Automotive – Light Sources (head lights)

from

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• Head light types
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History

Historic development in Automotive Head Lights; Source: [1]
Head light types

- Dim light
- Main light
- Add on head light
- Adverse weather light
- Backup light
- Spot lights
- Search head lights
Head light types

- Dim light

Head light level: 0.65 m, cone of light length: 65 m -> 1%
Head light types

- Dim light
- Main light
- Add on head light
- Adverse weather light
- Backup light
- Spot lights
- Search head lights
Head light systems

• Two head light system
• Four head light system
• Right-hand / Left-hand driving
Head light systems

- Two head light system


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Head light systems

- Four head light system

Single head light [2]
Head light systems

- Right-hand / Left-hand driving

Light radiation characteristics at dim light [2]
Reflector technology

Praboloid – head light

- Reflector technology
- Conventional head light system
- since 1910

1. Reflector
2. Light source
3. Aperture stop
4. Diffusing panel

Lateral view [2]

Top view [2]
Clearance surface reflector

- Reflector system
- Free Reflector surface
- many single surfaces, designed by a PC
- Light efficiency 45 %
- By scattering reflector
- Whole reflector is used
- 80 % increase compared with Praboloid

Lateral view [2]

Top view [2]
Reflector technology

DE – head light

- Three axis Ellipsoid
- Small construction; high power
- Middle of the 80 markets
- Projection system
- Light efficiency 36 %
- Sharp bride-dark-border

1. Reflector
2. Light source
3. Aperture stop
4. Lens
5. End panel

Lateral view [2]

Top view [2]

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Automotive – Light sources (head lights)
Reflector technology

Super DE – head lights

- Projection system
- Three axis Ellipsoid
- Clearance surface Reflector
- Light efficiency 52 %
- since 1988

1. Reflector
2. Light source
3. Aperture stop
4. Lens
5. End panel

Reflector technology

Luminous flux balance [1]

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Automotive – Light sources (head lights)
Reflector technology

Paraboloid head light [2]

Clearance surface reflector - head light [2]
Reflector technology

De head light [2]

Super De head light [2]

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Automotive – Light sources (head lights)
## Light sources

<table>
<thead>
<tr>
<th>Lampe</th>
<th>Lichtfunktion</th>
<th>Bauform</th>
<th>el. Leistung, Lichtstrom</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Fernlicht Nebellicht</td>
<td>Axialwendel</td>
<td>55 W, 800 lm</td>
</tr>
<tr>
<td>H3</td>
<td>Fernlicht Nebellicht</td>
<td>Transversalwendel</td>
<td>55 W, 1,450 lm</td>
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<tr>
<td>H4</td>
<td>Abblendlicht + Fernlicht</td>
<td>2 x Axialwendel</td>
<td>60 W/55 W 1,650 lm/1,000 lm</td>
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<tr>
<td>H7</td>
<td>Alle Scheinwerfer-Lichtfunktionen</td>
<td>Axialwendel</td>
<td>50 W, 1,500 lm</td>
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<tr>
<td>H8</td>
<td>Nebellicht (u. U. Abblendlicht)</td>
<td>Axialwendel</td>
<td>35 W, 800 lm</td>
</tr>
<tr>
<td>H9</td>
<td>Fernlicht</td>
<td>Axialwendel</td>
<td>65 W, 2,100 lm</td>
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<tr>
<td>H11</td>
<td>Alle Scheinwerfer-Lichtfunktionen</td>
<td>Axialwendel</td>
<td>50 W, 1,350 lm</td>
</tr>
<tr>
<td>HB3</td>
<td>Fernlicht</td>
<td>Axialwendel</td>
<td>60 W, 1,860 lm</td>
</tr>
<tr>
<td>HB4</td>
<td>Abblendlicht Nebellicht</td>
<td>Axialwendel</td>
<td>51 W, 1,095 lm</td>
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<tr>
<td>NDF</td>
<td>Abblendlicht Fernlicht</td>
<td>2 x Axialwendel</td>
<td>75 W/68 W 1,700 lm/1,100 lm</td>
</tr>
<tr>
<td>H13</td>
<td>Abblendlicht Fernlicht</td>
<td>2 x Axialwendel</td>
<td>75 W/68 W 1,700 lm/1,100 lm</td>
</tr>
</tbody>
</table>

List commercial Halogen lamps [3]

incoherent light sources: Automotive – Light sources (head lights)
## Light sources

<table>
<thead>
<tr>
<th>Light Source</th>
<th>Specific life $T_c$ (DIN 60810) [h]</th>
<th>Realistic life $T_c$ [h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>400</td>
<td>960</td>
</tr>
<tr>
<td>H3</td>
<td>400</td>
<td>990</td>
</tr>
<tr>
<td>H4</td>
<td>700</td>
<td>1050</td>
</tr>
<tr>
<td>H7</td>
<td>550</td>
<td>630</td>
</tr>
<tr>
<td>H7 LL = long life</td>
<td>930</td>
<td>1000</td>
</tr>
</tbody>
</table>

Duration of different Halogen Lamps [1]

**incoherent light sources:**

*Automotive – Light sources (head lights)*
incoherent light sources:

- D2S use in Projection systems
- D2R use in Reflection systems
- D1S use in Projection systems
- D1R use in Reflection systems

Xenonlamps [3]
Light sources

Increase of the illumination [1]

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Automotive – Light sources (head lights)
Light sources

Left: Xenon-Lamp spectrum; right: Halogen lamp spectrum [1]
Light sources

incoherent light sources:

Automotive – Light sources (head lights)

Xenon vs. Halogen [3]
LED head lights

- First realization in Audi R8
- Advantages:
  - Light color is more like daylight
  - Extremely long life
  - Significantly lower consumption
  - Energy saving
  - Lower operating temperature

LED Module [4]
Light sources

Full LED head light

Front of the Audi R8 [5]
Daytime running lights

• Often realized by dim lights
  relatively high fuel consumption
  100 W Light power equates approx. 0.12 l / 100 km

• LED Systems
(AFS) Adaptive Frontlighting System

- Headlamp control
- Dynamic bend lighting
- Connectable static bend light
- Connectable static bendinglight

AFS Module with Bi Xenon head lights [4]
AFS

- Town Light
- Motorway Light
- Adverse weather light

AFS head lamp control [1]

AFS head lamp control [4]

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incoherent light sources: Automotive – Light sources (head lights)

Video Varilis [3]
References

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3) http://www.hella.com/produktion/HellaDE/WebSite/Channels/Home/Home.jsp
4) http://www.al-lighting.de/
5) http://wwwaudi.de/
Thank you for your attention