DIN 4119 / DIN EN 14015

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Engineering and Construction of Storage Tanks
DIN 4119 / DIN EN 14015

REGULATIONS

MATERIALS

FOUNDATION

DESIGN

MANUFACTURER

TESTING

TOLERANCES

DIN 4119-1: Fundamentals, Design, Tests (Jun 1979)
DIN 4119-2: Calculation (Feb 1980)

DIN EN 14015: Design and manufacture (Feb 2004)

DIN 4119 withdrawn by DIN (Deutsches Institut für Normung)

DIN 4119 replaced by DIN EN 14015

DIN EN 14015 is not a harmonised standard

National building regulations

DIN 4119 in technical building regulations
### Technical building regulations – Bavaria

<table>
<thead>
<tr>
<th>2.4.5</th>
<th>DIN 4119</th>
<th>Oberirdische zylindrische Flachboden-Tankbauwerke aus metallischen Werkstoffen</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Teil 1</td>
<td>Anlage 2.4/4 und 2.4/7</td>
<td>-; Grundlagen, Ausführung, Prüfungen</td>
<td>Juni 1979</td>
</tr>
<tr>
<td>Teil 2</td>
<td></td>
<td>-; Berechnung</td>
<td>Februar 1980</td>
</tr>
</tbody>
</table>

https://www.stmi.bayern.de
Scope of application

**DIN EN 14015**
Design pressure \( \leq 500 \text{ mbar} \)
Design negative pressure \( \leq 20 \text{ mbar} \)

**DIN 4119**
„slight pressure or slight negative pressure“

**DIN EN 1993-4-2**
Design pressure \( \leq 500 \text{ mbar} \)
Design negative pressure \( \leq 100 \text{ mbar} \)
Material - Requirements

DIN EN 14015: Section 6
DIN 4119-1: Section 5 and AD-2000

- DIN EN 10025: Hot rolled products of structural steels
- DIN EN 10028: Steels for pressure purposes
- DIN EN 10088: Stainless steels
- DIN EN 10216/DIN EN 10217: Tubes
- DIN EN 1092: Steel flanges
Inspection documents

DIN EN 10204: Types of inspection documents

DIN EN 14015
3.1 Certificate

DIN 4119
3.1 or 3.2 Certificate (AD-2000)
S235, P265: 3.1 Certificate
1.4462: 3.2 Certificate
Foundation tolerances – peripheral

**DIN EN 14015**
5mm difference in level between 2 points 5 m apart
difference in level between any 2 points 24 mm

**DIN 4119**
1‰ difference in level between 2 points 5 m apart
difference in level between any 2 points 12 mm
Foundation tolerances – foundation surface

**DIN 4119:** not stipulated

**DIN EN 14015**

Table 23 — Foundation surface tolerances

<table>
<thead>
<tr>
<th>Diameter of tank</th>
<th>Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D \leq 10$</td>
<td>10</td>
</tr>
<tr>
<td>10 &lt; $D \leq 50$</td>
<td>$D / 1000$</td>
</tr>
<tr>
<td>50 &lt; $D$</td>
<td>50</td>
</tr>
</tbody>
</table>
DIN 4119 / DIN EN 14015

Design - Eurocodes

DIN EN 14015
Section 7 - 11

DIN 4119
DIN EN 1991: Actions on structures
DIN EN 1993: Design of steel structures

Germany: Technical building regulations!
### Technical building regulations – DIN EN 1993

#### 2.4 Metall- und Verbundbau

<table>
<thead>
<tr>
<th>2.4.1</th>
<th>DIN EN 1993</th>
<th>Eurocode 3: Bemessung und Konstruktion von Stahlbauten</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1-1</td>
<td>Anlagen 2.3/4, 2.4/1 E und 2.4/8 E</td>
<td>-; Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dezember 2010</td>
</tr>
<tr>
<td>-1-2</td>
<td>Anlage 2.3/5</td>
<td>-; Teil 1-2: Allgemeine Regeln – Tragwerksbemessung für den Brandfall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dezember 2010</td>
</tr>
</tbody>
</table>

*)
Shell

Joint efficiency factor
DIN 4119: factor 0.85 or 1.0 (NDT acc. to DIN 4119-1 section 7)
DIN EN 14015: factor 1.0

min. shell thickness DIN 4119
Carbon steels: 5mm – 11mm
Stainless steels: not stipulated

min. shell thickness DIN EN 14015
Carbon steels: 5mm – 12mm
Stainless steels: 2mm – 6mm
Tank bottom

Design: Overlapped or butt welded

**DIN 4119**
Carbon steels: overlapped min. 6,5mm / butt welded min. 5,0mm
Stainless steels: not stipulated

**DIN EN 14015**
Carbon steels: overlapped min. 6mm / butt welded min. 5mm
Stainless steels: overlapped min. 5mm / butt welded min. 3mm
Roof

Self supporting cone or dome roof with or without roof structure

**DIN 4119**
- Carbon steels: min. 4,0mm
- Stainless steels: not stipulated

**DIN EN 14015**
- Carbon steels: min. 5mm
- Stainless steels: min. 3mm
Qualifications and test pieces

Qualifications
Qualification testing of welders: DIN EN ISO 9606-1
Welding operators: DIN EN ISO 14732
Qualification of welding procedures: DIN EN ISO 15614

Welding of test pieces
DIN EN 14015: t > 13mm
DIN 4119: Joint efficiency factor 1,0
Nondestructive testing

Testing requirements
DIN 4119: AD-2000 HP 5/1, HP 5/3
DIN EN 14015: acc. to table 32

Inspection scope
DIN 4119: section 7
DIN EN 14015: acc. to table 30, 31
Nondestructive testing DIN EN 14015

DIN EN 14015 table 32

<table>
<thead>
<tr>
<th>502</th>
<th>Excess weld metal</th>
<th>Internal weld of shell with floating roof or floating cover</th>
<th>$h \leq 1 \text{ mm} + 0,1 \ b$, maximum 5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other welds</td>
<td></td>
<td>$h \leq 1 \text{ mm} + 0,15 \ b$, maximum 7 mm</td>
</tr>
</tbody>
</table>

DIN EN 4119 (AD-2000 HP5/1, HP 5/3)

| Zu große Nahtüberhöhung (Stumpfnaht) | Weicher Übergang wird verlangt. | $b$ | $h$ | $h \leq 1 \text{ mm} + 0,25 \ b$, aber max. 10 mm | $h \leq 1 \text{ mm} + 0,15 \ b$, aber max. 7 mm | $h \leq 1 \text{ mm} + 0,1 \ b$, aber max. 5 mm | $h \leq 1 \text{ mm} + 0,1 \ b$, aber max. 5 mm |
Nondestructive testing – Inspection scope

DIN 4119 joint efficiency factor 0,85
1 radiographic test on at least 30 m of vertical welds
1 radiographic test on at least 60 m of circular welds

DIN 4119 joint efficiency factor 1,0
(or yield point > 355 N/mm² or t > 30 mm or T < -10°C)
100% of vertical welds
5% of circular welds
Nondestructive testing – Inspection scope

DIN EN 14015
Carbon steels: Table 30
Stainless steels: Table 31
Table 30 — Extent of radiographic and ultrasonic examination of welds to carbon and carbon manganese steel shell plates

<table>
<thead>
<tr>
<th>Plate</th>
<th>Type of examination</th>
<th>Welds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V1(^1)</td>
</tr>
<tr>
<td>Yield strength N/mm(^2)</td>
<td>Thickness mm</td>
<td>%</td>
</tr>
<tr>
<td>&lt; 355</td>
<td>≤ 13</td>
<td>Radiographic</td>
</tr>
<tr>
<td></td>
<td>&gt; 13 to 30</td>
<td>Radiographic or Ultrasonic (^4)</td>
</tr>
<tr>
<td></td>
<td>&gt; 30</td>
<td>Radiography or Ultrasonic (^4)</td>
</tr>
<tr>
<td>≥ 355</td>
<td>≤ 13</td>
<td>Radiographic</td>
</tr>
<tr>
<td></td>
<td>&gt; 13 to 30</td>
<td>Radiographic or Ultrasonic (^4)</td>
</tr>
<tr>
<td></td>
<td>&gt; 30</td>
<td>Ultrasonic (^4)</td>
</tr>
</tbody>
</table>
### Table 31 — Extent of radiographic examination and penetrant testing of welds to stainless steel shell plates

<table>
<thead>
<tr>
<th>Plate thickness $e$ mm</th>
<th>Type of examination or test</th>
<th>Welds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V1 $^1$</td>
</tr>
<tr>
<td>≤ 8</td>
<td>Radiographic</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 8 to 13</td>
<td>Radiographic</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 13</td>
<td>Radiographic</td>
<td>5</td>
</tr>
<tr>
<td>All thickness</td>
<td>Penetrant</td>
<td>10</td>
</tr>
</tbody>
</table>
Tolerances – Uplift of bottom plates

DIN EN 14015
0,25% of diameter / max. 100 mm

DIN 4119
0,25% of diameter / max. 100 mm
### Tolerances – Tank shell diameter

**DIN EN 14015**

Table 24 — Tolerance limits on inside tank radius

<table>
<thead>
<tr>
<th>Radius</th>
<th>Tolerance</th>
<th>Measurement points</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R \leq 5$</td>
<td>$\pm 5$</td>
<td>6</td>
</tr>
<tr>
<td>$5 &lt; R \leq 20$</td>
<td>$\pm 0.1%$ of radius</td>
<td>8</td>
</tr>
<tr>
<td>$20 &lt; R$</td>
<td>$\pm 20$</td>
<td>Each plate</td>
</tr>
</tbody>
</table>

NOTE: Measurements should be remote from any fitting or opening.

**DIN 4119**

Diameter 1% measured close to the bottom / max. 40 mm
### Tolerances – Tank shell local deformation

**DIN EN 14015**

vertical 1m straightedge / horizontal 1 m radius template

Table 25 — Maximum differences between the design and the as built profile

<table>
<thead>
<tr>
<th>Plate thickness</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e \leq 12.5$</td>
<td>16</td>
</tr>
<tr>
<td>$12.5 &lt; e \leq 25$</td>
<td>13</td>
</tr>
<tr>
<td>$25 &lt; e$</td>
<td>10</td>
</tr>
</tbody>
</table>

**DIN 4119**

vertical 0,5 m straightedge / horizontal 0,5 m radius template  
max. 10 mm
**Tolerances – Tank shell vertical**

**DIN EN 14015**
1/200 of total height / max. 50 mm

**DIN 4119**
5% of total height / max. 80 mm
DIN 4119 / DIN EN 14015

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