M-LIGHT RANGE

LED HEADLIGHTS, MARKER & TAIL LIGHTS
MAFELEC develops and produces LED Headlights, Marker & Tail lights to equip rolling stock: Conventional trains, High-speed trains, Locomotives and Shunters, Subways and rail maintenance machines.

Having the advantage of a wider range of standard products and its ability to develop products to the entirely dedicated design, MAFELEC is your partner for your global projects.

Thanks to its optical and electronic expertise, MAFELEC designs products to standardized features and meeting stringent requirements on light intensities, shapes of beams, colourimetry and appearance. The phenomena of optical guidance, light diffusion, formatting of beams with anti-glare are as many subjects of studies conducted on our sites.

OUR INNOVATIVE SOLUTIONS

- Delayed differentiation
- Finer optical adjustments
- Obsolescence management
- Improved reliability of the status feedback
- Recording of data for maintenance assistance
- Integrated defrosting solution
- Development of anti-glare solution
- Development of interconnecting functions
In the different stages of your project, from defining the need to operation, MAFELEC brings you its expertise:

- Definition of the need and knowledge of current standards
- Calculation of the return on investment
- Adaptation to the specific characteristics of the environment and client design
- Simulation in the laboratory and on the train (client platform) for assistance to integration and the obtaining of comprehensive compliance
- Measurements on the existing park at train mid-life
- Replacement of modules if necessary
- Assessment of operation and of ageing after a few years of operation.

**OUR MEANS**

> **R&D Department**

More than 40 engineers and technicians specialized in: mechanics, electronics, electricity, optics, magnetism, acoustics and materials.

- Optimization of industrial tools
- Dedicated technical teams
- Calculation and simulation software

> **Test and qualification laboratories**

In the qualification phase, all our products undergo endurance tests in our laboratories equipped with state-of-the-art equipment: mechanical, electrical, and electromagnetic tests, resistance in harsh or specific environments (climatic tests, pressure, salt mist, etc.).

A dedicated optical laboratory including a dark room of 15m length for various optical measures.
COMBINED / COMPACT HEADLIGHT

Multi-function

Optical
Diameter 170mm
5 functions:
Full and dimmed mode Headlight,
Full and dimmed mode Marker light,
red Tail light
LED technology,
Life duration > 60,000 hours
Compliant light intensities
EN 15153-1: 2013

Mechanical
Front / rear mounting
Adjustment of the position (headlight)

Certified STI LOC & PAS 2014

Optical and mechanical variants

Glass protection / defrosting options
Headlight only, Marker light only and Tail light only
Version with cutoff
Version > 200,000 Cd
(suitable for the Asian, American and Australian markets)

Adaptation in the framework of a renovation

Mechanical and electrical adaptation
Optical measurement of the existing solution
Simulation of optical solutions
**PAR 56 Headlight**

**Optical**
- Diameter: 200 mm
- Modes: Full and dimmed mode headlight
- LED technology
- Life duration > 60,000 hours
- Compliant light intensities: EN 15153-1: 2013

**Mechanical**
- Compatible with the dimensional array
- Halogen PAR56
- Rectangular version

**Dedicated Headlight mainly for renovation**
- Different versions

**Standards**
- USA / Australia: 49 CFR 229
- India: ELRS/SPEC/PR/2004
- Japan: JIS-C-7503
COMPACT BICOLOR MARKER AND TAIL LIGHTS

Compact bicolor Marker and Tail light,
3 modes

Optical
- Diameter 110 mm
- Modes: white Marker, full and dimmed mode, red Tail light
- LED technology,
- Life duration > 60,000 hours
- Light intensities compliant with EN 15153-1: 2013

Mechanical
- Glass option
- Front / rear fitting
- Flashing amber version
- STI LOC & PAS 2014 certification

Tail light

Optical
- Diameter 170 mm
- LED technology,
- Life duration > 60,000 hours
- Light intensities compliant with EN 15153-1: 2013
The steps of a successful collaboration

1. Definition of the need
   - Study of constraints:
     - Electrical
     - Mechanical
     - Standards

2. Technical proposal
   - Mechanical & electrical integration
   - Optical simulation

3. Making a model

4. Measures on the train

5. Tests and validation

6. Industrialization

7. Manufacture

Adaptation to customer design

A modular basis allowing various forms for
“Plug and play” solutions
THE ADVANTAGE OF LED TECHNOLOGY

LED HEADLIGHT, MARKER AND TAILS LIGHTS HAVE MANY ADVANTAGES:

• Reduced power consumption:

  Compared to a halogen Headlight, the electrical power consumption is divided by 5.

  For example (Headlight function):
  For a fleet of 100 trains, operating 10 hours per day, 365 days per year, with a price of €0.12 per KwH

• A reduction of maintenance costs and improvement of the availability of trains.

  Compared to a halogen Headlight, the duration of life is 15 times higher, which divides the number of interventions as many times.

  In addition, LED technology enables you to have

• A stable luminous flux:

  It takes approximately 60,000 hours to observe a decrease in light intensity by 30%, against a few hundred hours for halogen.

• Low dissipation needed
  Allowing designing lightweight and compact products.

• A flexible arrangement, adapting to all designs

• Other strong points

  High mechanical resistance (shock and vibration)
  Not very sensitive to low temperatures
  Insensitive to being switched on and off repeatedly
  Instant lighting
  Progressive end of life

  No mercury
  No ultra-violet
**SUMMARY TABLE**

<table>
<thead>
<tr>
<th>Multi-functions</th>
<th>Headlights</th>
<th>Marker &amp; Tail lights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 170mm</td>
<td>Ø 170mm</td>
<td>Ø 110mm</td>
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<tr>
<td>Ø 170mm</td>
<td>Ø 120mm</td>
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<tr>
<td>Rectangular</td>
<td>PAR56</td>
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### Conventional trains / High speed / Locomotives

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<tr>
<td>Anti-glare</td>
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<tr>
<td>Australia</td>
<td>AS 7531.3-2007 lower projector</td>
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<td>USA</td>
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### Subway systems

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<th>Headlight</th>
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<tbody>
<tr>
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<td>Flood light</td>
<td>Flood light</td>
<td>Flood light</td>
<td>Tail light</td>
<td>Tail light</td>
<td>Flashing orange light</td>
</tr>
</tbody>
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**MAFELEC** 9
CONTROL PANELS & ELECTRICAL CABINETS

- Multi-technology dashboards
- Control & signalling auxiliaries
- Special switches
- Signalling boxes
- VACMA pedal
- Emergency push buttons
- Circuit Breakers
- Power supply sockets

INFRASTRUCTURE

- Track lights
- Signalling boxes
- Power supply boxes
- Control panels
- Controls of bridges, elevators & winches

FRONT & REAR LIGHTING OF THE TRAIN

- Combined headlights
- Headlights
- Marker & Tail lights
**POWER & ELECTRICAL DISTRIBUTION**
- Power switches (up to 2,000 Amps)
- Cut-off switches
- Terminal blocks
- Isolators and partition bushes

**CARRIAGES**

**Inside**
- Push buttons and indicator lights (M-Door range) for:
  - Door systems
  - Toilet
  - Disabled persons space
  - Emergency call
  - Grab handles
  - Power supply sockets
  - Pictograms & indicator lights
  - Buzzers

**Outside**
- Door indicator lights
- Brake indicators
- Level indicators
- Door opening controls
- Bogie lighting