Ringscaff

- Product Manual for Canada -

The prefabricated access and working scaffold
1. Preface

The Scafom Ringscaff scaffold system is a modular scaffold system that combines the speed of erection of a system scaffold with the flexibility of traditional systems. The Ringscaff system consists of modular components as vertical standards, horizontal ledgers and transoms and vertical diagonals that can be connected to a fixed rosette in various positions. All modular components are developed and proofed according to the European standards EN12810 / 12811.

This manual is made for the people who build and work with the Ringscaff system. It helps them to erect standard, basic scaffold structures safely and efficiently. For non standard use or more complex structures, please consult your technical services department, or contact your supplier for further advice.

Furthermore, the components are described, including the way to be used and their safe working loads. This manual gives guidance for facade scaffolds with nominal width of 0,65m (2 steel boards) and 1,15m (4 steel boards).

Note:

Erection, changing and dismantling of the Ringscaff scaffold system should only be carried out by or under the supervision of a competent person who is familiar with the system.

Damaged components should not be used to erect a scaffold. The condition of the parts can be checked visually during erection of the scaffold. If parts look worn or are damaged they should not be used, but sent back to your branch depot for repair.

Information given in this document is specific to equipment of the “Ringscaff 2005”, modular scaffold system, production started from 2005.

The loads that are mentioned in this manual are based on the “Ringscaff 2005” system. For loads concerning the former produced “Ringscaff 2000” system, see also Appendix II: German Technical Approval.
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3. **Assembly of the modular connection**

The connection of the various Ringscaff components exists of a special shaped rosette, which is welded every 0.50 m on the vertical standards, in combination with a wedge-holding ledger-end.

The flat rosette has four narrow holes and four large holes, see figure 3.1.

![Figure 3.1: Ringscaff rosette](image)

The four narrow holes position the ledgers automatically and securely at right angles after the wedge is secured.

The four large holes permit the alignment of ledgers and diagonal braces at the required angle, see figure 3.2.

![Figure 3.2: Plan view Ringscaff node](image)
The connection is made by (see figures 3.3)

a) sliding the wedge-holding ledger-end over the flat rosette....

b) insert the wedge into one of the holes....

c) and secure the wedge with a hammer blow.

The connection has been changed into a force transmitting rigid connection, that can take loads immediately, see figure 3.4.

Figure 3.3 a     Figure 3.3 b     Figure 3.3 c

Figure 3.4: Fixed node-point
4. **Components used in the Ringscaff system**

An example of a Ringscaff working scaffold is shown in figure 4.1.

![Figure 4.1: Example of scaffold construction](image)

This construction exists of the following basic components:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>01</strong></td>
<td><em>Adjustable base jack</em></td>
</tr>
</tbody>
</table>

The adjustable base jack is used for leveling the scaffold-standards at the same height.
02 Base collar

The base collar with a single rosette, is placed over the base jack and enables an easy base out of the scaffold.

03 Vertical standard

The vertical standard bears the loads from the scaffold down to the earth.
The standard tube 48.3mm has rosettes at 0.5 m interval, a pressed spigot at the top and drilled holes at both ends.
The lengths vary from 0.5m up to 4.0m.

04 Ledger / transom

The ledger exists of 48.3mm dia tube and wedge-holding ledger-ends at both ends.
The ledger is used in different lengths as support for steel decks or wooden scaffold boards or as structural element. The ledger is also used as guard rail or knee rail.

05 Vertical brace

The vertical brace exists of a 48.3mm dia tube with wedge connections at both ends.
The vertical brace increases the stiffness of the scaffold construction.
06 Intermediate transom

The intermediate transom shortens the free space within a scaffold bay that can be decked with wooden scaffold boards. The position of the transom is fixed by a wedge.

07 Side bracket

The side bracket can be used to expand the working platform with one or two steel decks.

08 Toe board

The toeboards are mounted on every working platform and they prevent material to be falling down from the working platform.

09 WA Steel board

The steel deck is used to create platforms. The decks are made out of light-weight steel sheet with a non-skid surface. The steel decks are placed on the transoms.

10 Anchor

To create a stable construction, the facade scaffold needs to be anchored. Together with a connection eye on the building and couplers on the vertical, the anchors connect the scaffold with the building and take away the horizontal loads from the scaffold to the building.

11 Coupler

Couplers are used to connect two scaffolding tubes (diam 48.3mm). (for example connecting the anchor to the vertical)
For a complete list of all available Ringscaff components, including product numbers and weights, see appendix I and the Ringscaff Price list.
5. **Load capacity of Ringscaff components**

The strength, stiffness and stability of the scaffold construction is defined by the rigidity of the Ringscaff node point and the load bearing capacity of the several Ringscaff components.

In this chapter is set out the rigidity of the node point as well as the load-capacity of load bearing components like the Ringscaff base jack, standards, ledgers, diagonals and steel decks. These loads are based on the “Ringscaff 2005-system”.

All the mentioned loads are “Safe working loads” or “permissible loads”. These loads are defined as the ultimate design load divided by the prescribed load factor (1.5). For the values of the ultimate design loads and for the control calculations of the node-point, see appendix II: German Technical Approval Z-8.22-869.

5.1 **Ringscaff node point (permissible loads)**

**Bending moment on connection:**

\[ \text{My} = V \times a \]

\[ \text{max My} = +/- 73.3 \text{ kNcm} \]

**Normal force on connection:**

\[ \text{max N} = +/- 25.7 \text{ kN} \]
Vertical load on rosette: \( \text{max } V_z = +/- \ 20.5 \text{ kN} \)

Horizontal load on rosette: \( \text{max } V_y = +/- \ 10.6 \text{ kN} \)
5.2 Ringscaff base jack

<table>
<thead>
<tr>
<th>Extension “H” (mm)</th>
<th>Max. Concentric Load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>62</td>
</tr>
<tr>
<td>300</td>
<td>55</td>
</tr>
<tr>
<td>450</td>
<td>52.5</td>
</tr>
</tbody>
</table>

**Permissible concentric Load for base jack**
(no horizontal load)

Note:
The above mentioned load capacities for the base jack are indicating values. The load capacity for the base jack must be calculated in relation to the actual forces on the complete scaffold construction.
5.3 Ringscaff standards

<table>
<thead>
<tr>
<th>Permissible centric vertical Load for standards</th>
<th>2m brace spacing</th>
<th>1,5m brace spacing</th>
<th>2,5m bracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>28,1 kN</td>
<td>42,2 kN</td>
<td>19,3 kN</td>
<td></td>
</tr>
</tbody>
</table>

Note:
The above mentioned load capacities for standards are indicating values. The vertical load capacity for standards depends on several other factors as:

- Lift height of the platforms
- Influence of horizontal loads
- Bracing and anchoring pattern of the scaffold.

For estimating the exact load capacity of standards, contact your design engineer.

Standards are made with pressed spigot. These standards are not to be used for suspension-constructions! For suspension-standards, see appendix 1.
5.4 Ringscaff ledgers

**Load bearing capacity of Ledgers**

<table>
<thead>
<tr>
<th>Bay length (m)</th>
<th>0.65</th>
<th>1.15</th>
<th>1.57</th>
<th>2.13</th>
<th>3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Uniformly distr. load (kN/m)</td>
<td>27.4</td>
<td>9.4</td>
<td>5.4</td>
<td>3.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Max. Point load in the middle (kN)</td>
<td>8.8</td>
<td>5.2</td>
<td>4.0</td>
<td>3.1</td>
<td>2.3</td>
</tr>
</tbody>
</table>

**Load bearing capacity of Double Ledgers**

<table>
<thead>
<tr>
<th>Bay length (m)</th>
<th>1.57</th>
<th>2.13</th>
<th>3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Uniformly distr. load (kN/m)</td>
<td>17.5</td>
<td>12.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Max. Point load in the middle (kN)</td>
<td>13.9</td>
<td>11.5</td>
<td>7.4</td>
</tr>
</tbody>
</table>
5.5 Ringscaff diagonals

\[ \text{Load bearing capacity of Vertical brace} \]
\[ (2.0\text{m lift}) \]

<table>
<thead>
<tr>
<th>Bay length (m)</th>
<th>1.15</th>
<th>1.57</th>
<th>2.13</th>
<th>3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Compression load (kN)</td>
<td>-10.1</td>
<td>-9.9</td>
<td>-7.8</td>
<td>-5.7</td>
</tr>
<tr>
<td>Max. Tension load (kN)</td>
<td>+13.0</td>
<td>+13.0</td>
<td>+13.0</td>
<td>+13.0</td>
</tr>
</tbody>
</table>

5.6 Ringscaff WA steel decks

\[ \text{Load bearing capacity of WA-Steel decks width = 0,24m} \]

<table>
<thead>
<tr>
<th>Bay length (m)</th>
<th>0.65</th>
<th>1.15</th>
<th>1.57</th>
<th>2.13</th>
<th>3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Concentrated load (kN)</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
<td>1.14</td>
</tr>
<tr>
<td>Max. Platform load (kN/m²)</td>
<td>4.89</td>
<td>4.89</td>
<td>4.89</td>
<td>4.89</td>
<td>2.45</td>
</tr>
</tbody>
</table>
5.7 Ringscaff side brackets

Ringscaff side brackets have been designed to have a load capacity of 1,5 kN/m² on the extended platform.

<table>
<thead>
<tr>
<th>Load bearing capacity of Side brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Max. q-load (kN/m)</td>
</tr>
<tr>
<td>Side bracket 0,65m (2 planks)</td>
</tr>
<tr>
<td>Side bracket 0,99m (3 planks)</td>
</tr>
</tbody>
</table>

5.8 Ringscaff lattice girders

<table>
<thead>
<tr>
<th>Load bearing capacity of Lattice girders</th>
</tr>
</thead>
<tbody>
<tr>
<td>(bracing of top-girder every 1,1m)</td>
</tr>
<tr>
<td>Length (m)</td>
</tr>
<tr>
<td>4,27 (14’)</td>
</tr>
<tr>
<td>Max. Point load in the middle (kN)</td>
</tr>
<tr>
<td>28,0</td>
</tr>
<tr>
<td>Max. Uniformly distr. load (kN/m)</td>
</tr>
<tr>
<td>6,58</td>
</tr>
</tbody>
</table>
6. **Assembly of working platforms**

Working platforms exist of a platform, created by steel decks or wooden boards, in combination with a side protection. This side protection exists of two guard rails and a toeboard!

![Figure 6.1: Side protection](image)

In this chapter is explained the way of creating working platforms with the standard Ringscaff steel decks.

The load bearing capacity of a platform depends on how the load will be transferred from the platform via the ledgers to the standards.

**Working platforms with steel decks**

The Ringscaff WA steel decks have a non-skid surface and are fitted with claws on the ledgers. The decks are provided with an anti-lift device at both ends which has to be put in place during assembly. The anti lift device prevents the steel deck from lifting up by accident or by the effects of wind load. See figure 6.2.

![Figure 6.2: Anti-lift device steel decks](image)
Standard steel decks have a width of 0,24 m. The following arrangements are possible for the several platform widths:

<table>
<thead>
<tr>
<th>Bay width (m)</th>
<th>0,65</th>
<th>1,15</th>
<th>2,13</th>
<th>3,05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr of decks:</td>
<td>2x 0,24</td>
<td>4x 0,24</td>
<td>8x 0,24</td>
<td>12x 0,24</td>
</tr>
</tbody>
</table>

**Figure 6.3:** Arrangement of steel decks
7. **Anchoring and Bracing**

Scaffold constructions in free-standing position are not stabil and therefore need always to be anchored to a stabil facade.

In principal a scaffold is, due to the connection of loose components, a “weak” system. To create a strong and stabil construction, the scaffold must therefore be stabilised by some specific extra components.

The stabilisation of facade scaffolds must be created in all the 4 following different sections:

- a) Stabilisation of the sections perpendicular to the facade
- b) Stabilisation of the inner section, parallel to the facade
- c) Stabilisation of the outer section, parallel to the facade
- d) Stabilisation of the horizontal sections of the scaffold

![Figure 7.1: Sections of facade scaffold](image)

For stabilisation of sections a) and b) there are used **anchors** (or **tie members**) and **V-anchors**, for section c) **vertical braces** and for sections d) **steel decks** or **horizontal braces**.

**Anchoring**

For stabilisation of the scaffold perpendicular to the facade, there are used tie members. The tie members take care of global stability for the scaffold (the scaffold is prevented from turning over) and local stability (the buckling length of the verticals is reduced).

A tie member exists of:

- an anchoring tube with a special hook for fixation on the anchoring tool
- couplers to fix the anchoring tube to the standards of the scaffold
- an anchoring tool to fix the anchoring tube to a stabil and strong façade.

The tie members are mounted with couplers on the inner and outer standard, close (< 0,30m) to the node point of standard and ledgers. (See figure 7.2)
**Figure 7.2**: Example of tie member

**Note**: Be aware that the tie member and the anchoring underground are always able to take up the requested horizontal loads of the scaffold construction. These horizontal loads need to be established by calculating.

**Figure 7.3**: Tie members

The number of tie members needs to be established by calculation or must be according to a standard configuration. The tie members need to be positioned on a regular pattern all over the scaffold. Depending on the required number of tie members we can mainly distinguish 4 different patterns:

- 8 meter pattern and 4 meter on the outside standards, see figure 7.4
- 4 meter pattern or 4 meter staggered pattern
- 2 meter pattern, tie members at every 2 m node point.

**Figure 7.4**: Anchoring pattern
V-anchors

In case that it is not possible to use tie-members that are fixed on both the inner- and outerstandards, for stabilising the inner section parallel to the façade, there can be used tie members that are placed in an angle of about 60 deg, like a V-anchor. V-anchors have to be placed, depending on the imposed horizontal loads parallel to the facade, preferably at least at both ends of the scaffold.

![V-anchors](image)

Figure 7.5: V-anchors

Vertical bracing

For stabilising the outer plane of the scaffold, parallel and perpendicular to the facade there are used vertical braces. Vertical braces are placed in at least every 5th bay on every lift and in every end bay perpendicular to the facade.

![Vertical bracing](image)

Figure 7.6: Vertical bracing
Horizontal bracing

The horizontal sections of the scaffold are stabilised by either steel decks or in case of platforms with wooden boards, by horizontal braces. These horizontal braces need to be placed in at least every 5th bay on every lift.

Figure 7.8: Horizontal bracing in case of wooden platforms
8. **Access to the Ringscaff scaffold**

For access to the Ringscaff scaffold there are two different possible solutions:

1) Access by special aluminium/plywood ladderplatforms

2) Access by aluminium stairways

### 8.2 Access by aluminium/plywood ladderplatforms

By assembling aluminium/plywood platforms with integrated ladder and special access doors, it is possible to get access to higher lifts.

The ladderplatforms are integrated in the working platforms.

The maximum safe working load for the platform is 200 kg/m².

![Figure 8.1: Access to higher lifts with aluminium ladderplatforms](image-url)
8.3 Access by aluminium stairways

Another possibility to get access to the scaffold at higher lifts, is to build a separate stair tower to the scaffold. Therefore the Ringscaff system has two different solutions:

a) Building an extra bay on the outside of the scaffold. The stairs are mounted all in the same direction. You can access each lift of the scaffold, walk around on this lift and go to the following lift by the next stairs.

b) Building an extra wider bay against an access bay in the scaffold. The stairs are mounted in opposite direction and at the end of the stairs you can access the working platforms.
9. **Erection and dismantling of the scaffold**

Before starting to erect a scaffold the following important items have to be considered:

a. Be aware of the function of the scaffold
b. Check all the loads that are imposed on the scaffold construction
c. Be aware of the line up of the scaffold
d. Be convinced that all the loads can be supported by the scaffold construction
e. Be convinced that all the vertical loads of the scaffold can be supported by the ground and that all horizontal loads can be taken over by the anchors and the building
f. Check the position of the scaffold in relation to the surroundings
g. Be aware of all the safety regulations
h. Be aware that the erection people are skilled to build the scaffold construction
i. Be aware that the erection people are completely instructed
j. Check all the tools that are used during erection

k. Check all the materials that are used in the scaffold construction. **No damaged material is allowed to be used in any scaffolding construction!**

**ERECTION PROCEDURE**

9.1 Start the erection by laying the equipment components out in approximate positions.

9.2 Place the base collar on the jack, see figure 9.1

*Figure 9.1*

9.3 Repeat the procedure, placing base jacks in all four corners of the bay and connect using ledgers/transoms. Lock all of the wedges in place by using a hammer, see figure 9.2
Level the base using a spirit level and by adjusting the wing nut on the base jack. It is recommended to use wooden boards under the base-jacks to spread the load.

Insert standards into base jacks, putting 3m standards on the outside and 2m on the inside of the scaffold, see figure 9.3

Start the erection of the first lift by fixing in place the ledgers and transoms; figure 9.4

Note: It may be necessary to place the steel decking on this base level to assist with erection of the first lift.
9.7 Diagonal/face bracing should be fixed to at least every fifth bay from the bottom to the top of the scaffolding or as required by design; see figure 9.5
9.8 Place steel decks at first lift level, see figure 9.6
Note: If using timber scaffold boards, intermediate transoms should be placed along the ledgers.

Figure 9.6

9.9 Ensure all working lifts have a double guardrail and toeboard. Ladders or ladder decks should be installed as erection proceeds to ensure safe access from one lift to another. The next lift should still be decked out from below and a ladder used to access the lift. To proceed with the erection on next lifts, there should be used temporary erection guard rails and/or personnel safety tools like harnesses for safe working on unfinished lifts, see figure 9.6/9.7.

Figure 9.7
9.10 The scaffold should be physically tied in at the first available position, ideally at second lift level. The tie pattern illustrated earlier in this manual should be consulted.

9.11 When the erection has been finished and the scaffold is ready for use, the “scafftag” must show the right instructions for using the scaffold.

**DISMANTLING PROCEDURE**

The safe dismantling of the Ringscaff scaffold system relies upon the following basic operations and controls:

1. All platforms should be cleared of loose materials and the scaffold checked to ensure it is still in a correctly erected condition, e.g., components or ties have not been removed or incorrectly re-fixed. The “scafftag” must show that the scaffold is not safe for use.

2. Remove diagonal braces connected to standards above the level of the top platform.

3. Remove toeboard brackets, toeboards, and guard-rails to the top platform.

4. Remove standards connected above platform level, having first checked that all components previously fixed to them have been removed.

5. Working from a temporary platform below the top platform, remove the steelboards from the top platform.

6. Remove all ledgers and transoms at the top platform level.

7. Working always from a temporary platform not more than 2m below the level from which components are to be removed, progressively dismantle the scaffold in the sequence described above.

8. Remove ties progressively as the scaffold is dismantled. NB: Ties should not be removed until they would prevent further dismantling of the scaffold.

9. Components should be lowered to the ground by passing from hand to hand down the scaffold or by means of an appropriate safe lowering method, such as by hand line, crane, hoist, etc.
APPENDIX I:  RINGSCAFF COMPONENTS

The following components can be used in the modular Ringscaff scaffolding system. For a complete survey including prices, see the Ringscaff pricelist.

Base components

**Adjustable base jack**

The adjustable base jack is used for leveling the scaffold-standards at the same height.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E02RS0005</td>
<td>Ringscaff base jack 0,60m</td>
<td>4,0</td>
</tr>
</tbody>
</table>

**Adjustable base jack, swiveling**

The swivel base jack can be used when standards need to be placed on slopes.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E02RS0008</td>
<td>Ringscaff base jack, swiveling 0,78m</td>
<td>6,3</td>
</tr>
</tbody>
</table>

**Base collar**

The base collar with a single rosette, is placed over the base jack and enables an easy base out of the scaffold.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0002</td>
<td>Ringscaff base collar</td>
<td>1,5</td>
</tr>
</tbody>
</table>
**Vertical standard**

The vertical standard bears the loads from the scaffold down to the earth. The standard has rosettes at 50 cm interval, a pressed spigot on the top and drilled holes at both ends. The lengths vary from 0.5m up to 4.0m.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0005</td>
<td>Ringscaff vertical standard 0,5m</td>
<td>3,5</td>
</tr>
<tr>
<td>E04RS0030</td>
<td>Ringscaff vertical standard 1,0m</td>
<td>6,0</td>
</tr>
<tr>
<td>E04RS0055</td>
<td>Ringscaff vertical standard 1,5m</td>
<td>8,4</td>
</tr>
<tr>
<td>E04RS0071</td>
<td>Ringscaff vertical standard 2,0m</td>
<td>10,8</td>
</tr>
<tr>
<td>E04RS0096</td>
<td>Ringscaff vertical standard 3,0m</td>
<td>15,7</td>
</tr>
<tr>
<td>E04RS0107</td>
<td>Ringscaff vertical standard 4,0m</td>
<td>20,6</td>
</tr>
</tbody>
</table>

**Vertical standard without spigot**

This standard is identical to the vertical standard without the pressed spigot. This enables to place top jacks or other supplementary components. Lengths 0.5m – 4.0m.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0006</td>
<td>Ringscaff vertical standard without spigot 0,5m</td>
<td>2,5</td>
</tr>
<tr>
<td>E04RS0031</td>
<td>Ringscaff vertical standard without spigot 1,0m</td>
<td>5,0</td>
</tr>
<tr>
<td>E04RS0056</td>
<td>Ringscaff vertical standard without spigot 1,5m</td>
<td>7,4</td>
</tr>
<tr>
<td>E04RS0072</td>
<td>Ringscaff vertical standard without spigot 2,0m</td>
<td>9,8</td>
</tr>
<tr>
<td>E04RS0097</td>
<td>Ringscaff vertical standard without spigot 3,0m</td>
<td>14,7</td>
</tr>
<tr>
<td>E04RS0108</td>
<td>Ringscaff vertical standard without spigot 4,0m</td>
<td>19,6</td>
</tr>
</tbody>
</table>

**Vertical standard for suspension**

The suspension standard is identical to the vertical standard, except that the spigot is bolted. Suspension standards are used for suspended scaffolding constructions.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0574</td>
<td>Ringscaff vertical double bolted spigot 1,0m</td>
<td>6,7</td>
</tr>
<tr>
<td>E04RS0575</td>
<td>Ringscaff vertical double bolted spigot 1,5m</td>
<td>9,1</td>
</tr>
<tr>
<td>E04RS0576</td>
<td>Ringscaff vertical double bolted spigot 2,0m</td>
<td>11,5</td>
</tr>
<tr>
<td>E04RS0578</td>
<td>Ringscaff vertical double bolted spigot 3,0m</td>
<td>16,4</td>
</tr>
<tr>
<td>E04RS0579</td>
<td>Ringscaff vertical double bolted spigot 4,0m</td>
<td>21,3</td>
</tr>
</tbody>
</table>
Horizontals

**Ledger**

Ledgers in several lengths are used as supports for decks or wooden boards. Ledgers are also used as guard rail.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0244</td>
<td>Ringscach ledger 0,65m/2'2&quot;</td>
<td>2.2</td>
</tr>
<tr>
<td>E04RS0023</td>
<td>Ringscach ledger 0,91m/3'0&quot;</td>
<td>3.4</td>
</tr>
<tr>
<td>E04RS0480</td>
<td>Ringscach ledger 1,15m/3'10&quot;</td>
<td>4.1</td>
</tr>
<tr>
<td>E04RS0058</td>
<td>Ringscach ledger 1,57m/5'2&quot;</td>
<td>5.9</td>
</tr>
<tr>
<td>E04RS0079</td>
<td>Ringscach ledger 2,13m/7'0&quot;</td>
<td>7.5</td>
</tr>
<tr>
<td>E04RS0105</td>
<td>Ringscach ledger 3,05m/10'0&quot;</td>
<td>10.9</td>
</tr>
</tbody>
</table>

**Double ledger**

Double ledgers, in several lengths, are used to support greater loads in bays of 2,13m and 3,05m.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0367</td>
<td>Ringscach double ledger 2,13m/7&quot;</td>
<td>12.7</td>
</tr>
<tr>
<td>E04RS0366</td>
<td>Ringscach double ledger 3,05m/10'</td>
<td>18.6</td>
</tr>
</tbody>
</table>

**Intermediate ledger**

Intermediate ledgers shorten the free space within a scaffold bay. The bay can partially be decked with steel decks or wooden boards.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0541</td>
<td>Ringscach intermediate transom 0,65m</td>
<td>2.3</td>
</tr>
<tr>
<td>E04RS0542</td>
<td>Ringscach intermediate transom 1,15m</td>
<td>4.5</td>
</tr>
<tr>
<td>E04RS0067</td>
<td>Ringscach intermediate transom 1,57m</td>
<td>6.3</td>
</tr>
<tr>
<td>E04RS0543</td>
<td>Ringscach intermediate transom 2,13m</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Diagonals

**Vertical brace**

Vertical braces increase the vertical stiffness of the scaffold.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0481</td>
<td>Ringscaff vertical brace 1,15m x 2,0m</td>
<td>6.8</td>
</tr>
<tr>
<td>E04RS0065</td>
<td>Rings scaff vertical brace 1,57m x 2,0m</td>
<td>7.2</td>
</tr>
<tr>
<td>E04RS0140</td>
<td>Ringscaff vertical brace 2,13m x 2,0m</td>
<td>8.6</td>
</tr>
<tr>
<td>E04RS0106</td>
<td>Ringscaff vertical brace 3,05m x 2,0m</td>
<td>10</td>
</tr>
</tbody>
</table>

Decks

**WA Steel deck 0,24m**

Steel decks with a width of 0,24m and an integrated anti-lift device create a working platform. The steel decks suit all ledgers with a 48,3mm tube as support

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04WA0008</td>
<td>Ringscaff WA steel deck 1,15m</td>
<td>6.6</td>
</tr>
<tr>
<td>E04WA0009</td>
<td>Ringscaff WA steel deck 1,57m</td>
<td>8.6</td>
</tr>
<tr>
<td>E04WA0011</td>
<td>Ringscaff WA steel deck 2,13m</td>
<td>11.4</td>
</tr>
<tr>
<td>E04WA0012</td>
<td>Ringscaff WA steel deck 3,05m</td>
<td>16.1</td>
</tr>
</tbody>
</table>

Aluminium plywood ladder platform -1m

Ladder platforms create an access in the scaffold.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0465</td>
<td>Ringscaff plywood ladder platform -m</td>
<td>26.4</td>
</tr>
<tr>
<td>E04RS0466</td>
<td>Ringscaff plywood ladder platform -m</td>
<td>29.9</td>
</tr>
</tbody>
</table>
**Supplementary items**

### Side bracket

The side bracket creates an extension of the working platform. For use with two or three WA steel decks.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0246</td>
<td>Ringscaff bracket 0,65m/ 2 boards</td>
<td>6.8</td>
</tr>
<tr>
<td>E04RS0019</td>
<td>Ringscaff bracket 0,99m/ 3 boards</td>
<td>11.9</td>
</tr>
</tbody>
</table>

### System lattice girder

The Ringscaff lattice girders can create openings in the scaffold for bridging purposes.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04RS0163</td>
<td>Ringscaff lattice girder 4,27m/14'</td>
<td>44.4</td>
</tr>
<tr>
<td>E04RS0164</td>
<td>Ringscaff lattice girder 6,39m/21'</td>
<td>65.1</td>
</tr>
<tr>
<td>E04RS0165</td>
<td>Ringscaff lattice girder 8,53m/28'</td>
<td>86.9</td>
</tr>
</tbody>
</table>

### Wedge RA coupler

The wedge RA coupler is used to connect two tubes with diameter 48,3mm in an angle of 90 degrees. The fixation is made by hammering the wedges.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04AA0036</td>
<td>Wedge RA coupler</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### Wedge swivel coupler

The wedge swivel coupler is used to connect two tubes with diameter 48,3mm in a free angle. The fixation is made by hammering the wedges.

<table>
<thead>
<tr>
<th>Product nr</th>
<th>Description</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E04AA0037</td>
<td>Wedge swivel coupler</td>
<td>1.6</td>
</tr>
</tbody>
</table>
APPENDIX II: German Technical Approval (Z-8.22-869)
General construction authority type approval

Type approval no. : Z-8.22-869

Applicant: Scafom International BV
De Kempen 5
6021 PZ BUDEL
THE NETHERLANDS

Type approval for: Modular Scaffolding System “Ringscaff”

Valid until: April 30, 2010

The items approved above are hereby authorised for general construction authority purposes. * This general construction authority type approval consists of 14 Pages and 15 Annexes.

Translation of German original not verified by the Deutsches Institut für Bautechnik.

* This general construction type approval replaces the general construction type approval nr. Z-8.22-869 from 5 March 2001, changed by notification from 10 April 2003.
The object is for the first time approved on 5 March 2001 for the generally approved construction authority type / juridical type.
I. GENERAL TERMS AND CONDITIONS

1. The general construction authority type approval is evidence that the items approved may be used in accordance with federal state construction regulations.

2. A general construction authority type approval does not replace the approvals, consents or certificates required by law for the execution of construction projects.

3. This general construction authority type approval is issued without prejudice to any third party rights, particularly intellectual property rights.

4. Without prejudice to any more detailed provisions in the ‘special terms and conditions’, manufacturers and/or distributors of the items approved must furnish users of the items licensed with copies of the general construction authority type approval and draw their attention to the fact that the general construction authority type approval must be kept on site. Copies of the general construction authority type approval must be held available for the authorities concerned on demand.

5. This general construction authority type approval may only be reproduced in full, and may not be reproduced in part except with the consent of the Deutsches Institut für Bautechnik. Neither the wording nor any drawings in any advertising may conflict with the general construction authority type approval. Any translations of this general construction authority type approval must include the words “Translation of the German original not verified by the Deutsches Institut für Bautechnik”.

6. This general construction authority type approval is issued subject to revocation. The terms of the general construction authority type approval may be amended and extended retrospectively, especially in the light of new technical developments.
II. SPECIAL TERMS AND CONDITIONS

1. Approved items and scope
This general construction type approval applies to the erection of a modular system “Ringscaff” for access, protection as well as shoring scaffolds.

The modular scaffold is built with standards and horizontals as well as vertical diagonals, which are joined at special node points. The scaffold nodes are available in models “Ringscaff 2005” and “Ringscaff 2000”; the latter is no longer manufactured. This general construction type approval determines the manufacture of the components of “Ringscaff 2005” as well as the application of both types.

The node points consist of a joint plate, which is welded to a standard tube and ledger-ends, welded onto U- or horizontal (tubular) ledgers and or vertical hinged diagonals. The ledger ends enclose the joint plate and are attached onto the plate by inserting a secured wedge. By tightening the wedge against the plate, the ledger ends are pressed against the standard tube.

A maximum of eight ledger ends can be assembled onto one joint plate.

The requirements or the stability calculations of access and protection scaffolds are detailed in DIN 4420-1, for those for shoring applications in DIN 4421. The parameters and stiffness of the node points to be used in the stability calculations are included in this type approval.

The design and approval of façade scaffolding requires a general construction authority type approval in each individual case.

The scaffold nodes of model “Ringscaff 2005” are shown as summary in Annex 1.

2. Requirements for the individual components of the scaffolding node point

2.1. Attributes and assembly

2.1.1. Structural components.
The components of the scaffolding node points and their connections to uprights, ledgers, U-profiles and diagonals must comply with the details in table 1 and the documents lodged with the Deutsches Institut Für Bautechnik.

The following sections are applicable for the manufacture of the nodes for model “Ringscaff 2005”; type “Ringscaff 2000” is no longer produced.

2.1.2. Materials.
The material for the components of the scaffold nodes must meet the requirements in Table 1; their properties are covered in the Standard DIN EN 10204 as shown in Table 1.

2.1.3. Ultimate load of the ledger ends
The ultimate load of the ledger ends (U-transom and horizontal ledger ends) by the application of a tensile load amounts to 42.6 kN.

2.1.4. Corrosion protection
The steel components must be sufficiently protected against corrosion according to the standards series DIN EN ISO 12944 or through galvanizing to DIN EN ISO 1461.
Table 1: Technical Rules and Test requirements for the components of the Scaffold node “Ringscaff 2005”

<table>
<thead>
<tr>
<th>Component</th>
<th>Material Number</th>
<th>Assignment</th>
<th>Technical Rule</th>
<th>Certification to DIN EN 10204</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard tube, Tube for U-transom</td>
<td>1.0038</td>
<td>S235JRG2*)</td>
<td>DIN EN 10025</td>
<td>2.3*)</td>
</tr>
<tr>
<td>Horizontal Ledger</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical diagonals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Plate</td>
<td>1.0570</td>
<td>S355J2G3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ledger end for U- and Tubular ledger And Vertical diagonals</td>
<td>----</td>
<td>ASTM A27 Grade 70-40**)</td>
<td>ASTM A 27</td>
<td>3.1.B</td>
</tr>
<tr>
<td>Wedge</td>
<td>1.0986</td>
<td>S550MC</td>
<td>DIN EN 10149-2</td>
<td></td>
</tr>
</tbody>
</table>

*) The elevated yield stress to ReH >= 320 N/mm² is to be attained during manufacture through cold working, whereby the elongation at rupture may not be less than the requirement for steel to DIN EN 10-025 – S 355J2G3. These attributes are to be evidenced in a certificate 3.1B to DIN EN 10 204.

**) The chemical composition as well as the mechanical properties must meet the requirements as laid down by the German Institute for Construction.

2.2. Manufacture and Marking

2.2.1 Manufacture

Companies, that manufacture the welded components of the Scaffold system according to this approval type, must have certification that they are suitably qualified. This proof is considered as furnished, when the company can present a classification as welding contactor above Class C (Lower suitability proof with extension for the manufacturing of welded joints in cast steel and of construction components with enhanced yield strength) according to DIN 18800-7:2002-9 relating to the requirements of this type approval, for the manufacture of welded joints. In this context component related manufacturing tests are to be in accordance to the documents deposited with German Institute for Construction.

2.2.2 Marking

The node joints are to be marked in accordance with the centrally coordinated regulations of the provinces with

- Capital letter “U”
- The shortened type approval number “869” and
- Manufacturer’s identifier

Additionally the last two numbers of the year of manufacture are to be shown. The marking may take place only if the conditions of section 2.3 are met.
2.3. Proof of conformity

2.3.1 General
The determination of the conformity of the nodes with the requirements of this general type approval must furnish each manufacturer with a certificate of conformity which is based on a company owned production control system and regular external tests of the nodes according to the regulations below.
For the provision of a certificate of conformity and the external control on the required production testing, the manufacturer of the nodes has to maintain specifically designed certification as well as a control system.
The German Institute is to receive a copy of the Certification from the external controller. The German Institute is to simultaneously receive a copy of the original test certificates.

2.3.2 Company specific production control
In every manufacturing plant, a company controlled production system is to be designed and maintained. In the company specific production control system the anticipated and continual production is planned, with the prerequisite, that all the manufactured components shall meet the demands of this type approval.
The company designed production control system shall at least include the following measures:

- **Control and testing of finished goods**:
  - It can be ascertained, that the raw material conformity certification as per paragraph 2.1.2 are available and that they conform with the test requirements.
  - That a minimum of 10 components from each manufacturing batch, as well as 1‰ are to be retested for conformity to quality and dimension. The actual dimensions are to be documented.
  - Connecting heads of cast steel are to be carefully checked to be crack free.

- **Tests which are to be applied to manufactured nodes**:
  - At least 0.025‰ of the fabricated joint plates, after welding to a standard, are to be subjected to a tensile force to breaking point by, on the one side a horizontal ledger, and on the other a U-transom, both of which are connected into a large hole of the joint plate. The tests for the determination of the ultimate tensile load are to be according to the regulations “Test assumptions for Scaffolding Systems and Scaffolding components”\(^1\). The ultimate tensile load shall not be lower than that specified in paragraph 2.1.3.

The results of the company’s production control are to be noted and evaluated. The results must at a minimum contain the following criteria:
- Designation of the component/scaffold node
- Method of control
- Date of manufacture and test of component or scaffold node
- Result of controls and tests and comparison with the requirements
- Signature of the persons responsible for the company’s production control

The documentation is to be maintained for a minimum of five years. These are to be presented when requested to the German Institute for Construction and the highest relevant building authority.
With insufficient test data, the manufacturer is to immediately implement the necessary measures to rectify the shortfall. Components and node points, that do not meet specification, are to be handled in such a manner that faulty components are segregated from correct ones. After determination of a fault - so far as technically possible and necessary to prove the removal of the fault - the tests concerned are to be repeated immediately.

2.3.3 External auditing

In every factory, the company’s production control system is to be regularly checked, at least twice per annum, by an external auditor. In the context of the external audit, an initial test on the node points is to be performed and specimens are to be taken for random sampling tests. The samples and tests are incumbent on the plant under consideration at the time.

At a minimum the following tests are to be performed:

- It is to be ascertained, that the test certificates according to paragraph 2.1.2 are available and that they meet the standards required.
- For a minimum of at least 5 components according to paragraph 2.1.1, the dimensions as per the specification in the drawings of appendices are to be met and compared to the tolerances within the type approval.
- At least 5 normal tension tests are to be performed with U-transoms and horizontal ledgers according to the conditions in paragraph 2.3.2.
- The marking for components as specified in paragraph 2.2.2 are to be checked.

The components are to be taken from current production.

The results of the certification and external audit are to be retained for at least 5 years. They are to be made available to the certification authority that is the German Institute for Construction or the highest relevant building inspection authority, upon request.

3. Design and dimensional requirements.

3.1 General

Unless this ruling states otherwise, the design and dimensions of the scaffolding erected using this scaffolding joint, are subject to the requirements of the technical construction standards, and DIN 4420-1 for working and protection scaffolding and DIN 4421 for load bearing scaffolds. Using the nodes in a support scaffold according to DIN 4421, the admissible resistance $zul'R$ from the indicated load capacity in the following sections, divided by 1.5, has to be determined.

Stability calculations of the scaffolding must be provided in each individual case, or by static type-testing, if it does not conform to a standard design under the general construction authority type approval.

The regulations in the following paragraphs are only applicable to connections between the ledger ends and the tubes shown in the tables (ledgers and diagonals).
The connections of horizontals and U transoms are treated in the following paragraphs in general as ledger connections. The data for stiffness and loading of the connections are applicable for both “small” and “large” holes in the joint plate.

3.2 System assumptions

The static systems to be used for calculation purposes should be modelled in accordance to appendix 12. The short bars from the upright axes to the connections may be assumed to be immune to expansion, shear, bending and torsion forces. In the sections below, the quoted indices are seen as local coordinates systems with the ledgers in the X axis and the uprights or standards in the Z axis.

The connection of a ledger of the type “Ringscaff 2000” may only transfer normal loads, bending moments and shear forces in a horizontal plane, and at right angles thereto only shear forces. With the type “Ringscaff 2005” additional bending moments in the plane perpendicular to the standard tube / ledger are permitted. When proofing the scaffold system it should be remembered that the bending moment at the ledger / upright joint applies to the outside of the upright.

At the connection of a vertical diagonal, only normal forces can be transferred in the horizontal plane. The vertical component of a vertical diagonal joint is to be accounted for with an eccentricity in accordance with appendix 12. The torsion moment around the standard tube resulting from the horizontal component of the vertical diagonal joint was transferred via the node in the type “Ringscaff 2000” and absorbed in the ledgers.

In the following sections the characteristic values of the node joints (coefficients, stiffness) are to be used as calculation values and to determine the permissible loading from the applicable calculation values.

If it is not certain that only components of a particular type are used in a scaffold or that their effect has not been established through detailed calculation or planning; for the calculation of a particular scaffold the following assumptions are to be considered;

- load bearing calculations, maximum stiffness:
  - Details as per type “Ringscaff 2000”

- minimal or intermediate stiffness
  - Details as per type “Ringscaff 2005”

Should Vertical diagonals of both types be employed in a scaffold, then the details of the type “Ringscaff 2000” must be used in the calculations.

3.3 Ledger connection

3.3.1 Load-Deformation-Constrains
  3.3.1.1 Bending in the vertical plane

The calculation of a scaffold is dependent on the type of ledger connection in the plane of the ledger and the standard (vertical plane) taking into account a turning moment according to the Moment / Rotation table annex 13 and 14, sketches 1 to 6. Insofar as the ledger connections cannot be considered flexible, then in calculating a scaffold system with average torsional resistance; the following additional calculations are to be supplied:

- Under the worst case combination of loads, strength tests must be carried out assuming minimum torsion displacement springs at all ledger joints, Yf being taken as 1.15, contrary to DIN 4420-1.
Limit tests to be carried out at the position of greatest torque in the ledger joint at the maximum and minimum rotational torsion rigidity. These limit analyses may be carried out on simplified limited local systems.

3.3.1.2 Bending in the horizontal plane
In the calculation of a scaffold with node joints exclusive of the type “Ringscaff 2005”, the loading of ledger ends through bending in the horizontal plane is to take account of a bending moment according to the Moment/Turning angle relationship as shown in Appendix 15, sketch 17.

3.3.2 Load capacity
3.3.2.1 General Proof
A ledger joint must be shown not to exceed the loadings as outlined in Table 2.

**NOTE:** The mentioned loads are “design-loads”, not permissible loads. Permissible loads are defined as: “design-load”/1.5!

<table>
<thead>
<tr>
<th>Joint ledger section load</th>
<th>Design load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ringscaff 2005</td>
</tr>
<tr>
<td>Bending moment $M_{y,R,d}$ [kNcm]</td>
<td>± 110,0</td>
</tr>
<tr>
<td>Vertical shear force $V_{z,R,d}$ [kN]</td>
<td>± 30,8</td>
</tr>
<tr>
<td>Bending Moment $M_{z,R,d}$ [kNcm]</td>
<td>± 50,0</td>
</tr>
<tr>
<td>Horizontal shear force $V_{y,R,d}$ [kN]</td>
<td>± 15,9</td>
</tr>
<tr>
<td>Normal force $N_{R,d}$ [kN]</td>
<td>± 38,5</td>
</tr>
</tbody>
</table>

3.3.2.2 Interaction standard tube / ledger connection
Loaded joint plates must, according to Type, conform to the following requirements:

a) Type “Ringscaff 2005”

\[ 0.224 \cdot I_A + I_R \leq 1 \]

where

$I_A$ Utilization of ledger connection

\[ I_A = \frac{M_y}{M_{y,R,d}} \]
Bending moment in ledger connection

Loading against bending in the ledger connection is subject to table 2

Vectored utilization in the standard tube within reach of a loaded joint plate.

Where \( V_{\text{act}} \leq 1/3 \) apply:

\[
I_S = \frac{a}{b} \quad (a,b \text{ see Figure 1, where } b \text{ is to be determined from the interactional relationship as per Figure 1}).
\]

Where \( 1/3 < V_{\text{act}} \leq 0.9 \) the vectored utilization rate considering the interactional relationship is to be determined according to left part of the equation, Section 4 of Table 7, Din 4420-1:1990-12

\[
V_{\text{act}} = \frac{V_{\text{st}}}{V_{\text{st},\text{R},\text{d}}}
\]

Shear force in the Standard tube

Proportional transverse loading in Standard tube

\[
V_{\text{st},\text{R},\text{d}} = V_{\text{pl},\text{d}} = 48.5 \text{ kN}
\]

\[
m = \frac{M_{\text{st}}}{M_{\text{st},\text{R},\text{d}}} = \cos \left( \frac{\pi}{2} \cdot n \right)
\]

\[
n = \frac{N_{\text{st}}}{N_{\text{st},\text{R},\text{d}}}
\]

Utilisation of bending moments in standard tube

Bending moments in upright tube

Proportional bending moment in upright tube

\[
M_{\text{st},\text{R},\text{d}} = M_{\text{pl},\text{d}} = f_{y,d} \cdot \alpha_{\text{pl}} \cdot W_{\text{el}} = 175 \text{ kNcm}
\]

Utilisation of normal forces in the standard tube

Normal forces in the upright tube

Proportion of normal force in the upright tube

\[
N_{\text{st},\text{R},\text{d}} = N_{\text{pl},\text{d}} = f_{y,d} \cdot A = 132 \text{ kN}
\]

Figure 1

b) Type “Ringscraf 2000”

\[
0,148 \cdot I_A + I_S \leq 1
\]

where
I_A Utilization of ledger connection

\[ I_d = \frac{M_y}{M_{y,R,d}} \]

- \( M_y \): Bending moment in ledger connection
- \( M_{y,R,d} \): Loading against bending in the ledger connection is subject to table 2

I_S Utilization in the standard tube within reach of a loaded joint plate

\[ I_s = \frac{\sigma_N}{f_{y,d}} \]

Where \( \sigma_N = \frac{N_{st}}{A_{st}} + \frac{M_{st}}{W_{el,St}} \)

- \( N_{st} \): Load through normal force in standard tube
- \( M_{st} \): Load through bending in the standard tube
- \( A_{st} \): Cross-sectional area of standard tube
- \( W_{el,St} \): Elastic moment of inertia of standard tube
- \( f_{y,d} = 291 \text{kN/cm}^2 \) (Yield stress limit in the upright)

3.3.2.3 Combination of sections

Where section combinations at ledger joints occur, the following conditions must be met:

a) Type “Ringscaff 2005”

\[
\frac{N^{(+)}_{R,d}}{N_{R,d}^{(+)}} + \frac{M_y}{M_{y,R,d}} + \frac{M_z}{M_{z,R,d}} + \frac{V_y}{V_{y,R,d}} \leq 1
\]

\[
\frac{N^{(+)}_{R,d}}{N_{R,d}^{(+)}} + \frac{V_z}{V_{z,R,d}} + \frac{M_z}{M_{z,R,d}} + \frac{V_y}{V_{y,R,d}} \leq 1
\]

b) Type “Ringscaff 2000”

\[
\frac{N^{(+)}_{R,d}}{N_{R,d}} + \frac{M_y}{M_{y,R,d}} + \frac{\max(V_z - 1.4; 0)}{V_{z,R,d}} + \frac{V_y}{25.0} \leq 1
\]
Whereby:

\[ N^{(*)} \]  Direct tension force in ledger end

\[ M_y, V_z, M_z, V_y, \]  Load coefficients in ledger end

\[ N_{R,d}^{(*)} \]  Load capacity versus direct load according to table 2

\[ M_{y,R,d}, V_{z,R,d}, M_{z,R,d}, V_{y,R,d} \]  Load coefficients as per table 2

### 3.4 Connection of vertical diagonal braces

#### 3.4.1 Load deformation behaviour

**a) Vertical diagonals type “Ringscaff 2005”**

In a combined system the vertical diagonals inclusive of the ledger ends are to be considered as to their rigidity dependent on the load direction (tension or compression) and length according to Table 3. The deformation of standards and ledgers incurred due to the eccentricity \( e_y \) (Appendix 12) is indicated in the table.

**b) Vertical diagonals type “Ringscaff 2000”**

In a combined system the vertical diagonals inclusive of the ledger ends are to be considered as to their rigidity dependent on the load direction (tension or compression) and length of diagonal according to Table 4.

#### Table 3:

**Characteristic values for vertical diagonals of type “Ringscaff 2005”**

<table>
<thead>
<tr>
<th>Field Length L (m)</th>
<th>Field Height H (m)</th>
<th>Tube Length (m)</th>
<th>Compression Loading</th>
<th>Tension Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_d ) ( A_{eff} ) [kN]</td>
<td>( N_{V,R,d} ) (^{(*)}) [kN]</td>
<td>( E_d ) ( A_{eff} ) [kN]</td>
<td>( N_{V,R,d} ) (^{(*)}) [kN]</td>
<td></td>
</tr>
<tr>
<td>6,14</td>
<td>2,5</td>
<td>6,49</td>
<td>2480</td>
<td>2,2</td>
</tr>
<tr>
<td>0,73</td>
<td>2,0</td>
<td>2,08</td>
<td>2500</td>
<td>18,3</td>
</tr>
<tr>
<td>1,09</td>
<td>2,1</td>
<td>2,21</td>
<td>2730</td>
<td>17,0</td>
</tr>
<tr>
<td>1,40</td>
<td>2,36</td>
<td>2,36</td>
<td>2410</td>
<td>15,7</td>
</tr>
<tr>
<td>1,57</td>
<td>2,45</td>
<td>2,45</td>
<td>2230</td>
<td>14,9</td>
</tr>
<tr>
<td>2,07</td>
<td>2,77</td>
<td>2,77</td>
<td>1930</td>
<td>12,5</td>
</tr>
<tr>
<td>2,57</td>
<td>3,14</td>
<td>3,14</td>
<td>1830</td>
<td>10,2</td>
</tr>
<tr>
<td>3,07</td>
<td>3,54</td>
<td>3,54</td>
<td>1780</td>
<td>8,4</td>
</tr>
<tr>
<td>4,14</td>
<td>4,46</td>
<td>4,46</td>
<td>1720</td>
<td>5,3</td>
</tr>
<tr>
<td>1,57</td>
<td>1,5</td>
<td>2,06</td>
<td>1370</td>
<td>18,5</td>
</tr>
<tr>
<td>2,57</td>
<td>2,85</td>
<td>2,85</td>
<td>1240</td>
<td>12,0</td>
</tr>
<tr>
<td>1,57</td>
<td>1,73</td>
<td>1,73</td>
<td>859</td>
<td>19,5</td>
</tr>
<tr>
<td>2,07</td>
<td>2,16</td>
<td>2,16</td>
<td>840</td>
<td>17,5</td>
</tr>
<tr>
<td>2,57</td>
<td>2,62</td>
<td>2,62</td>
<td>916</td>
<td>13,6</td>
</tr>
<tr>
<td>3,07</td>
<td>3,08</td>
<td>3,08</td>
<td>1010</td>
<td>10,6</td>
</tr>
<tr>
<td>1,57</td>
<td>0,5</td>
<td>1,50</td>
<td>535</td>
<td>19,5</td>
</tr>
<tr>
<td>2,57</td>
<td>2,47</td>
<td>2,47</td>
<td>783</td>
<td>14,7</td>
</tr>
</tbody>
</table>

\( L,H \) see Appendix 12
Table 4: Stiffness $C_{V,d}$ of the spring and loading of vertical diagonals type “Ringscaff 2000”

<table>
<thead>
<tr>
<th>Field Length L (m)</th>
<th>Field Height H (m)</th>
<th>Tube Length (m)</th>
<th>Compression Loading</th>
<th>Tension Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$C_{V,d}^{(+)}$ [kN/cm]</td>
<td>$N_{V,R,d}^{(+)}$ [kN]</td>
</tr>
<tr>
<td>6,14</td>
<td>2,5</td>
<td>6,49</td>
<td>3,7</td>
<td>2,1</td>
</tr>
<tr>
<td>0,73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,09</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,57</td>
<td>1,5</td>
<td>2,06</td>
<td>12,8</td>
<td>13,4</td>
</tr>
<tr>
<td>2,57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,57</td>
<td>1,0</td>
<td>2,62</td>
<td>12,2</td>
<td>13,1</td>
</tr>
<tr>
<td>3,07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,57</td>
<td>0,5</td>
<td>1,50</td>
<td>13,3</td>
<td>13,5</td>
</tr>
<tr>
<td>2,57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$N_{V,R,d}$ see Appendix 13

3.4.2 Proof of carrying capacity

For the vertical diagonals the following proof has to be met:

$$\frac{N_V}{N_{V,R,d}} \leq 1$$

Whereby:

- $N_V$: Tension of compression force in the diagonal
- $N_{V,R,d}$: Load capacity of vertical diagonals for compression resp. tension forces
  - a) Type “Ringscaff 2005” per Table 3
  - b) Type “Ringscaff 2000” per Table 4
### 3.5 Joint Plate

#### 3.5.1 Connection at adjacent holes in the joint plate

When connecting two ledgers, or one ledger and a vertical diagonal brace in immediately adjacent holes, the proof required is:

\[
\left( n_A^2 + n_B^2 \right) + \left( v_A^2 + v_B^2 \right) \leq 1
\]

with:

- \( n, v \) interaction see table 6
- \( A \) ledger A
- \( B \) ledger B or vertical diagonal brace

#### Table 5: Part of interaction

<table>
<thead>
<tr>
<th>Part of interaction</th>
<th>Connection Ledger A / Ledger B</th>
<th>Connection Ledger A / Vertical diagonal brace B</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n^A )</td>
<td>( \frac{N_A^{(+)} + \left</td>
<td>M_{y}^A \right</td>
</tr>
<tr>
<td>( n^B )</td>
<td>( \frac{N_B^{(+)} + \left</td>
<td>M_{y}^B \right</td>
</tr>
<tr>
<td>( v^A )</td>
<td>( \frac{V_{z}^{A}}{V_{z,R,d}} )</td>
<td>( \frac{\cos \alpha \cdot N_{V}}{V_{z,R,d}} )</td>
</tr>
<tr>
<td>( v^B )</td>
<td>( \frac{V_{z}^{B}}{V_{z,R,d}} )</td>
<td>( \frac{\cos \alpha \cdot N_{V}}{V_{z,R,d}} )</td>
</tr>
</tbody>
</table>

Where:

- \( N_A^{(+)}; N_B^{(+)} \) normal forces (only tension forces) in the ledger (ledger A or B)
- \( M_{y}^A; M_{y}^B \) bending moments at the ledger connection (ledger A or B)
- \( V_{z}^{A}; V_{z}^{B} \) vertical shear forces at the ledger connection (ledger A or B)
- \( N_{V} \) normal force at the vertical diagonal braces
- \( N_{V}^{(+)} \) tension force at the vertical diagonal braces
- \( e \) lever arm ledger connection
  - Type “Ringscaff 2005” \( e = 3.5 \text{ cm} \)
  - Type “Ringscaff 2000” \( e = 2.75 \text{ cm} \)
- \( e_{0} \) Lever arm vertical brace connection \( e_{0} = 5.7 \text{ cm} \)
- \( N_{R,d}, V_{z,R,d} \) Load capacities as in table 2.

Approvals to be carried out in pairs around the joint plate.
3.5.2 Connecting ledgers and/or diagonals in any given holes in the joint plate

\[
\frac{\sum V_z}{\sum V_{z,R,d}} \leq 1
\]

Where:

\(\sum V_z\) is the sum of all the vertical shear forces acting on the joint plate under the reference factors (incl. vertical components of the vertical diagonal braces)

\(\sum V_{z,R,d}\) is the load capacity for the joint plate for the vertical shear forces

Type “Ringscaff 2005” : \(\sum V_{z,R,d} = 109,0\) kN

Type “Ringscaff 2000” : \(\sum V_{z,R,d} = 69,5\) kN

4 Erection regulations

Up to eight bars may be connected per joint plate.

The erection of the scaffold has to be in accordance with the erection manual.

The connecting head wedges must be driven home from above with a 500 g hammer.

Before being used in scaffolding, components must be checked to see that they are in perfect condition. Any damaged components must not be used.

Only components may be used that are marked to conform to the general construction type approval, according to paragraph 2.2.2.
U-Ledger 54x48x54x2.5
S235JRG2 DIN EN 10025

Tube ledger ø48.3×3.2
S235JRG2 DIN EN 10025
with extended yield strength ReH>320 N/mm²

Diagonal face brace ø48.3×2.3mm
S235JRG2 DIN EN 10025

Standard tube ø48.3×3.2mm
S235JRG2 DIN EN 10025
with extended yield strength ReH>320 N/mm²

01) Standard
02) Tube ledger
03) Diagonal face brace
04) Joint plate
05) Ledger end for tube ledger
06) Wedge
07) Diagonal face brace end
08) Rivet ø16 DIN 1654 T2 QSt 36–3 elvz
09) U ledger
10) Ledger end for U ledger

Corrosion protection: Hot dip galvanised according to EN–ISO 1461

GENERAL ARRANGEMENT
NODE POINT
TYPE "RINGSCAFF 2005"
MODULAR SYSTEM RINGSCAFF

Annex 01 for
general construction type
approval Z–8.22–869
of 6. April 2005
Deutsches Institut für Bautechnik
(XXYY)=production marking
Material: S355J2G3 DIN EN 10025

Standard tube \( \phi 48.3 \times 3.2\)mm
S235JRG2 DIN EN 10025
with extended yield strength \( R_e > 320 \) N/mm²
LEDGER TUBE Ø48.3*3.2
S235JR2 DIN EN 10025
with extended yield strength
Reh>320 N/mm²

LEDGER END
FOR HORIZONTAL LEDGER
TYPE "RINGSCAFF 2005"
MODULAR SYSTEM RINGSCAFF

Scafom International bv
De Kempen 5
6021 FZ Buwel (NL)

Welding angle
\[ \alpha = 370° \]
\[ a > t = 3.2 \text{mm} \]

SECTION A–A:

B50 = casting number
(XXYY) = production marking

Material: ASTM A27 Gr 70–40

Annex 03 for
general construction type
approval Z–B22–869
of 6. April 2005
Deutsches Institut für Bautechnik

B50
Ü869

0 20 40 60 80 100
Section A–A: Welding view

Total welding length = 182 mm
\(t = 2.5\text{mm}\)

U–Ledger 54x48x54x2.5
S235JRG2 DIN EN 10025

B53 = casting number
\((XXYY) = \text{production marking}\)

Material: ASTM A27 Gr 70–40
Type:
B51 = (casting number), Right: as drawn
B52 = (casting number), Left: mirrored
(XXYY)=production marking

Material: ASTM A27 Gr 70–40

0 20 40 60 80 100
(XXYY)=production marking
Material: S500MC
SECTION B–B:

Edges deburred

DETIAL X

Markings on bottom side because of punch direction

(XYYY)=production marking
S235JRG2 DIN EN 10025

Is not produced anymore!

SCAFOM INTERNATIONAL BV
DE KEMPEN 5
6021 PZ BUDEL (NL)

JOINT PLATE
TYPE "RINGSCAFF 2000"
MODULAR SYSTEM RINGSCAFF

Annex 08 for general construction type approval Z–8.22–869 of 6. April 2005
Deutches Institut für Bautechnik
(XXYY)=production marking

B33=casting number

EN–GJMW–360–12, EN1562

Is not produced anymore!
(XXYY)=production marking
(B30)=casting number, left
(B31)=casting number, right

EN–GJMW–450–7 DIN EN 1562

Is not produced anymore!

SCAFOM INTERNATIONAL BV
DE KEMPFEN 5
6021 PZ BÜDEL (NL)

LEDGER END
FOR DIAGONAL FACE BRACES
TYPE "RINGSCAFF 2000"

MODULAR SYSTEM RINGSCAFF

Annex 10 for
general construction type
approval Z–8.22–869
of 6. April 2005
Deutches Institut für Bautechnik
(XXYY) = production marking
Rivet Ø6*10
S700MC

Is not produced anymore!
LEDGER CONNECTION

DYNALOG FACE BRACES

MOMENTS IN THE NODE $M^k$
RESULTING FROM A DIAGONAL FORCE:

$M_x^k = e_y \cdot N_v \cdot \cos \alpha$
$M_y^k = 7.75 \cdot N_v \cdot \cos \alpha$
$M_z^k = e_y \cdot N_v \cdot \sin \alpha$

Type "Ringscuff 2000": $e_y = 5.0 \text{ cm}$
Type "Ringscuff 2005": $e_y = 4.5 \text{ cm}$
\[ \varphi_{m,d} = 2.4 \times 10^{-3} + \frac{|M_y|}{(9380 - 83.7 \times |M_y|)} \text{ [rad]} \]

Figure 1: Average rotational rigidity

\[ \varphi_{\text{max},d} = 2.4 \times 10^{-3} + \frac{|M_y|}{(4060 - 30.0 \times |M_y|)} \text{ [rad]} \]

Figure 2: Minimum rotational rigidity

\[ \varphi_{\text{min},d} = 2.4 \times 10^{-3} + \frac{|M_y|}{(19000 - 158.0 \times |M_y|)} \text{ [rad]} \]

Figure 3: Maximum rotational rigidity

mit \( M_y \) in kNcm
\[ \varphi_{m,d} = \frac{I M_y I}{(17320 - 187 \times I M_y I)} \quad [\text{rad}] \]

\[ \varphi_{\text{min},d} = \frac{I M_y I}{(37700 - 365 \times I M_y I)} \quad [\text{rad}] \]

\[ \varphi_{\text{max},d} = \frac{I M_y I}{(9460 - 99 \times I M_y I)} \quad [\text{rad}] \]

Bild 4: Mittlere Drehfedersteifigkeit

Bild 5: Minimale Drehfedersteifigkeit

Bild 6: Maximale Drehfedersteifigkeit

mit \( M_y \) in kNcm
Figure 7: Average rotational rigidity

\[ M_Z = 0 \text{ to } 23 \text{ kNm} : \quad \varphi_{m,d} = \frac{IM_Z}{1640} \quad [\text{rad}] \]

\[ M_Z = 23 \text{ to } 50 \text{ kNm} : \quad \varphi_{m,d} = 1.40 \times 10^{-2} + \frac{IM_Z - 23}{166} \quad [\text{rad}] \]

mit \( M_Z \) in \text{kNm}