

GSV Guidelines

Quality Criteria for Rental Formwork

Version April 2003

Güteschutzverband Betonschalungen e.V.
(Quality Protection Association for Concrete Formwork)

Table of Contents

1	Preliminary remarks	3
2	Basic principles	3
3	Quality criteria	4
3.1	Crane-dependent/-independent modular frame formwork for walls .	5
3.1.1	Formlining – acceptable and unacceptable features.....	5
3.1.2	Frame area – acceptable and unacceptable features.....	6
3.2	Crane-dependent girder formwork for walls	8
3.2.1	Formlining – acceptable and unacceptable features.....	8
3.2.2	Girder grid	9
3.2.3	Storage and transport of the girder formwork	10
3.3	Crane-dependent girder and modular frame formwork for	
	circular walls.....	11
3.3.1	Formlining – acceptable and unacceptable features.....	11
3.3.2	Girder grid	12
3.3.3	Storage and transport	13
3.4	Adjustable telescopic props.....	14
3.4.1	Cleaning condition.....	14
3.4.2	Damage	15
3.4.3	Repairs	16
3.5	Timber formwork girder, 200 mm high	17
3.5.1	Girder chords	17
3.5.2	Nail holes and additional drill holes	17
3.5.3	Notches	17
3.5.4	Split chords	17
3.5.5	Cutting to length and end protection.....	17
3.5.6	Cleaning condition.....	17
3.5.7	Foreign substances	17
3.5.8	Repairs	17
3.6	Modular slab formwork.....	18
3.6.1	Formlining – acceptable and unacceptable features.....	18
3.6.2	Frame area – permissible and non-permissible features	19
3.7	Standard table forms	21
3.7.1	Formlining – acceptable and unacceptable features.....	21
3.7.2	Timber formwork girder, 200 mm high.....	22
3.8	Column formwork	24
3.8.1	Formlining – permissible and non-permissible features	24
3.8.2	Frame area – permissible and non-permissible features	25
3.8.3	System components	25
3.9	Accessories.....	26
3.9.1	Functional contact areas	26
3.9.2	Other function areas of the accessories	26
4	Concluding remarks	27

Guidelines

“Quality Criteria for Rental Formwork“

(Version April 2003)

1 Preliminary remarks

Formwork rental has become the most important area of business for formwork manufacturers and is also of great significance for those companies involved in both selling and renting construction equipment. They possess the appropriate levels of rental stock which are offered and utilised in the construction sector.

In its “Rental Formwork” instructional booklet (June 1999), the Quality Protection Association for Concrete Formwork (GSV) defined the issue as well as that of the scope of services between the hirer and rental company. Likewise, general quality criteria for rental formwork were described, whose specifications are put forward in these guidelines.

The “Quality Criteria for Rental Formwork“ guidelines have defined the various features of rental formwork that must be maintained for deliveries of rental materials and, for return deliveries, serve as the material assessment factor. They replace the corresponding GSV guidelines of January 2000.

If there is no supplementary agreement between the hirer and rental company, general terms and conditions of business apply as well as the general rental and delivery terms of the rental company.

2 Basic principles

The GSV “Rental Formwork“ instructional booklet (June 1999) defines rental formwork as a used piece of equipment. Therefore, changes to the characteristics of the rental formwork are permissible due to wear. The rental formwork itself must be in clean state as well as technically perfect and in a functional condition. It is inspected at the rental depot in accordance with these GSV guidelines and, if necessary, supplemented according to conditions laid down by the rental company. In cases of any deviation from

the required condition, measures deemed appropriate by the rental company are taken and charged accordingly.

Repairs are carried out by the rental company.

The limit values of the characteristic changes are subsequently listed and documented in part with the help of photographs. The given values accommodate the changes in characteristics which correspond to correct and professional use on the construction site as well as fulfilling all customary requirements regarding the quality of the concrete surface. Damage which is due to inappropriate handling, for example through external force, is not taken into consideration. This is not permissible.

It is recommended that an agreement on purchase conditions be reached in advance between the hirer and rental company for any losses or for irreparably damaged rental materials

3 Quality criteria

These items are part of the following list of criteria:

- Clause 3.1: crane-dependent/-independent steel and aluminium
Modular frame formwork for walls
- Clause 3.2: crane-dependent girder wall formwork
- Clause 3.3: crane-dependent girder and modular frame
formwork for circular walls
- Clause 3.4: adjustable telescopic props
- Clause 3.5: timber girders
- Clause 3.6: modular slab formwork
- Clause 3.7: standard table forms
- Clause 3.8: column formwork
- Clause 3.9: accessories

3.1 Crane-dependent/-independent modular frame formwork for walls

3.1.1 Formlining – acceptable and unacceptable features

3.1.1.1 Cleaning condition

Required cleaning condition: used, free of concrete surplus, laitance is permissible



Photo 1: Example of a required cleaning condition

3.1.1.2 Mounting of formlining

The formlining must be tightly fitted in the frame. All gaps between the frame and the formlining must be completely closed.

3.1.1.3 Swelling

Formlining projection on the longitudinal and lateral sides of the frame is permissible up to 1 mm.

3.1.1.4 Additional drill holes

Additional drill holes are not permissible.

3.1.1.5 Nail holes

Nail holes are permissible to a limited extent.

3.1.1.6 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 1 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.

3.1.1.7 Foreign substances

Foreign substances, such as nails, are not permissible.

3.1.1.8 Repairs

Only correctly and professionally executed repairs are allowed. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.1.1.9 Rear side of formlining

Laitance, thin layer of concrete surplus, concrete spillage and scratches are allowed.

3.1.2 Frame area – acceptable and unacceptable features

3.1.2.1 Contact areas of the frame

Required cleaning condition: used, free of concrete surplus, laitance is permissible.

3.1.2.2 Other functional areas of the frame

Laitance, thin layer of concrete surplus and concrete spillage are allowed only if the functional efficiency of the formwork element is not impaired.



Photo 2: Example of required cleaning condition of the contact areas

3.1.2.3 Anchor sleeves, frame sleeves

Anchor sleeves and frame sleeves must be free of concrete.

3.1.2.4 Holes

Holes are not permissible.

3.1.2.5 Cracks

Cracks are not permissible.

3.1.2.6 Repairs

Correctly and professionally executed repairs on the frame are allowed.
Repairs are to be carried out only by the rental company.

3.2 Crane-dependent girder formwork for walls

This comprises crane-dependent, ready-for-use and flat girder formwork with a girder grid consisting of from timber formwork girders and steel waling. As formlining, 3-ply sheeting or veneer plywood is predominantly used.

3.2.1 Formlining – acceptable and unacceptable features

3.2.1.1 Cleaning condition

Required cleaning condition: used, front side and edges must be free of concrete surplus, laitance is permissible.

3.2.1.2 Mounting of formlining

The formlining must be firmly mounted to the formwork girders.

3.2.1.3 Additional drill holes

Additional drill holes are not permissible.

3.2.1.4 Nail holes

Nail holes are permissible to a limited extent.

3.2.1.5 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 2 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.



Photo 3: Permissible surface scratching

3.2.1.6 Repairs

Only correctly and professionally executed repairs are allowed. The maximum permissible number and the arrangement of repair positions conform to guidelines laid down by the respective rental company. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.2.1.7 Damage to the rear side of the formwork panel

Formlining damage up to 10 mm long (diagonally) on the rear side is permissible.

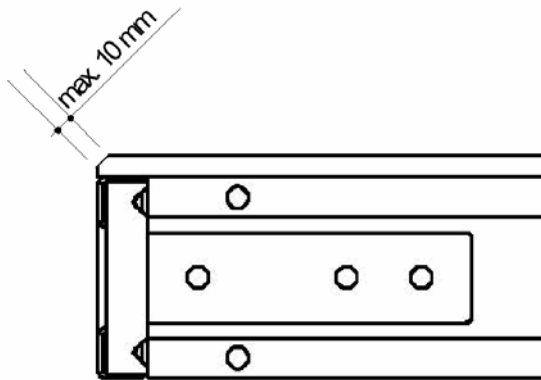


Photo 4: Permissible damage to the formlining

3.2.1.8 Rear side of formlining

Thin layer of concrete surplus, concrete spillage, crusts of concrete and scratches are allowed.

3.2.2 Girder grid

3.2.2.1 Contact areas for extensions

Contact areas must be free of concrete surplus; laitance is permissible.

3.2.2.2 Scope of the extension function

Thin layer of concrete surplus, concrete spillage and crusts of concrete are permissible only if the functional efficiency of the formwork panel and extension panel are not impaired.

3.2.2.3 Timber formwork girder, 200 mm high (see also Clause 3.5)

3.2.2.3.1 Girder chords

Chipped edges, one-sided ≤ 25 mm wide (diagonally) and ≤ 25 cm long are permissible.

3.2.2.3.2 Nail holes and additional drill holes

Nail holes are permissible. Additional drill holes are not permissible.

3.2.2.3.3 Notches

Notches ≤ 2 mm deep are permissible.

3.2.2.4 Steel waling

Concrete spillage and crusts of concrete are permissible. Changes to system components, e.g. welding on of additional parts, are not permissible.



Photo 5: Permissible concrete surplus on the steel waling

3.2.3 Storage and transport of the girder formwork

For girder formwork, correct logistical procedures play a decisive role in preventing damage during storage and transportation.

Among other things, the use of suitable timbers when stacking the panels is required to prevent damage to the formlining by the steel waling. In addition, the formlining edges must be protected by suitable means when bundling.

3.3 Crane-dependent girder and modular frame formwork for circular walls

This comprises crane-dependent, ready-for-use, radius-adjustable girders and frame formwork with a girder grid consisting of timber or steel formwork girders and steel waling as well as steel frames. Veneer plywood is predominantly used as formlining.

3.3.1 Formlining – acceptable and unacceptable features

3.3.1.1 Cleaning condition

Required cleaning condition: used, front side and edges must be free of concrete surplus, laitance is permissible

3.3.1.2 Mounting of formlining

The formlining must be firmly mounted to the formwork girders.

3.3.1.3 Additional drill holes

Additional drill holes are not permissible.

3.3.1.4 Nail holes

Nail holes are permissible to a limited extent.

3.3.1.5 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 1 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.

3.3.1.6 Foreign substances

Foreign substances, such as nails, are not permissible.

3.3.1.7 Repairs

Only correctly and professionally executed repairs are allowed. The maximum permissible number and the arrangement of repair positions conform to guidelines laid down by the respective rental company. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.3.1.8 Damage to the rear side of the formwork panel

Formlining damage up to 5 mm long (diagonally) on the rear side is permissible.

3.3.1.9 Rear side of formlining

Thin layer of concrete surplus, concrete spillage, crusts of concrete and scratches are allowed.

3.3.2 Girder grid

3.3.2.1 Contact areas for extensions

Contact areas must be free of concrete surplus; laitance is permissible.

3.3.2.2 Extension function

Thin layer of concrete surplus, concrete spillage and crusts of concrete are permissible only if the functional efficiency of the formwork panel and extension panel are not impaired.

3.3.2.3 Timber formwork girder, 200 mm high

3.3.2.3.1 Girder chords

Chipped edges, one-sided ≤ 25 mm wide (diagonally) and ≤ 25 cm long are permissible.

3.3.2.3.2 Nail holes and additional drill holes

Nail holes are permissible. Additional drill holes are not permissible.

3.3.2.3.3 Notches

Notches ≤ 2 mm deep are permissible.

3.3.2.4 Steel formwork girders

- Additional drill holes
Additional drill holes are not permissible.
- Changes to the girders
- Changes to the girders, e.g. welding on of additional components, removal of girder parts, notches in the girder itself and hammering out dents, are not permissible

3.3.2.5 Steel waling

Concrete spillage and crusts of concrete are permissible. Changes to system components, e.g. welding on of additional parts, are not permissible.

3.3.2.6 Spindling for radii adjustment

Spindle threads must be free of any concrete surplus. Laitance is permissible only if the functional efficiency is not impaired.

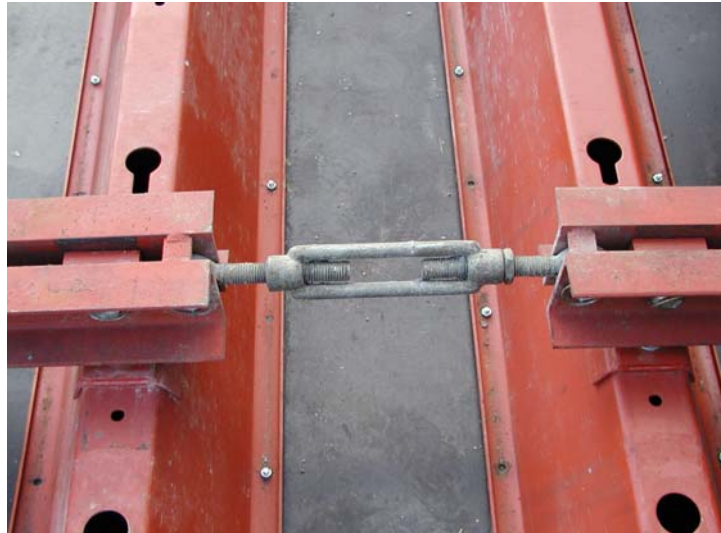


Photo 6: Example of a spindle in usable condition

3.3.3 Storage and transport

For girder formwork, correct logistical procedures play a decisive role in preventing damage during storage and transportation.

Among other things, the use of suitable timbers when stacking the panels is required to prevent damage to the formlining by the steel waling.



Photo 7: Use of timbers for stacking formwork panels

3.4 Adjustable telescopic props

Comprises of approved props with outer tube and extension tube (inner tube) for adjustable telescopic extensions. Materials: steel and aluminium.

3.4.1 Cleaning condition

3.4.1.1 Outer tube

The outer tube must be free of larger lumps of concrete surplus and other dirt accumulation. Laitance, concrete spillage and single clumps of fine concrete surplus are permissible



Photo 8: Used props, required cleaning condition

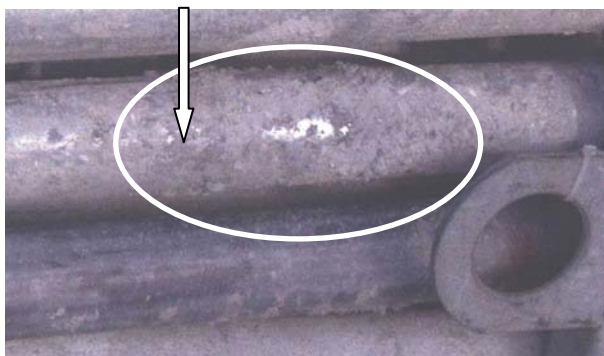


Photo 9: Impermissible large crusts of concrete and dent on outer tube

3.4.1.2 Extension tube (inner tube)

The extension tube must be completely free of any concrete surplus.

3.4.1.3 Thread

The thread of the adjustment device must be free of concrete surplus. Laitance is permissible only if the functional efficiency is not impaired.

3.4.1.4 Head and base plates

The head and base plates must be free of concrete surplus. Safe erection of the prop must be guaranteed. Concrete film and laitance are permissible.

Holes in the head and base plates must be free of any concrete surplus so that correct attaching of accessories can be carried out.

3.4.2 Damage

3.4.2.1 Cracks

Cracks on components and welds are not permissible.

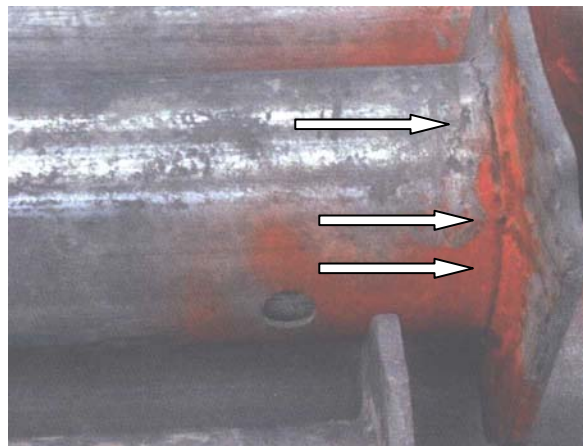


Photo 10: Impermissible crack in a weld

3.4.2.2 Deformation

Deformation of the base and head plates are permissible up to 1 mm outwards and 3 mm inwards. Manufacturer specifications must be observed at all times. Dents and bumps are acceptable as long as the extent and number do not affect the functionality. The extension tube must be manually extendable over its entire length. The load-carrying capacity of the prop must not be impaired.

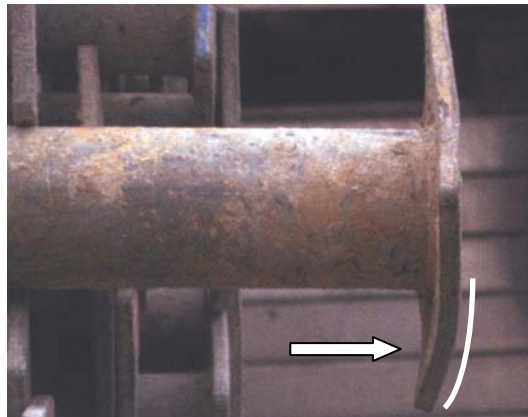


Photo 11: Unacceptable deformation of the base plate

3.4.2.3 Positioning holes

The bolt holes of the prop must be free of concrete surplus. Additional drill holes are not permissible. Only original parts of the respective manufacturer are to be used. A combination of parts from different manufacturers is not permissible.

3.4.3 Repairs

Only correctly and professionally executed repairs are allowed. Repairs are to be carried out only by the rental company.

3.5 Timber formwork girder, 200 mm high

Comprises industrially manufactured formwork girders made of timber

3.5.1 Girder chords

Chipped edges, one-sided ≤ 25 mm wide (diagonally) and ≤ 25 cm long are permissible.



Photo 12: Permissible chipped edges

3.5.2 Nail holes and additional drill holes

Nail holes are permissible. Additional drill holes are not permissible.

3.5.3 Notches

Notches ≤ 2 mm deep are permissible.

3.5.4 Split chords

Split chords are not permissible.

3.5.5 Cutting to length and end protection

Cutting to length of girders is not permissible and the product-specific end protection must be intact.

3.5.6 Cleaning condition

Required cleaning condition: used, free of concrete surplus, laitance is permissible

3.5.7 Foreign substances

Foreign substances are not permissible.

3.5.8 Repairs

Repairs to girders are not permissible.

3.6 Modular slab formwork

Comprises crane-independent modular slab formwork panels. The panels usually consist of an aluminium frame with fitted formlining.

3.6.1 Formlining – acceptable and unacceptable features

3.6.1.1 Cleaning condition

Required cleaning condition: used, free of concrete surplus, laitance is permissible



Photo 13: Permissible cleaning condition of the formlining

3.6.1.2 Mounting of formlining

The formlining must be tightly fitted in the frame. All gaps between the frame and the formlining must be completely closed.

3.6.1.3 Swelling

Formlining projection on the longitudinal and lateral sides is permissible up to 1 mm.

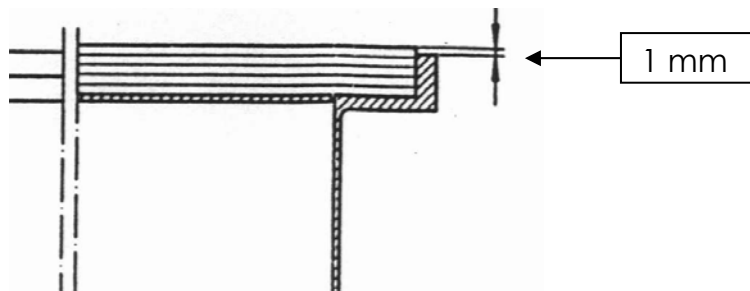


Photo 14: Formlining projections of up to 1 mm are permissible

3.6.1.4 Additional drill holes

Additional drill holes are not permissible.

3.6.1.5 Nail holes

Nail holes are permissible to a limited extent.

3.6.1.6 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 1 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.



Photo 15: Non-permissible scratches in the formlining (depth > 1 mm)

3.6.1.7 Foreign substances

Foreign substances, such as nails, are not permissible.

3.6.1.8 Rear side of formlining

Laitance, thin layer of concrete surplus, concrete spillage, and scratches are allowed.

3.6.1.9 Repairs

Only correctly and professionally executed repairs are allowed. The maximum permissible number and the arrangement of repair positions conform to guidelines laid down by the respective rental company. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.6.2 Frame area – permissible and non-permissible features

3.6.2.1 Contact areas of the frame

Required cleaning condition: free of concrete surplus, laitance is permissible

3.6.2.2 Other functional areas of the frame

Laitance, thin layer of concrete surplus and concrete spillage are allowed only if the functional efficiency of the formwork panel is not impaired.

3.6.2.3 Damage to frame profile

Damage affecting the mechanical functionality is not permissible.



Photo 16: Non-permissible damage to the frame profile

3.6.2.4 Drill holes

Additional drill holes and holes in frame are not permissible.

3.6.2.5 Cracks

Cracks in the frame are not permissible.

3.6.2.6 Repairs

Only correctly and professionally executed repairs are allowed. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.7 Standard table forms

Comprises crane-dependent table forms consisting of:

- formlining
- girder grid
- system components for attaching props
- accessories

In principle, changes to the table form construction are not permissible.

3.7.1 Formlining – acceptable and unacceptable features

3.7.1.1 Cleaning condition

Required cleaning condition: used, free of concrete surplus and other dirt accumulation e.g. inappropriate use of release agent. Laitance is permissible.



Photo 17: Permissible cleaning condition

3.7.1.2 Mounting of formlining

The formlining must be firmly attached to the girder grid.

3.7.1.3 Fixing means

Fixing means (screws, nails, clips) may protrude from the formlining by up to 1 mm in order to compensate for any swelling to the formlining as well as to prevent the formation of lumps (impressions) on the concrete surface.

3.7.1.4 Formlining joints

Gaps between the formlining sheets within one slab table, which are a result of swelling and shrinkage, are permissible. Additional sealing of the joints through inserts or similar is, according to standards, not required.

3.7.1.5 Projection walers

Projection walers between adjacent formlining sheets from different swelling intensity of the sheeting at the edges (different age, dampness intensity, manufacturing tolerance) as well as on nail and screw fixings and repaired areas, are permissible.

3.7.1.6 Screw and nail holes

Screw and nail holes are permissible to a limited extent.

3.7.1.7 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 1 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.

3.7.1.8 Edge damage

Edge damage on table edges with lengths of 50 mm and 5 mm depth are permissible.

3.7.1.9 Repairs

Only correctly and professionally executed repairs to the top layer of the formlining are allowed.

3.7.1.10 Rear side of the formlining

Thin layer of concrete surplus, concrete spillage, surface scratches and correctly closed holes on the concreting side are permissible.

3.7.2 Timber formwork girder, 200 mm high

3.7.2.1 Girder chords

Chipped edges, one-sided ≤ 25 mm wide (diagonally) and ≤ 25 cm long are permissible.

3.7.2.2 Nail holes and additional drill holes

Nail holes are permissible. Additional drill holes are not permissible.

3.7.2.3 Notches

Notches ≤ 2 mm deep are permissible.

3.7.2.4 Shore post connection elements

Changes to the position of the prop connectors is not permissible. Any deformation which affects the functional efficiency is not permissible.

3.8 Column formwork

Comprises crane-dependent and crane-independent circular column formwork made of steel or aluminium, and equipped with steel or aluminium formlining as well as rectangular column formwork made of steel or aluminium equipped with laminated plywood, steel or plastic formlining. For rectangular column formwork without formlining, which allows the contractors a free choice, the criteria for frames and accessories apply. For rectangular column formwork, which is assembled from modular frame panels, quality criteria according to Clause 3.1 apply.

3.8.1 Formlining – permissible and non-permissible features

3.8.1.1 Cleaning condition

Required cleaning condition: used, free of concrete surplus and other dirt accumulation, laitance is permissible.

3.8.1.2 Mounting of formlining

The formlining must be firmly attached to the sub-structure.

3.8.1.3 Nail holes

Nail holes are permissible to a limited extent on wood and plastic formlining.

3.8.1.4 Drill holes and dents

For metal formlining, all types of perforation and dents are not permissible.

3.8.1.5 Surface damage

Scratches and laminar damage, e.g. effects of internal vibrator, are permissible to a limited extent up to 1 mm deep. Sawing cuts are not permissible. Rental company specifications must be observed at all times.

3.8.1.6 Repairs

Only correctly and professionally executed repairs are allowed. The maximum permissible number and the arrangement of repair positions conform to guidelines laid down by the respective rental company. They are to be evaluated according to specifications laid down by the rental company. Repairs are to be carried out only by the rental company.

3.8.1.7 Rear side of formlining

Thin layer of concrete surplus, concrete spillage and scratches are permissible.

3.8.1.8 Foreign substances

Foreign substances, such as nails, are not permissible.

3.8.2 Frame area – permissible and non-permissible features

3.8.2.1 Contact areas of the frame

Required cleaning condition: free of concrete surplus, laitance is permissible

3.8.2.2 Other function areas of the frame

Laitance, thin layer of concrete surplus and concrete spillage are allowed only if the functional efficiency of the formwork panel is not impaired.

3.8.3 System components

Changes to system components, e.g. welding on of additional parts, is not permissible.

3.9 Accessories

3.9.1 Functional contact areas

Required cleaning condition: used, free of concrete surplus, laitance is permissible

3.9.2 Other function areas of the accessories

Laitance, thin layer of concrete surplus and concrete spillage are allowed only if the functional efficiency of the accessories is not impaired.

4 Concluding remarks

These guidelines define the quality criteria of rental formworks for hirers and rental companies, and thus provide further transparency regarding the application of modern formwork technology. The basis is formed through the GSV "Rental Formwork" instructional booklet (June 1999 version) which contains the following items:

- definition of rental formwork
- sub-process: delivery and return of rental formwork, handling on the construction site as well as repairs and cleaning before return
- price structure for rental formwork: rental, one-off expenditure, additional services (special services).

Editors: Güteschutzverband Betonschalungen e.V.
P.O. Box 10 41 60
40852 Ratingen
Germany
Internet: www.gsv-betonschalungen.de

Publisher: Self-published

© 2003 Güteschutzverband Betonschalungen e.V.