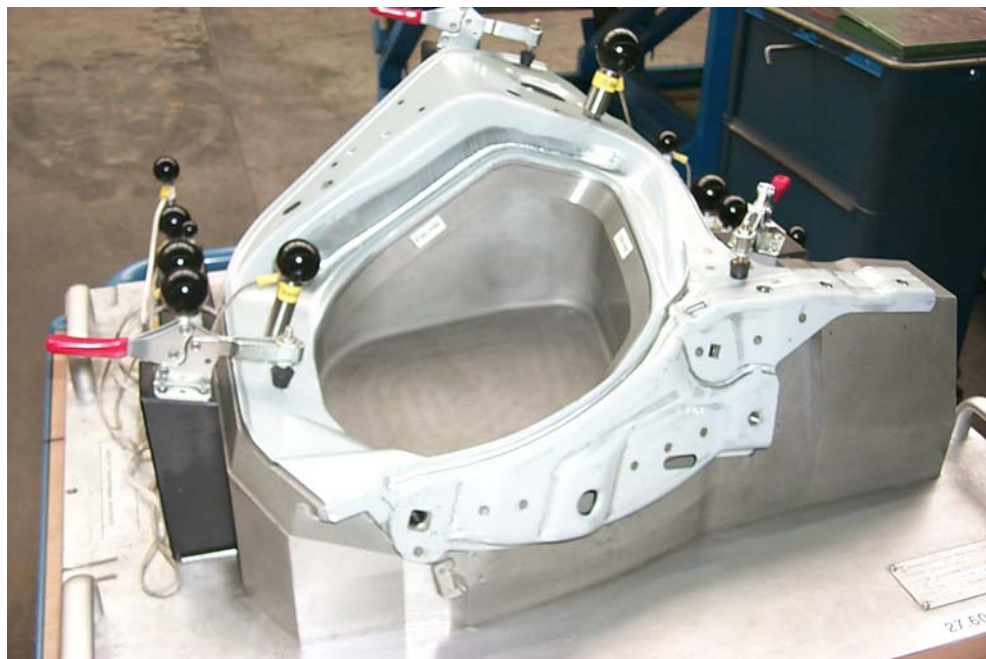


Design specification for gauges

Design Specification for Gauges



Design specification for gauges

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Design specification for gauges

1 Purpose

This design specification for gauges serves to provide the functional communication between the departments advanced quality planning and manufacturing by indicating definite guidelines.

The design specification for gauges ordered by KIRCHHOFF Automotive accommodates the requirements placed on test equipment regarding materials, accuracy and function. These requirements are based upon generally accepted technical practices and operational needs.

Compliance with these requirements is mandatory for all departments involved. They are determined by the construction and inquiry data as well as by the present design specification.


For the manufacturer, this means that he can only fulfil the requirements in an alternative way regarding a cheaper production when there have been consultations with the advanced quality planning [EQ] and the alternatives have been expressly approved.

The advanced quality planning must authorise deviations from these rules, required by KIRCHHOFF Automotive that may arise from urgent operational demands. Thus the validity of the other regulations is not affected.

Hence the design specification with revision status 3 must be applied to all newly ordered gauges. For all gauges that are already finished or are under construction at the effective date the previous revision status 2 is applied.

In case of modified legal requirements come into effect or possible gaps maybe in the regulations of this design specification, the licit degree by law and respectively the corresponding state of the art of the application will be substitution.

Attendorn, 30 April 2004



R. Kowalke
QM Sales & Engineering

Design specification for gauges

2 Symbol and Abbreviation Descriptions

- BSK = Trimmed edge
- DATUM(S) = Zero admission(s)
- EM = Extended measurement surface
- EQ = Advanced quality planning
- GFK = Glass fiber laminate
- LL = Clearance
- LH = Left-hand side
- LHD = Left-hand-driver
- LHD/LH = Left-hand-driver/Left-hand side
- LHD/RH = Left-hand-driver/Right-hand side
- RH = Right-hand side
- RHD = Right-hand-driver
- RHD/LH = Right-hand-driver/Left-hand side
- RHD/RH = Right-hand-driver/Right-hand side
- RPS = Reference point system
- UVV = Rules for accident prevention
- ZSB = Assembly

Design specification for gauges

3 Gauge and production tolerances

3.1 Datums

Contact surfaces and hole positions called out as DATUM are to be produced with a tolerance range of $\pm 0,05$ mm.

3.2 Other surfaces and positions

- Hole positions are to be produced with a tolerance range of $\pm 0,10$ mm.
- Areas with clearance are to be produced with a tolerance range of $\pm 0,15$ mm.
- Extended measurement surfaces (EM) are to be produced with a tolerance range of $\pm 0,15$ mm.
- Outline templates are to be produced with a tolerance range of $\pm 0,15$ mm.

3.3 Surface condition

- Locations points / Datums: Rz 10
- Net relation surfaces / Base: Rz 10
- Gauge body: Rz 25
- Generally: Rz 40

3.4 Proportionality and Fits

- Locating Pin / Bushing: H7 / g6
- Checking pin (go/no go)/ Bushing: H7 / g6
- Length of pin guideway: minimum 1,5 x guided- \emptyset ;
maximum: 30 mm
- Proportion guided- \emptyset to checked- \emptyset : minimum 1:1,5;
maximum: 30 mm

Design specification for gauges

4 Design of Gauges

4.1 Generally

All Gauges must be designed and produced according to the fixed reference system (normally ASME Y14.5M-1994 or RPS) stated on the part drawing. After completion of the gauge construction the CAD data have to be forwarded to the quality planner via Odette - preferably in

- a) catia model;
- b) cgm -
- c) step -
- d) vda - or
- e) iges- format;
- f) or corresponding drawing(s)

for the construction release. All expenses referred to gauge fabrication which haven't been officially released by the quality planner are for the supplier's account.

It has to be guaranteed that all measuring points (e. g. surfaces, edges, holes) are measurable and reachable by the measuring machine. That has to be particularly considered with regard to dispositions of clamps, displaceable bridges, templates or similar.

Describing the fitting situation (net position) has to be standard practice. To improve the handling the assembly construction may be swayed by integer multiples of 90° around the individual axes, provided that is not excluded in the gauge inquiry. In case the position is not obviously from the drawing it has to be taken from the CAD data.

The datums are the net relation for the gauges. The bases that are mounted in the base plate have to be made wear resistant and if possible protected against any damages. For that reason three accordingly secured bushings with a ground flange have to be chosen. The position of all bushings has to be indicated in the three axes.

Additional net relations on the gauge are allowed. Nevertheless, it has to be noted that KIRCHHOFF Automotive takes the Datums indicated in the part drawing as a basis to align the gauge when checking.

The CAD data are the basis for the gauge construction and will be provided by KIRCHHOFF Automotive.

Design specification for gauges

When designing the gauge, distortion stiffness and deformation resistance have to be considered. Regarding the base plates and body assembly this design specification can only contain the basics. Exact specifications according to the project will be defined by the responsible quality planner.

Selection of materials has to be adapted to the intended use of the gauge. Fundamentally, form stable and abrasive resistant materials have to be chosen. The gauge's material must be protected against corrosion.

4.2 Base Plates / Sizes

The default materials for base plates are:

- rolled aluminium plate (aluminium block material)
- casted aluminium
- light weight construction plates.

In order to standardize the size of the gauges only the following base plate dimensions are permitted to be used:

1.	200 mm x 300 mm
2.	400 mm x 300 mm
3.	400 mm x 600 mm
4.	800 mm x 600 mm
5.	800 mm x 1200 mm
6.	1200 mm x 1600 mm
7.	400 mm x 1600 mm
8.	600 mm x 1600 mm

Deviations will be ordered according to the project by the quality planner.

Design specification for gauges

5 Gauge body and construction

5.1 Basics

The gauge body and construction has to be set up in aluminium (material AlMg4,5Mn) or plastic – block material in a *shore* D hardness of minimum 80 (e. g. Cibatool BM 5112 grey or Cibatool BM 5166 ivory) according to the project requirements.

Neither a component (e. g. clamp, slider, pin) nor the tested part itself may protrude the base plate due to its dimensions.

All checking pins, bushings, platings and clamps have to be marked in ascending order, that means:

- Platings and clamps: A1, A2,....,
- Locating pins & bushings: Z1, Z2,....,
- Checking pins & bushings: P1, P2,.... .

Additionally, locating pins and Zero contact surfaces have to be marked with yellow colour.

If generously tolerated holes or windows have only to be checked for “presence”, that has to be made by pins that are fixed in the gauge body and protrude the part by minimum 3 mm, that means if the hole or window is missing the part cannot be checked. These pins have to be tightly and exchangeable. Should that not be possible due to reasons of construction or handling an alternative has to be found together with the quality planner.

5.2 Dial Gauges

If dial gauges are needed for testing one or more criteria, preferably the following models should be used:

- Dial gauge analogue
Measuring range 0-3 mm, clamping shank- \varnothing 8 mm h6,
Body- \varnothing 40 mm
- Dial gauge analogue
Measuring range 0-5 mm, clamping shank- \varnothing 8 mm h6,
Body- \varnothing 40 mm

Design specification for gauges

- Dial gauge analogue
Measuring range 0-10 mm, clamping shank- \varnothing 8 mm h6,
Body- \varnothing 58 mm
- Dial gauge digital, with Mitutoyo Digimatic Interface
Measuring range 0-12,5 mm, clamping shank- \varnothing 8 mm h6,
Body- \varnothing 58 mm

The quality planner determines the character of the model (analogue or digital) according to the project.

Upon adjustment of the dial gauge it has to be taken into account that the measuring result can be clearly read off.

Furthermore, the supplier has to provide certificates of calibration for all concerned measuring devices.

On each measuring position at a gauge the requirements mentioned in the Ford/GM/Chrysler directive "Measurement System Analysis", third edition, March 2002, have to be fulfilled concerning the measurement system capability type one and two. The values for repeatability, reproducibility, variation of measurement system and variation of measured parts should not exceed 0,1 if possible, maximum, however, should be 0,3.

Therefore, it is absolutely necessary to pay attention to a stable construction while designing the gauge and to minimise the clearance, e.g. at fits and guidances.

Generally, KIRCHHOFF Automotive will check the measurement system capability of the gauges in the initial gauge approval process.

5.3 Arrangement / Clamping

Generally, two locating pins will be used to align the part tested. One of them has to be carried out as a "tapered pin", the other one as a "sword-like pin".

Preferably, these pins should be carried out springy. The swordlike pin has to be assured against torsion. On the narrow side of the swordlike pin the positional tolerance has to be included. Spring and clamping forces have to be coordinated according to the construction of retaining and test part.

Design specification for gauges

When designing guide bushing and the related pin, each size of checking pins has to be associated with the bushing diameter accordingly. Thereby mix-up and confusions of the checking pins or positions should be eliminated.

All checking pins for formed holes as well as square and hexagon holes have to be designed not allowing any rotation of the pin.

All contact surfaces, bushings and pins have to be designed wear-resistant (hardened and ground) and exchangeable.

Positions and sizes of datum surfaces are normally provided by the end customer. However, the size should not be below 10X10 mm or \varnothing 12mm, unless this is condition of the checking part.

The test part has to be fixed with knee-lever clampings on its position. Unless otherwise noted, for each datum surface a separate clamping fixture has to be used. For that, perpendicular clampings should be used which are clamping by pressure upwards/forwards.



Fig. 1: Perpendicular clamping fixture

5.4 Test Criteria

5.4.1 Contour

All contour tests have to be made with 3 mm clearance. For checking the part contour a corresponding maximum/minimum – bended checking pin (no go/go pin) has to be prepared. If while constructing it is established that deviations from the clearance dimension are necessary, the concerned quality planner has to be informed. He will decide to which extend the deviation can be accepted respectively will work out a suitable technical solution together with the gauge supplier.

Design specification for gauges



Fig. 2: Maximum/Minimum- checking pin

5.4.2 Trimming

Trimming has always to be designed on nominal size. For checking an EM of minimum 20 mm, 90 degrees to the part geometry, has to be worked out.

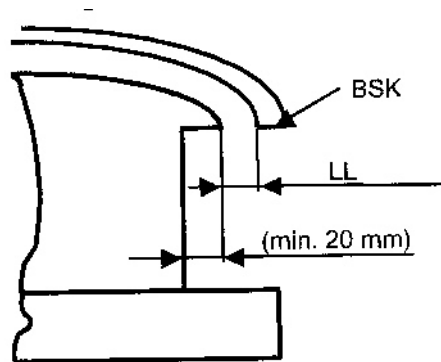


FIG. 3: Trimming inspection

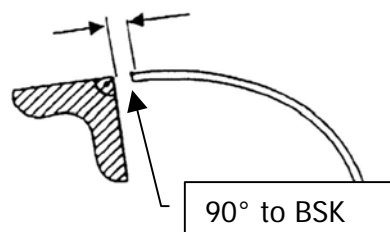
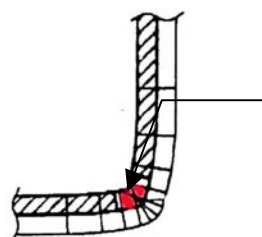
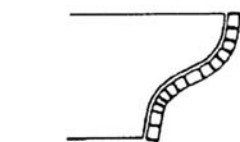


Fig. 4:
EM-Surface 90° to the trimmed edge



In case of overlaps,
concerning areas are
to be uncovered

Fig. 5:
Overlaps

Design specification for gauges

5.4.3 Test Positions

- Checking Pins (holes) have to be produced following the principle: „Minimum hole diameter minus positional tolerance“. Only cords may be used for fixing the checking pins at the base plate of the gauge. A suitable deposition for the pins has to be provided by the use of a plastic or aluminium block with drillings incorporated.
- The locating or checking pins have to be stored in a way that the handling is not affected. The deposition places have to be marked according to the corresponding pins. Checking pins & bushings: P1, P2 (see chapter 5.1)
- For checking of nuts preferably pins with two diameters (first: checking of nuts, second: checking of holes) should be used. For the checking of nuts the following is imperative: „Core diameter of the nut minus positional tolerance“.
- Bolts or screws have to be checked by corresponding bushings; for the checking diameter of the bushing the following is imperative: “Nominal diameter of the screw or maximum dimension of the bolt plus extent of position tolerance”.



Fig. 6: Deposition for checking pins

5.4.4 Hole Diameters

For hole diameters with a tolerance range less than 0,3 mm limit plug gauge with go / no go – dimension have to be provided. Minimum and maximum dimensions as well as KA no. (without suffix) have to be engraved into the plug gauges.

Design specification for gauges

The specification DIN 7162 has to be obeyed while producing limit plug gauges. This standard provides the necessary oversize on the go side and the tolerances for designing the limit plug gauges depending on the nominal size as well as the tolerance range of the hole.

In case of elongated holes tolerances and oversizes have to be identified separately for the long and small side.

In case of several (elongated) holes with the same dimensions and tolerances on the part to be checked only one limit plug gauge has to be provided accordingly.

For fastening of plug gauges on the gauge body and corresponding marking see chapters 5.1 and 5.4.3.

5.5 Painting

All gauge constructions have to be painted with RAL 5015. Ground plates remain unpainted. Deviations have to be instructed by the quality advance planning.

6 Weight

For all gauges transport grips are to be provided. If the weight of the gauge exceeds 15 kg, additionally to the grips four threaded holes M12 have to be added to enable screwing-in of ring bolts (see UVV). Underside (depending on the gauge size) at least four feet (made of hardened plastic or rubber) have to be fixed.

If required the gauge has to be supplied including a transport cart. This cart will be enquired and ordered separately by the quality planner.

7 Colour Scheme

In order to have an uniform overall picture, the colour scheme in the following chart (page 14) has to be used:

Design specification for gauges

Area:	Colour:	Remark:
Primary colour on constructions up to approx. 25 mm in front of BSK	RAL 5015	Surface
Surfaces not to be tested, exposed	Black	Surface
DATUM 'S, Zero admission, Zero areas	Yellow	clamps, bushings, bolts, billets, tensioned surfaces
Nominal area (outline)	Red	Bore holes or signs
Clearance (3mm – general tolerance)	Green	Bore holes or signs
Clearance (3mm – matching surfaces)	Blue	
Hidden surfaces without layout - on demand	White	Surface
	Grey	Surface
EM – at least 20mm	Red	Bore holes or signs

8 Marking

Marking or labeling of the gauges are to be specified in German and English.

The gauge mark has to be designed as follows:



PRÜFLEHRE /
CHECKING FIXTURE

Kunde /
Customer: _____

Teil-Name /
Part name: _____

Leihennummer /
Gauge number: _____

Sample. Signs will be provided
by EQ

Design specification for gauges

Example:

Customer: *Daimler Chrysler AG*

Part Name: *Halter / Bracket*

Number of test equipment: *(KA- Number without index)*

- The quality planner provides the number of test equipment.
- Furthermore, on the gauge a suitable legend has to be applied in which the used colour codes and abbreviations are explained.
- In addition, a producer sign is allowed, but it must not be including any article specific information.
- All signs may only be screwed.
- All interchangeable parts, loose parts and supplementary gauges are to be marked with the gauge number. Supplementary gauges which represent attachments are also to be given part name and number.
- After acceptance of the gauge at KIRCHHOFF Automotive the gauge sign will be documented by means of a test badge.

Design specification for gauges

9 Scope of Delivery

The gauge has to be supplied carriage paid to good receipt of KIRCHHOFF Kutsch Olpe. The delivery must include the following documents by CD-ROM:

- Provided CAD data by KIRCHHOFF Automotive (all transmitted versions in original format).
- Gauge and part constructions (identical to the gauge status) in catia model, cgm, step, vda or iges format.
- Measurement report including comparison of target and actual, incl. BSK (EM) numerally and graphically in PDF format.
- All other provided tools and documents in original format.
- If required: Gauge and part drawings (identical to the gauge status) in catia model, cgm, step, vda or iges format.
- If required: Operating instructions in German and/or English in MS-Word and Acrobat PDF format.

10 Gauge acceptance

The acceptance of gauges is handled by repeated measurements and measurement system capability studies. The inspection has to be documented by test badge and test certificate. In case the acceptance test should not be possible at KIRCHHOFF Automotive it will be arranged at the manufacturer's place.

Design specification for gauges

11 Acknowledgement of Receipt

KIRCHHOFF AUTOMOTIVE
Kirchhoff Kutsch GmbH
Mr R. Kowalke
Am Eckenbach 10-14

57439 Attendorn

Fax: +49 (0)2722 696-219

We confirm the receipt of the **Design Specification for Gauges** by KIRCHHOFF Automotive, revision status 3.

From now on we will confirm to this design specification in respect of each newly ordered gauge by KIRCHHOFF Automotive.

This specification replaces all previous agreements and requirements.

Company stamp

Date

Authorized signature

Please return that signed acknowledgement within 14 days after receipt of the design specification to KIRCHHOFF Automotive by FAX +49 (0)2722 696-219.