Quick investigation of BA15 cap-holder systems

IEC
The cap/holder family **B(A)(AU)(AW)(AX)(AY)(AZ)15d/s**, exists in the following combinations:
(categories for automotive and lamps for general lighting):

<table>
<thead>
<tr>
<th></th>
<th>General lighting services</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B15d</td>
<td></td>
<td>BA15d</td>
<td></td>
</tr>
<tr>
<td>BA15d</td>
<td>= equal to B15d / not used in Automotive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA15s</td>
<td>P21W (6V, 12V &amp; 24V)</td>
<td>R5W (6V, 12V &amp; 24V)</td>
<td>R10W (6V, 12V &amp; 24V)</td>
</tr>
<tr>
<td>BAX15d</td>
<td>S4 (6V &amp; 12V) (reserved)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAY15d</td>
<td>P21/5W (6V, 12V &amp; 24V)</td>
<td>(reserved)</td>
<td></td>
</tr>
<tr>
<td>BAZ15d</td>
<td>P21/4W (6V, 12V &amp; 24V)</td>
<td>(reserved)</td>
<td></td>
</tr>
<tr>
<td>BAU15d</td>
<td>PR21/4W (12V &amp; 24V)</td>
<td>PY21W (12V &amp; 24V)</td>
<td>RY10W (6V, 12V &amp; 24V)</td>
</tr>
<tr>
<td>BAU15s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA15d/s-3(100°/130°)</td>
<td>PY21/5W (12V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAW15d</td>
<td>PR21/5 (12V &amp; 24V)</td>
<td>PR21W (12V &amp; 24V)</td>
<td>RR10W (6V, 12V &amp; 24V)</td>
</tr>
<tr>
<td>BAW15s</td>
<td></td>
<td>RR5W (6V, 12V &amp; 24V)</td>
<td></td>
</tr>
</tbody>
</table>

**Mis-insertion (mis-use) is prevented by:**
- Information on the package (category and voltage)
- Information on the light source (category and voltage)
- Information on the luminaire (category and voltage)
- Information in the car manual (category and voltage)
# 15 mm Bayonet Fit family *(Main key dimensions)*

(dimensions: cap Ø15,175mm ± 0,125; holder Ø 15.40 ± 0,07)

<table>
<thead>
<tr>
<th>Fit (IEC 60061)</th>
<th>Cap Sheet (7004-..)</th>
<th>Holder Sheet (7005-..)</th>
<th>Ref pin Axial position</th>
<th>2nd (/ 3rd) pin Angle (clockwise)</th>
<th>2nd (3rd) pin (delta) Axial position</th>
<th>1st / 2nd pin Lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>B15d</td>
<td>11</td>
<td>16</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BA15d/s</td>
<td>11A</td>
<td>13</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BA15d/s-3(100°/130°)</td>
<td>11D</td>
<td>16</td>
<td>0° / 0 mm</td>
<td>+130° / -130°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BAU15d/s</td>
<td>19</td>
<td>13(d) / 19(s)</td>
<td>0° / 0 mm</td>
<td>-150°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BAW15d/s</td>
<td>11E</td>
<td>13</td>
<td>0° / 0 mm</td>
<td>+150°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BAX15d(/s)</td>
<td>18</td>
<td>-</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>2,00 ±0,15 / 0,78 ±0,08</td>
</tr>
<tr>
<td>BAY15d(/s)</td>
<td>11B</td>
<td>13</td>
<td>0° / 0 mm</td>
<td>180°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
<tr>
<td>BAZ15d(/s)</td>
<td>11C</td>
<td>13</td>
<td>0° / 0 mm</td>
<td>-150°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
</tr>
</tbody>
</table>
The Bayonet 15 mm fit system visualized (IEC 60061)

Family of key functions:
- Single contact / double contact
- 2\textsuperscript{nd} pin on 180° (B15, BA15, BAX 15)
- 2\textsuperscript{nd} pin on +150° (BAZ 15)
- 2\textsuperscript{nd} pin on -150° (BAW15)
- 2\textsuperscript{nd} pin on +130° & 3\textsuperscript{rd} pin on -130° (BA15s-3...)
- BAX 15d has deviating pin-lengths; holder not defined in IEC
Evaluation proposal Valeo (reference TFSR-01-10)

Existing PY21W Bulb holder BAU15s

Proposed PY21/LED bulb holder BAU15*s

Extending the 3\textsuperscript{rd} pin option for Existing cap BAW15d/s in a similar direction as proposed does the BAU15s cap result in two options:

3\textsuperscript{rd} pin for also for BAU15, and BAW 15?

BAU15*d/s

BAW15*d/s (alternative)
Examination Valeo Proposal:

• Angular offset from Reference pin (estimated from input:)
  • A slot at +70°, 80°, 90° 100° or 110° clockwise holder top-view (see next slide)

• All* current Automotive 15 mm Bayonet fits with this 3rd pin added,

• All* “Non-LED” automotive fit-types to be checked:
  • “reference” Cap-pin in “new Holder-Slot”
  • “non-reference” Cap-pin in “new Holder-Slot”
  • Some fits use a different “height” for the 2nd pin than the reference pin.

• Some executions appeared close fit (see following pages),
  (tolerances are expected not to prevent a Non-intended-Fit)

• Basic difference in “angular step” for the pins in this system should be 20° to enable a clear discrimination in the system

* the BAX system is not taken into account for it’s different pin lengths is not a real discriminator in the BA15; it just fit’s and there is no adequate holder definition in IEC
Alternative angles (potential options)
verification 20° offset requirement

New position – conditions:
• Discrimination to existing systems >10° (20° preferred to cover tolerances and effective discrimination)
→ From 100° to 110° a solution seems possible.

<table>
<thead>
<tr>
<th>current positions</th>
<th>Optional New positions (Delta angle)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40°</td>
</tr>
<tr>
<td>130°</td>
<td>90°</td>
</tr>
<tr>
<td>150°</td>
<td>110°</td>
</tr>
<tr>
<td>180°</td>
<td>140°</td>
</tr>
<tr>
<td>210°</td>
<td>170°</td>
</tr>
</tbody>
</table>
Evaluation proposal Valeo (reference TFSR-01-10)
Review angular positions between the pins for a 3\textsuperscript{rd} slot between 70° or 80°

Extending the 3\textsuperscript{rd} pin option for Existing cap BA15s, BAW15d/s, BAY15d and in a similar direction as proposed for the BAU15s cap result basically in two options:

- **BAU15*d/s**
  - AS PROPOSED
  - Option 1: copied as proposed for 3\textsuperscript{rd} pin in BAY15

- **BAW15*d/s**
  - Option 1: copied as proposed for 3\textsuperscript{rd} pin in BAY15
  - Option 2: mirrored as proposed for 3\textsuperscript{rd} pin in BAY15

- **BAY15*d/s**
  - Option 1: copied as proposed for 3\textsuperscript{rd} pin in BAY15
  - Option 2: mirrored as proposed for 3\textsuperscript{rd} pin in BAY15

- **BA15*d/s-3(100°/130°)**
  - Option 1: copied as proposed
  - Option 2: mirrored as propose

Alternative orientation to show 3\textsuperscript{rd} pin position with potential conflict / “near fit”
To facilitate the Full 15 mm bayonet Family,
All automotive fits need a substitute option

<table>
<thead>
<tr>
<th>Fit Substitute* (IEC “60061”)</th>
<th>Ref pin Axial position</th>
<th>2nd / 3rd pin Angle (clockwise)</th>
<th>2nd / 3rd pin (delta) Axial position</th>
<th>1st / 2nd pin Lengths</th>
<th>Extra pin Angle (clockwise)</th>
<th>Extra Pin Height/Length?</th>
</tr>
</thead>
<tbody>
<tr>
<td>B15*d</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>No need</td>
<td>No need</td>
</tr>
<tr>
<td>BA15*d/s</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>+??°</td>
<td>?</td>
</tr>
<tr>
<td>BA15*d/s-3(100°/130°)</td>
<td>0° / 0 mm</td>
<td>+130° / -130°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>+??°</td>
<td>?</td>
</tr>
<tr>
<td>BAU15*d/s (Valeo proposal)</td>
<td>0° / 0 mm</td>
<td>-150°</td>
<td>0,0 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>~70°</td>
<td>Full height (open section in holder)</td>
</tr>
<tr>
<td>BAW15*d/s</td>
<td>0° / 0 mm</td>
<td>+150°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>+??°</td>
<td></td>
</tr>
<tr>
<td>BAX15*d(/s)</td>
<td>0° / 0 mm</td>
<td>+180°</td>
<td>0,0 ±0,1 mm</td>
<td>2,00 ±0,15 / 0,78 ±0,08</td>
<td>+??°</td>
<td></td>
</tr>
<tr>
<td>BAY15*d(/s)</td>
<td>0° / 0 mm</td>
<td>180°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>+??°</td>
<td></td>
</tr>
<tr>
<td>BAZ15*d(/s)</td>
<td>0° / 0 mm</td>
<td>-150°</td>
<td>+3,2 ±0,1 mm</td>
<td>1,0 ±0,1</td>
<td>+??°</td>
<td></td>
</tr>
</tbody>
</table>
The BA(...)15 Cap holder system; Used area by the current family

Family of key functions:
- Single contact / double contact
- 2\textsuperscript{nd} pin on 180°
- 2\textsuperscript{nd} pin on +150°
- 2\textsuperscript{nd} pin on -150°
- 2\textsuperscript{nd} pin on +130° & 3\textsuperscript{rd} pin on -130°

54° is used by a single pin including the movement in the holder design

Remaining area 2 x 46° for an “extra pin” is too small:
Minimum 54° is required for a single pin, including its movement.

Hatched area’s represent the holder material required for the holder construction (enabling movement stop position for the cap)

β is occupied by bayonet 15 mm family by:
- 2\textsuperscript{nd} and 3\textsuperscript{rd} pin
- Movement of the pin in the holder design

Resulting occupied space in angular positions

Minimum 54° is required for a single pin, including its movement.
Red pin = reference pin

Green Pin extra pin (standard level)

White = elevated pin

Black Surface = reference pin plane

Light Blue surface = Axial lock on top of pins (@ 30° rotation)

Red Surface = elevated pin plane

Note: images build on Least Material Condition = maximum play acc. IEC 60061
70° and 90° versions (based on Valeo proposal)

|----------|-----------|-------------|------------|-----------|-----------|

Extra pin @ 90°

Extra pin @ 70°

Standard
Check: **BA15-LED-Holder** \( \vee \) non-LED caps

Ref pin – in new slot

BA15-LED holders

Extra pin @ 90°

Extra pin @ 70°
Check: **BA15-LED-Holder** ∨ₚ non-LED caps
Non-Ref pin – in new slot

- BA15
- BAU15
- BA15D-3
- BAY-15
- BAZ15
- BAW15

Extra pin @ 90°
Extra pin @ 70°
Check: BAU15-LED Holder- \( \vee_{s} \) non-LED caps

Ref pin in new slot

BA15 | BAU15 | BA15D-3 | BAY-15 | BAZ15 | BAW15

BAU15-LED holders

Extra pin @ 90°

Extra pin @ 70°

Close insert, elevated 2\(^{nd}\) pin => ok
Check: BAU15-LED Holder- \( \sqrt[3]{\text{non-LED caps}} \) Non-Ref pin in new slot

Caps

BA15  BAU15  BA15D-3  BAY-15  BAZ15  BAW15

BAU15-LED holders

Extra pin @ 90°

Extra pin @ 70°

Close insert, elevated 2\textsuperscript{nd} Pin=> ok
Check: BA15d-3-LED Holder - V/s non-LED caps
Ref pin in new slot

Close insert, elevated 2nd Pin=> ok
Check: BA15d-3-LED Holder /\_s non-LED caps
Non-Ref pin in new slot

BA15  BAU15  BA15D-3  BAY-15  BAZ15  BAW15

BA15d-3-LED holders

Extra pin @ 90°

Extra pin @ 70°

Close insert, => Not OK
Close insert @90°, => Not OK
Close insert, elevated 2^{nd} Pin=> ok
Close insert, elevated 2^{nd} Pin=> ok
Check: BAY15-LED Holder- ½ non-LED caps
Ref pin in new slot

BA15  BAU15  BA15D-3  BAY-15  BAZ15  BAW15

BA15d-3-LED holders
Extra pin @ 90°
Extra pin @ 70°
Check: BAY15-LED Holder - \( \frac{1}{2} \) s non-LED caps

Non-Ref pin in new slot


BA15Y-LED holders

Extra pin @ 90°

Extra pin @ 70°
Check: BAZ15-LED Holder- \( \frac{1}{2} \) non-LED caps
Ref pin in new slot

Caps


BA15Z-LED holders
Extra pin @ 90°
Extra pin @ 70°

Close insert, elevated 2\(^{nd}\) pin => ok
Check: BAZ15-LED Holder - \( \frac{1}{2} \) non-LED caps

Non-Ref pin in new slot


BA15Z-LED holders

Extra pin @ 90°

Extra pin @ 70°

Close insert, elevated slot => OK

Close insert @ 90°, elevated slot => OK

Close insert, elevated 2nd Pin => ok
Check: BAW15-LED Holder- ∨/√ non-LED caps
Ref pin in new slot

Caps

BA15  BAU15  BA15D-3  BAY-15  BAZ15  BAW15

BA15WLED holders

Extra pin @ 90°

Extra pin @ 70°

close insert
elevated slot => OK
Check: BAW15-LED Holder - \( \vee \) non-LED caps

Non-Ref pin in new slot

Caps


BAW-LED holders

Extra pin @ 90°

Extra pin @ 70°