Detailed Manual of Trucks and Trailers
Underrun Protective Devices
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1. **Introduction**

Due to what SASO has observed of car accidents where small vehicles get under trucks or trailers, leading to human and material loss, SASO has studied the international, national, regional standard specifications and referential writings related to underrun protective devices (UPDs) of trucks and trailers.

As a result, SASO has issued the following Saudi technical regulations:

1. Saudi technical regulation No. SASO GSO 2112 entitled "Motor vehicles - front underrun protective devices (FUPDs) for trucks and their testing methods" that based on the European regulation No. ECE R 93.
2. Saudi technical regulation No. SASO GSO 2113 entitled "Motor vehicles - lateral underrun protective devices (LUPDs) for trucks and trailers and their testing methods" that based on the European regulation No. ECE R 73.
3. Saudi technical regulation No. SASO GSO 2114 "Motor vehicles - rear underrun protective devices (RUPDs) for trucks and trailers and their testing methods" that based on the European regulation No. ECE R 58.

These regulations require all trucks and trailers to be equipped with front, lateral and rear UPDs in order to protect small vehicles from getting under trucks when collision occurs.

In addition to the technical regulations mentioned above, SASO has prepared this manual to clarify technical standards of UPDs in detail in order to clarify the way of achieving the Saudi technical regulations requirements in the right way for the beneficiaries.
2. General Technical Standards Associated with UPDs

2.1 Phosphoric Tapes

- The phosphoric tape should be on the UPD, so that it can be seen at night or when the visibility is not clear.

![Phosphoric tapes](image)

Figure 1: Phosphoric tapes

The phosphoric tape should be strong but should not be metallic. It should have a reflective layer with prismatic lens. It should also be yellow, or black and yellow, and should be self-adhesive and strong adhesive. It should maintain the reflection and color factors and be resistant to shrinkage, water and environmental factors. It should be wear resistant. It should also be ultraviolet stable and compatible with the European regulation (UN/ECE 104 CLASS C) or any equivalent.

![The way of fixing the phosphoric tape on the lateral device of the truck](image)

Figure 2: The way of fixing the phosphoric tape on the lateral device of the truck
Figure 3: The way of fixing the phosphoric tape on the rear device of the truck

- Width of the phosphoric tape used on the UPDs

<table>
<thead>
<tr>
<th>Lateral Underrun Protective Device</th>
<th>Rear Underrun Protective Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucks &lt; 12 tons</td>
<td>Trucks &gt; 12 tons</td>
</tr>
<tr>
<td>Trailers &lt; 10 tons</td>
<td>Trailers &gt; 10 tons</td>
</tr>
<tr>
<td>50 mm</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

### 2.2 Material Used in Making UPDs

- The mechanical properties of the underrun protective device's material shall be as follows:

<table>
<thead>
<tr>
<th>Material Used</th>
<th>Type</th>
<th>Min. Yield Strength</th>
<th>Min. Tensile Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>Hot Rolled</td>
<td>350 N/mm²</td>
<td>480 N/mm²</td>
</tr>
<tr>
<td>Aluminum Alloy</td>
<td>2000 Series (Al-Cu Alloy)</td>
<td>350 N/mm²</td>
<td>480 N/mm²</td>
</tr>
</tbody>
</table>

### 2.3 Bolts Used for Installation of UPDs

- The minimum mechanical properties of bolts should be as follows:

<table>
<thead>
<tr>
<th>Material Used</th>
<th>Property class</th>
<th>Min. Proof Strength</th>
<th>Min. Yield Strength</th>
<th>Min. Tensile Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-carbon martensite, Q&amp;T</td>
<td>10.9</td>
<td>830 N/mm²</td>
<td>940 N/mm²</td>
<td>1040 N/mm²</td>
</tr>
</tbody>
</table>
2.4 Welding Material Used for Installation of UPDs

- If welding is used, the section between the UPD and the bridge/support or between the bridge/support and the truck or trailer chassis should be fully welded as shown in Figure 4 below, knowing that (h) means welding thickness.

A) Welding a bar having a circular section to a flat surface.

B) Welding a bar having a rectangular section to a flat surface.

Figure 4: Approved welding shape
- Welding thickness (h) should be compatible with the truck chassis and the UPD and according to the correct methods followed in welding.

<table>
<thead>
<tr>
<th>t_c = h &amp; t_h = h when t_h = t_c</th>
<th>t_c &lt; h &amp; t_h &lt; h</th>
<th>t_c &gt; h &amp; t_h &gt; h</th>
</tr>
</thead>
<tbody>
<tr>
<td>t_c &gt; h &amp; t_h = h when t_c &gt; t_h</td>
<td>Not a correct welding</td>
<td>Not a correct welding</td>
</tr>
</tbody>
</table>

Where

h = welding thickness

t_c = thickness of the truck or trailer chassis

t_h = thickness of the UPD bridge or support

- The minimum requirements for the welder wire's material used in welding:

<table>
<thead>
<tr>
<th>AWS Electrode Number</th>
<th>Min. Yield Strength</th>
<th>Min. Tensile Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>E90 xx</td>
<td>531 N/mm²</td>
<td>620 N/mm²</td>
</tr>
</tbody>
</table>
3. General Standards of FUPDs for Trucks

- The Saudi technical regulation No. SASO GSO 2112: 2012 "Motor vehicles - front underrun protective devices (FUPDs) for trucks and their testing methods".
- The trucks that carry goods weighted over 3.5 tons including tank trucks, cranes and the mobile workshops should be equipped with effective front underrun protective devices.

3.1 Technical Requirements of FUPDs

- The front underrun protective device (FUPD) shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle, and it shall satisfy certain dimensional requirements. These shall be checked in accordance with the test procedure and conditions specified in this Regulation.
- The device may be so designed that its position at the front of the vehicle can be varied. In this case, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded.
- It shall be possible for the operator to vary the position of the device by applying a force not exceeding 400 Newton.
- The maximum mass of a vehicle type for which the FUPD to be installed shall not exceed the value indicated on the FUPD designed for the vehicle.
- The section height of the FUPD cross-member shall not be less than 100 mm for vehicles having a maximum mass between 3.5 and 12 tons, and not less than 120 mm for vehicles having maximum mass exceeding 12 tons.
- The maximum ground clearance with respect to the underside of the FUPD shall be no more than 400 mm, between the two points (P₁) in the installed condition.
- Outboard of each point (P₁) of the above mentioned height may be greater than 400 mm providing the underside is not above a plane passing through the underside of the FUPD directly below the point (P₁) and forming a slope at 15° above the horizontal.
- The FUPD shall have sufficient strength that the horizontal distance measured in the rearward direction between the foremost part of the vehicle after the application of the test forces and the test ram contact surface on the vehicle does not exceed 400 mm.
The lateral extremities of the cross-member shall not bend to the front or have a sharp outer edge; this condition is fulfilled when the lateral extremities of the cross-member are rounded on the outside and have a radius of curvature of not less than 2.5 mm.

The outermost surfaces of every front guard installation shall be essentially smooth or horizontally corrugated save that domed heads of bolts or rivets may protrude beyond the surface to a distance not exceeding 10 mm. (see Figure 7 and 8).
The width of the FUPD shall at no point exceed the width of the mud supporters nor shall it be more than 100 mm shorter.

Points $P_1$ are located up to 200 mm from the longitudinal planes tangential to the outermost points of the tires on the front axle (excluding the bulging of the tires close to the ground).

Points $P_2$ are symmetrical to the median longitudinal plane of the vehicle at a distance from each other of 700 to 1,200 mm inclusive. The exact positions shall be specified by the manufacturer (positions of the vehicle chassis).

The height above the ground of points $P_1$ and $P_2$ shall be defined by the vehicle manufacturer within the lines that bound the front face of the device. The height shall not, however, exceed 445 mm when the vehicle is unloaded.

$P_3$ is in the vertical longitudinal median plane of the vehicle.
3.2 General Dimensions for the Cross-Sectional Area of FUPD

- Main models for the cross-sectional area of FUPD as in Figure 10.

Figure 10: Main models for cross-sectional area of the front barrier.
Dimensions of the cross-sectional area

Trucks with a maximum weight between 3.5 to 12 tones.

<table>
<thead>
<tr>
<th>Type of cross-sectional area</th>
<th>minimum D (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C- Section</td>
<td>100</td>
<td>50</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Rectangle section</td>
<td>100</td>
<td>50</td>
<td>-----</td>
<td>5</td>
</tr>
</tbody>
</table>

Trucks exceeding weight 12 tones.

<table>
<thead>
<tr>
<th>Type of cross-sectional area</th>
<th>minimum D (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C- Section</td>
<td>120</td>
<td>60</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Rectangle section</td>
<td>120</td>
<td>60</td>
<td>-----</td>
<td>5</td>
</tr>
</tbody>
</table>

3.3 Different Main Models of FUPDs

The underrun protective device consists of front underrun protective device and the carrier bridge that connects the front underrun protective device to the truck chassis as in Figure 11.

![Figure 11: A model of FUPD and its carrier bridge](image)
3.3.1 Front Underrun Protective Device (FUPD)

- Location at where the place of FUPDs attached to the carrier bridges

![General model of truck FUPD](image)

Figure 12: General model of truck FUPD

![Front view illustrating the place of FUPD is fitted to the carrier bridge](image)

Figure 13: Front view illustrating the place of FUPD is fitted to the carrier bridge

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>L (mm)</th>
<th>Optional to add a support between bridge and FUPD</th>
<th>Must add a support between bridge and FUPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>1200-700</td>
<td>Less or equal to 400mm</td>
<td>The distance is over 400mm</td>
</tr>
<tr>
<td>Aluminum Alloy</td>
<td>1200-700</td>
<td>Less or equal to 400mm</td>
<td>The distance is over 400mm</td>
</tr>
</tbody>
</table>
3.3.2 Carrier Bridge Connecting FUPD to Truck Chassis

- When the truck has a chassis of (I-section beam), this type of carrier bridge is used.

![Figure 14: Model of carrier bridge used with (I-section beam) truck chassis](image1)

- When the truck has a chassis of (C-section beam), these types of the carrier bridge is used.

![Figure 15: Models of carrier bridge used with (C-section beam) truck chassis](image2)
3.3.3 Adding Support to Carrier Bridge between FUPD and Truck Chassis

- If the distance (W) after fixing the carrier bridge on the FUPD exceeds 400mm, a rear support shall be installed as shown in Figure. 16.

![Figure 16: Support must be added between FUPD and carrier bridge when distance (W) exceeds 400 mm](image)

3.3.4 Connecting FUPD Parts

- Connection can be done by welding or using bolts, as clarified in item 2.4. For bolts, they shall be as follows:

<table>
<thead>
<tr>
<th>Trucks with a maximum weight between 3.5 to 12 tones</th>
<th>Trucks exceeding weight 12 tones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Bolts</td>
</tr>
<tr>
<td></td>
<td>Number of Bolts</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>
3.3.5 Sample of FUPDs Models

For further details, see (Annex A).

Figure 17: Models of truck FUPDs
4. General Standards of RUPDs for Trucks and Trailers

- The Saudi technical regulation No. SASO GSO 2114 "Motor vehicles - rear underrun protective devices (RUPDs) for trucks and trailers and their testing methods".
- All vehicles carrying goods, including tankers, mobile cranes, mobile workshops, trailers and semi-trailers of maximum weight exceeding 3.5 tonnes shall be equipped with RUPDs to offer effective protection against underrunning in the event of rear collision with passenger cars.

4.1 Technical Requirements of RUPDs

- Ground clearance shall not exceed 550 mm.
- The section height of the RUPD member shall not be less than 100 mm.
- Lateral extremities of the cross-member shall not bend to the rear or have a sharp outer edge. This requirement can be considered as complied if the lateral extremities of the cross-member are rounded on the outside and have a radius of curvature of not less than 2.5mm.
- The width of the RUPD shall not, at any point, exceed the width of the rear axle measured at the outermost points of the wheels.
- RUPD must be as close as possible to the back of the track or trailer.

![Diagram of RUPD specifications](image)

Figure 18: Rear view of a truck shown technical specifications of RUPD

- The width of the RUPD shall not be more than 100mm shorter on either side than the width of the rear axle measured at the outermost points of the wheels.
• The RUPD may be so designed that its position at the rear of the vehicle can be varied. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded.

• The RUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle and be connected to the side-members of the vehicle body.

• This requirement shall be so satisfied when the horizontal distance measured in between the RUPD and the rear extremity of the vehicle does not exceed 400mm, at any of the points, before or after the test forces are applied ($P_1$, $P_2$, and $P_3$).

• The RUPD may be divided to be of more than one part if it blocks the lift mechanism platform. The lateral distance between the RUPD components shall not exceed 25mm and the effective surface shall be at least 350cm$^2$. However, in the case of vehicles having a width of less than 2000 mm and where it is impossible to achieve the above requirement, the effective surface may be reduced if the resistance criteria are met (see Figure 19).

![Figure 19: Rear view of a truck with load lifting platform indicating technical specifications of RUPDs](image)

• If the RUPD is designed so that its position at the rear of the vehicle can be varied, there shall be a guaranteed method of securing it in the service position, and making sure the force applied by the operator to vary the position of the RUPD does not exceed 400N.
• The RUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle.

• When a horizontal force of 100kN is applied to the RUPD, the distance between the back part of the RUPD and the rear extremity of the vehicle shall not exceed 400mm at any of the points where the test forces are applied.

• The RUPD shall be installed as far as possible at the end of the truck.

• If the device is installed on a vehicle body which itself extends the width of the rear axle, the requirement that the width of the RUPD must not exceed that of the rear axle shall not apply.

• The RUPD shall offer adequate resistance to forces applied parallel to the axis of the vehicle and be connected, when in the service position, to the side-members of the vehicle body or any other similar part.

4.2 General Dimensions for the Cross-Sectional Area of RUPDs

• The main cross-section area for the RUPD are shown in Figure 20.

![Figure 20: Main cross-sectional area models of RUPD](image)

• Dimensions of the cross-sectional area

For trucks with a weight less than 12 tones, and trailers with a weight less than 10 tones.

<table>
<thead>
<tr>
<th>Model Cross-sectional Area</th>
<th>D (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C- section</td>
<td>100</td>
<td>50</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Rectangle section</td>
<td>100</td>
<td>50</td>
<td>------</td>
<td>5</td>
</tr>
<tr>
<td>Circle section</td>
<td>100</td>
<td>------</td>
<td>------</td>
<td>5</td>
</tr>
</tbody>
</table>
4.3 Different Main Models of RUPDs

4.3.1 A Model of RUPD

- It consists of RUPD and the carrier bridge that connects the RUPD to the truck chassis as in Figure 21.

![Figure 21: Model of RUPD for a truck or trailer](image)

- Location at where the RUPDs attached to the carrier bridges

![Figure 22: Front view showing the position of installing the RUPD to the carrier bridge](image)

- A table clarifying the position of installing RUPD to the carrier bridge.

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>L (mm)</th>
<th>W (mm) Optional to add a support between bridge and FUPD</th>
<th>W (mm) Must add a support between bridge and FUPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>700-1200</td>
<td>Less or equal 400</td>
<td>Over 400</td>
</tr>
<tr>
<td>Aluminum Alloy</td>
<td>700-1200</td>
<td>Less or equal 400</td>
<td>Over 400</td>
</tr>
</tbody>
</table>
4.3.2 Carrier Bridge Connecting RUPD to Truck or Trailer Chassis

- When a truck or trailer has a chassis of (I-section beam), the type used for the carrier bridges is:

![Figure 23: Sample of a carrier bridge used with (I-section beam) chassis truck or trailer](image)

- When a truck or trailer has a chassis of (C-section beam), the type used for the carrier bridges is:

![Figure 24: Sample of a carrier bridge used with (C-section beam) chassis truck or trailer](image)

4.3.3 Adding Support to Carrier Bridge between RUPD and Truck or Trailer Chassis

In case the distance after installing the RUPD to the carrier bridge known as (W), exceeds 400mm, a rear support should be added to the bumper as in Figure 25. Note that the beam is installed between the carrier bridge and the RUPD outer edges.
Figure 25: A supporter is installed between the RUPD and carrier bridge when distance, known as (W), exceeds 400mm.

4.3.4 Connecting RUPD Parts

- Connection can be done by welding or using bolts as clarified in item 2.4. For bolts, they should be as follows:

<table>
<thead>
<tr>
<th>Number of Bolts</th>
<th>Bolt Diameter (mm)</th>
<th>Number of Bolts</th>
<th>Bolt Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>16</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>
4.3.5 Models of RUPDs for Truck and Trailer

- For further details, see (Annex B).

Figure 26: Models of truck and trailer RUPDs
5. General Specifications for LUPDs for Trucks and Trailers

- The Saudi technical regulation No. SASO GSO 2113: 2012 entitled "Motor vehicles - lateral underrun protective devices (LUPDs) for trucks and trailers and their testing methods”.
- All vehicles carrying goods with a weight over 3.5 tones, including tankers, mobile cranes, mobile workshops, trailers and semi-trailers shall be designed to offer effective protection to unprotected road users against the risk of falling under the sides of the vehicle and being caught under the wheels.

5.1 Technical Requirements for LUPDs

- The LUPD shall not exceed the overall width of the vehicle.
- The outer surface of the LUPD shall be smooth, and so far as possible continuous from front to the rear.
- Adjacent parts may overlap, provided that the overlapping edge faces rearwards or downwards, so that the rearward part does not protrude outboard of the forward part.
- The device may consist of a continuous flat surface or of one or more horizontal rails or a combination of surface and rails.
- Domed heads of bolts or rivets may protrude beyond the surface to a distance not exceeding 10 mm provided that they are smooth.
- The LUPD shall be rigid and shall be mounted securely without any vibration in normal use of the vehicle.
- The LUPD shall not be used for the attachment of brake, air or hydraulic pipes.
- The lower edge of the LUPD shall at no point be more than 550 mm above the ground.
- The upper edge of the LUPD shall not be more than 350 mm below that part of the structure of the vehicle.
- The distance between the side guard's rearward end and the outermost edge of the tire shall not exceed 300 mm.
The height of rails, used in LUPDs for trucks with a weight less than 12 tones and trailers with a weight less than 10 tones, shall not be less than 50 mm.

The height of rails, used in vehicles with a weight less than 12 tones and trailers with a weight less than 10 tones, shall not be less than 100 mm.

The distance between rails shall not exceed 300 mm.

The LUPD’s rearward end shall not be more than 30 mm in board from the outermost edge of the rear tires, over at least the rearmost 250 mm.

The main part of the LUPD’s outer surface shall not be more than 120 mm inboard from the outer most plane of the vehicle.

The forward edge of LUPD shall be constructed as follows:
  - On a motor vehicle: distance from the outer surface of the tire shall not exceed 300 mm.
  - On a drawbar trailer: distance from the outer surface of the tire shall not exceed 500 mm.
5.2 General Standard Dimensions for the Cross-Sectional Area of LUPDs

- The main cross-section area for the LUPD are shown in Figure 29.

- Dimensions of cross-sectional area
  For trucks with a weight less than 12 tones and trailers with a weight less than 10 tones.

<table>
<thead>
<tr>
<th>Model Cross-sectional Area</th>
<th>D (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-section</td>
<td>50</td>
<td>25</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Rectangle section</td>
<td>50</td>
<td>25</td>
<td>-------</td>
<td>2</td>
</tr>
<tr>
<td>Round section</td>
<td>50</td>
<td>-------</td>
<td>-------</td>
<td>2</td>
</tr>
</tbody>
</table>
For trucks with a weight more than 12 tones and trailers with a weight more than 10 tones.

<table>
<thead>
<tr>
<th>Model Cross-sectional Area</th>
<th>D (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-section</td>
<td>100</td>
<td>50</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Rectangle section</td>
<td>100</td>
<td>50</td>
<td>------</td>
<td>2</td>
</tr>
<tr>
<td>Round section</td>
<td>100</td>
<td>------</td>
<td>------</td>
<td>2</td>
</tr>
</tbody>
</table>

5.3 Different Main Models of LUPDs

5.3.1 Models of LUPD

- It consists of LUPD and the carrier bridge that connects the LUPD to the track or trailer chassis as shown in Figure 30.

![Figure 30: Model of LUPD for a truck or trailer.](image)

- LUPD distances between carrier bridge.

![Figure 31: View showing the position of installing the LUPD to the carrier bridge](image)
A table clarifies the position of installing the LUPD to the carrier bridge

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>X (mm)</th>
<th>Maximum Y (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>900 ± 100</td>
<td>500</td>
</tr>
<tr>
<td>Aluminum Alloy</td>
<td>900 ± 100</td>
<td>500</td>
</tr>
</tbody>
</table>

5.3.2 Carrier Bridge Connecting LUPD to Truck or Trailer Chassis

Figure 32: Carrier bridge models used to connect the LUPD to the chassis of the truck or trailer

Measurements of the underrun protective device carrier bridge

<table>
<thead>
<tr>
<th>Cross-sectional area of barrier bridge</th>
<th>Minimum d (mm)</th>
<th>Minimum t (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square Section</td>
<td>40 x 40</td>
<td>3</td>
</tr>
<tr>
<td>Round Section</td>
<td>40</td>
<td>3</td>
</tr>
</tbody>
</table>

5.3.3 Connecting LUPD Parts

Connection can be done by welding or using bolts as clarified in item 2.4. For bolts, they should be as follows:

<table>
<thead>
<tr>
<th>Trucks with a weight less than 12 tones</th>
<th>Trucks with a weight more than 12 tones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailers with a weight less than 10 tones</td>
<td>Trailers with a weight more than 10 tones</td>
</tr>
<tr>
<td>Number of Bolts</td>
<td>Bolt Diameter (mm)</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>4</td>
<td>12-15</td>
</tr>
</tbody>
</table>
5.3.4 Models of Truck and Trailer LUPDs

- For further details, see (Annex C).

Figure 33: Models of lateral truck and trailer LUPDs
Notes:

- All details mentioned in this manual are clarified in the Saudi technical regulations concerning underrun protective devices for trucks and trailers, previously mentioned.
- The edges of the front, lateral, and rear underrun protective devices should be closed and never kept open.
- The execution should be as per industry principles.
Annex (A)

Models of FUPDs in Trucks
Annex (B)

Models of RUPDs in Trucks and Trailers
Annex (C)

Models of LUPDs in Trucks and Trailers
LUPD can be installed to the carrier bridge using the Circular Shaped metal holder with bolts or by welding.

Circular Shaped metal holder
A section explaining how to install the LUFD to the carrier bridge using the metal holder and bolts.
LUPD can be installed to the carrier bridge using the square-shaped metal holder with bolts or by welding.

Square-shaped metal holder
LUPD can be installed to the carrier bridge using the square shaped metal holder with bolts or by welding.
Annex (D)

Models of Carrier Bridges and Supporters used in Connecting UPD to Chassis
Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.

- Identifying the distance (H) and (P) differs from truck or trailer to another. (P) shall not exceed 260mm. Angle e shall not be less than 18°, or more than 45°.
- To identify the number of bolts needed to install the carrier bridge to the truck or the trailer body, see pages 15 & 22.
- The position of the bolts may differ from the figure. In this case, the distance between them shall be taken into account.

The execution shall be as per industry principles.
Welding may be used instead of bolts. In this case, adhere to the specifications set forth in this manual.
Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.

- The execution shall be as per industry principles.
- Welding may be used instead of bolts. In this case, adhere to the specifications set forth in this manual.

- Identifying the distance (H) and (P) differs from truck or trailer to another, (P) shall not exceed 260mm. Angle α shall not be less than 15°, or more than 45°.
- To identify the number of bolts needed to install the carrier bridge to the truck or the trailer body, see pages 15 & 22.
- The position of the bolts may differ from the figure. In this case, the distance between them shall be taken into account.
Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.

- The execution shall be as per industry principles.
- Welding may be used instead of bolts. In this case, adhere to the specifications set forth in this manual.

- Identifying the distance (H) and (P) differs from truck or trailer to another. (P) shall not exceed 260 mm. Angle θ shall not be less than 18° or more than 45°.
- To identify the number of bolts needed to install the cross bridge to the truck or the trailer body, see pages 15 & 22. If the event of (I beam holder) bolts shall be used in pairs.
- The position of the bolts differs in case of using (I beam holder) measurements over 120 mm.
*Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.
Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.

- The execution shall be as per industry principles.
- Welding may be used instead of bolts. In this case, adhere to the specifications set forth in this manual.

- Identifying the distance (H) and (P) differs from truck or trailer to another. (P) shall not exceed 260mm. Angle e shall not be less than 18°, or more than 45°.
- To identify the number of bolts needed to install the carrier bridge to the truck or the trailer body, see pages 15 & 22.
- The position of the bolts may differ from the figure. In this case, the distance between them shall be taken into account.
Dimensions in this figure represent overall view in mm, and may differ from one truck or trailer to another.

- The execution shall be as per industry principles.
- Welding may be used instead of bolts. In this case, adhere to the specifications set forth in this manual.

- Identifying the distance (H) and (P) differs from truck or trailer to another. (P) shall not exceed 260mm. Angle e shall not be less than 18° or more than 45°.
- To identify the number of bolts needed to install the corner bridge to the truck or the trailer body, see pages 15 & 22.
- The position of the bolts may differ from the figure. In this case, the distance between them shall be taken into account.

L Shape C Beam Holder with a support

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