Assembly instructions - Vehicle restraint system

passco L1 H1-A-W4/N2-A-W3 (ES 2.00)

1. General information

The process goal is the fulfilment of the requirements of the European standard EN 1317 ff for the assembly of vehicle restraint systems.

These process instructions are to be used for vehicle restraint systems labelled with CE symbols.

If deviations from these requirements occur during the assembly without consulting the manufacturer, then the liability for defects in the construction product will be transferred to the executing company.

2. Responsibility

2.1 These process instructions apply for all divisions of the PASS + CO corporate group which are performing the assembly work.

2.2 The heads of the divisions are to ensure that the employees are familiar with the process instructions and that they apply them to the work.

If deviations from these requirements occur during the installation, then the liability for defects in the construction product will be transferred from the manufacturer to the assembler.

3. Regulations

3.1 Components from manufacturers produced in accordance with RAL-RG 620 are interchangeable and compatible with vehicle restraint systems bearing the CE symbol.

3.2 Vehicle restraint systems bearing the CE symbol are to be assembled in accordance with the present test reports.

3.3 The assembly is to be supervised and documented by a competent assembly professional, e.g. in accordance with the internal supervision report of the RAL-RG 620 quality and testing instruction (Annex 9)

3.4 Crash barrier beams must overlap in the direction of travel. Sigma posts are mounted with the closed side facing traffic. Please ensure in each case that the appropriate bracket is used for the A-profile or the B-profile. Crash barrier beams with A or B profiles can equally be used.

3.5 All crash barrier structural components are to be professionally stored and handled. They are to be protected against dirt, corrosion and damage. Structural components laid out for the assembly are to be installed within a short time. On operating routes where the work site is for a shorter duration, only those material quantities which can be installed within one day are to be laid out.

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3.6 A pneumatic or hydraulic piling implement and a hammer (the post heads must not excessively deform during pounding) are used to insert the posts in the ground. A pneumatic pile hammer should have impact energy per stroke of at least 420 Nm at 6 bar. A press-down force of at least 70 bar is recommended for hydraulic piling devices.

3.7 Information must be gathered about the supply lines (cables, pipes, lines etc.) before the piling work is started. The cable protection instructions of the supplier must be observed.

3.8 Information on the soil classes is to be considered. Driving the posts into soil class 1-2 is not permitted. If such ground conditions are found, then special measures are to be agreed on with the customer. This can involve a ground replacement or the installation of strip footing.

In soil class 3-5, the posts are to be driven in with a clamping length of 1.2 m. In exceptional cases, the clamping length of the single posts can be shortened to 1.00 m. Drilling must be done if the piling using the aforementioned devices takes longer than 3 minutes, whereby deformation or damage to the post heads occurs, or in the case of lateral springing.

Drilling is generally required in soil class 6 and 7 in the case of embedded slag, concrete, or bituminous paved surfaces. In the case of longer-than-average drilling times, the clamping length of the single posts can be shortened to 0.80 m. Drilled holes are to be filled with sand and the posts then driven in.

The posts may be shortened if pile-driving obstacles outside of the defined soil classes are encountered. This, however, requires the written authorization of the customer. If no written authorization is granted for shortening the posts, then special measures (buried or flat posts, strip footing or similar) are to be agreed on.

The minimum clamping lengths must be maintained depending on the soil classes.
Soil class 3-5: 1.00 m anchoring depth
Soil class 6-7: 0.80 m anchoring depth

3.9 The post clearance of 4.00 m may not be exceeded. If a post cannot be driven in at the position provided, e.g. due to a duct or supply line, then it must be displaced and an additional post driven in. The posts are to be driven in vertically. Deviations of 5 cm are permitted from every side based on the height of the post above the terrain. Pile-driving obstacles in the soil (such as stones, roots, etc.) can cause individual posts to distort more heavily or lateral springing can occur. If this occurs with more than 20% of the posts, then action must be taken and drilling carried out in accordance with soil class 6 and 7. The system installation is only permitted up to a maximum substructure slope 1:3.

3.10 Setting the safety barrier posts directly in concrete is prohibited.

3.11 If synthetic mortar (PC) or polymer-modified material (PCC) is used, then it must conform to TL BE-PCC.

3.12 All anchoring parts are hot-dip galvanized in accordance with RAL-RG 620. Stainless steel anchors may not be used.

If composite adhesive anchors are used, then the installation instructions of the anchor manufacturer are to be strictly followed.
- The anchor strength must at least conform to quality 4.6 or 5.8.
- The concrete quality/strength must conform to at least C20/25.
- The anchor may only be installed by personnel with appropriate training.
- Only those components supplied by the manufacturer may be used; the exchange of individual components (e.g. mortar cartridges) is not permitted.
- The drilled hole depth (= anchoring depth) of 125 mm must be complied with; shortening the anchor rod in the case of possible drilling obstacles is not permitted. When properly placed, the threaded part of the anchor rod may not protrude more than 15 mm beyond the nut.
- Edge and joint clearances of > 15 cm are to be maintained.
- The drilled hole is to be blown out at least 4x with the manual pump or oil-free compressed air (ISO 8573-1, Tab. 7.3, Oil class 4, < 5mg/m³); any possibly existing water is to be fully removed.
- The minimum waiting times for the pole installation depending on temperature of the anchoring base are to be maintained in accordance with the installation instructions of the anchor manufacturer. Only then can the posts be fastened (torque = 80 Nm). Moreover, the installation of the shear connector is possible in exceptional cases at -10°C to -6°C with a waiting time of 24 h.

At least one of the anchors must be loaded with a pull-out force of 30 kN to check for correct anchoring and tightened after relief of the loading with the corresponding torque of 80 Nm. No noteworthy slippage may occur here. If an anchor cannot meet the control conditions, then all of the anchors of the affected post and all of the anchors of the neighbouring posts must be checked.

Either the Hilti oval gasket is to be used for sealing the slots of the base plate or a backfill and covering are to be done without.

3.13 The insertion height is generally 75 cm ± 3 cm based on the upper edge of the road. The distance of the leading edge from the edge of the paved surface should generally be 50 cm.

Deviating from this, the insertion height directly in front of the system must be determined in case the leading edge of the safety barrier:
1) is mounted with a clearance a > 60 cm from the edge of the paved surface, or
2) is mounted to the edge of the paved surface with a clearance of a > 30, whereby the shoulder has a cross slope of more than 12%.

3.14 Curves with a height difference of more than 7.5 cm are to be avoided. Please proceed as follows if higher curves of up to 20 cm are already available which can no longer be removed. If possible, the vehicle restraint systems are to be arranged in such a way that the leading edge of the rail is flush with the leading edge of the respective curve. The installation height is then based on the upper edge of the road. At a distance of > 30 cm from the leading edge of the curve, the height of the crash barrier beam is to be based on the upper edge of the top curve. Deviating installation heights are to be coordinated with the customer and require a written confirmation.

3.15 Only those screws which demonstrably have the same quality as in the start-up test may be used. The screws must sit vertically in the structural parts to be connected and be properly tightened.

The screws M 10x45 between the crash barrier beams and the posts are to be tightened manually. This corresponds to a torque achieved when a weight of around 25-30 kg is applied to a ratchet, 1/2" connection.
The screws for the M 16x27 butt joint are to be screwed together with a torque of at least 70 Nm, but no more than 140 Nm.

The use of an impact wrench which can be set to the respective torque with a maximum torque of 500 Nm is recommended.
Tools required for screwing together:
Socket
- for M16 SW 24 mm,
- for M10 SW 17 mm or SW 16 mm (depending on the screw standard).
Screw-wrench
- for M10 SW 17 mm or SW 16 mm (depending on the screw standard).

Please note with the screwed butt joints that the lug of the round-headed bolts must be placed in the
tip of the drip hole.

In general, only hot-galvanised screws may be used. The strength class 4.6 may neither be exceeded
nor fallen short of.

Screw joint material which was already installed once may not be re-used.

3.16 The following must be observed if components need to be adapted at the construction site:

- Use a saw of cut-off grinder to cut to length; deburr the cut edges
- Drill the holes professionally
- Maintain hole diameters and clearances in accordance with the specifications of the applicable
  RAL-RG 620-Drawing
- Use zinc dust coating (according to DIN ISO 1461) to protect the edges against corrosion

Thermal processing such as welding or flame cutting is not permitted.

3.17 Crash barrier beams must be installed without tension. Pre-bent rails (referred to as radius rails)
must be used in curves with radii < 30 m. Radii are available in increments of 2.5 m:

25 m – 22.5 m – 20 m – 17.5 m – 15 m – 12.5 m – 10 m – 7.5 m – 5 m – 2.5 m

Convex radii are to be used in external curves, concave radii in internal curves. Bending of crash bar-
rier beams at the construction site or during installation which is so excessive that permanent deforma-
tions occur is not permitted.

Care must particularly be given to concave radii (internal curves) to ensure that the joint overlap in
screw connections does not gape apart. It is recommended that the joint overlap be screwed together
before the rail is attached to the posts.

- Expansion of the holes, such as due to enlargement with a drift, is not permitted.

3.18 Pivots with a tilt of 1:20 – in exceptional cases of 1:12 – are permitted. If the start of the crash
barrier stretch is located on a rising slope, then it may be laterally pivoted and integrated in the cut
slope, taking into account an installation height of no more than 85 cm. This also applies for crash
barrier stretches in the transition area of the cut/embankment. A post clearance of 1.33 m is required
for this in the slope area of the first two fields.

3.19 ESP/4.0 cannot be used in water conservation areas since at least containment level H1 is re-
quired here.
3.20 Depending on the vehicle restraint system, only suitable start and end structures as well as transition structures are to be installed. Evidence must be provided here that the resulting longitudinal forces are absorbed (test report or verified static computation).

Written confirmation by the manufacturer is required for the connection to other protective devices.

3.21 The installation of additional devices is generally possible. Additional devices are considered to be:
- Guide post top pieces attached to posts
- Guide post top pieces attached to the rail together with the screwed butt joint
- Crash barrier reflectors which are attached to the rail with round head screws in the centre hole.
- Crash barrier post casings in accordance with TL-SPU
- Underride guard
- Pipe railing
- Profile railing
- Anti-skid protection for pedestrians and bicyclists

Written confirmation by the manufacturer is required for the attachment of additional devices (e.g. glare protection).

3.22 The attachment of traffic signs is not permitted. Traffic signs may be set up within the sphere of action if they can be knocked over or sheared off.

3.23 All crash barrier components having a permanent (plastic) deformation must generally be replaced.

Particular caution must be exercised in the transition areas to the undamaged rails when damaged crash barrier parts are being replaced. Care must be given to ensure that the rails remaining after disassembly are not damaged by the usage of an angle grinder, spike or hammer.

Due to temperature-related length changes or heavy deflection caused by strong vehicle approaches, the hole patterns in the longitudinal direction often no longer fit when the new rails are connected to the existing crash barriers. If the distance between the hole axes is less than 5 cm, the difference can usually be compensated by loosening the screws at several joints. Otherwise, proceed as follows:

If repairs are made at excessively low temperatures, the new rails are generally too short. The installation length between the post axes is greater than 4.00 m (e.g. 4.07 m), i.e. the overlap is less than 30 cm. This is not permitted. Two adapters must therefore be prepared to achieve a total installation length > 4.00 m. (Example: 2.00 m + 2.07 m = 4.07 m). An additional post is to be installed to prevent the maximum post clearance of 4.00 m from being exceeded.

At high temperatures or in the case of strong deflection, the rail overlap is generally greater than 30 cm. No adapter is required in this case. New holes must be drilled instead. This is only permitted, however, if the clearance between the new outer edges and the existing holes is more than 2.5 cm.

Adapters and the drilling of new holes, however, should generally be avoided, even if this means increased expenditure due to disassembly and reassembly of the bordering areas.

Expanded post holes in the shoulder must again be sealed in a way that ensures that the newly piled post is sufficiently stable. In the case of multiple accident damage at the same location, either the
shoulder must be reattached or additional posts mounted as needed and in consultation with the customer.

If crash barriers are installed on streets already in operation (e.g. during repair work), then excess material must be completely removed so that after several hours of interruption, the routes are operationally ready and the ends of the crash barrier rail can be completely screwed together and secured with makeshift lowering (tilt angle, a rail, head piece placed on the ground).

3.24 Crash barrier parts can be used again for retrofits and/or conversions if:

- the components do not have any visible deformations and/or damages (e.g. torn out, drifted or burnt out holes),
- the structural parts still have a zinc coating thickness of at least 55 µm,
- the components requiring labels still have an easily recognisable manufacturer label and inspection period stamp.

Already used attachment materials (screws, nuts, washers, cover flaps, connection straps) may not be used again. New material must always be used. New material must always be used for the repair of damage caused by accidents.

Structural parts which can no longer be used are to be made unusable, e.g. by separation of components or splitting, and removed screw materials are to be sent for recycling.

3.25 There are no requirements for inspection and maintenance.

If the assembly is done in Germany, then it is independent of the ambient temperature at the time of the installation (exception for repairs, see 15.) The installation in regions where the outside air temperature T_{min} in accordance with EN 1991-1-5/NA is below -24 °C may only be carried out with written authorisation by the manufacturer.

4. Miscellaneous

National and international contractual specifications, the relevant system test reports (ITT) in accordance with EN 1317-2:3:4, product-specific instruction manuals and assembly panels apply.

RPS, RAL-RG 620 and TL-SP, ZTV, VOB, and usage permits are to be considered in Germany

Enclosures:
Installation table passco L1 2.00
Repair Manual

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Number per section</th>
<th>Number per meter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos. 1.1/1.2</td>
<td>1 pcs.</td>
<td>0.25 pcs.</td>
<td>Safety barrier beam Passco, profile A/B</td>
</tr>
<tr>
<td>Pos. 2</td>
<td>2 pcs.</td>
<td>0.5 pcs.</td>
<td>post C 100/60/25</td>
</tr>
<tr>
<td>RAL040.00</td>
<td>2 pcs.</td>
<td>0.5 pcs.</td>
<td>butt plate M18</td>
</tr>
<tr>
<td>RAL040.00</td>
<td>8 / 6 pcs.*</td>
<td>2 / 1.5 pcs.*</td>
<td>HRK bolt with nib M16x27 4.6 with nut</td>
</tr>
<tr>
<td>Pos. 3</td>
<td>2 pcs.</td>
<td>0.5 pcs.</td>
<td>HRK bolt with nib M16x45 8.8 with nut</td>
</tr>
<tr>
<td>RAL040.30</td>
<td>10 / 8 pcs.*</td>
<td>2.5 / 2 pcs.*</td>
<td>Flat washer 18</td>
</tr>
</tbody>
</table>

*1: specification for profile A, 2: specification for profile B

### Pile driving:

- Edge distance of posts: \( a = \text{edge distance of safety barrier} + 0.1 \text{ m} \)
  - E.g. 0.5 m edge distance of safety barrier → \( a = 0.6 \text{ m} \)
- Height of Posts: \( H = 0.68 \text{ m} +/− 0.03 \text{ m} \)
- Height of construction: \( 0.73 \text{ m} +/− 0.03 \text{ m} \)
- Space between posts: \( PA = 2.00 \text{ m} \)
- Locate posts with closed end towards the carriageway.

### Installation of safety barrier beam:

- **Connection of beam with post:**
  - Per post 1 bolt M16x45 8.8 / button-head (nib) with nut and flat washer 18.
  - Locate butt plate M18 under the bolt head at the side of the beam.
  - Nut and flat washer at the side of the post.
- **Connection of butt overlap of safety barrier beam:**
  - Profile B:
    - Per butt 6 bolt M16x27 4.6 / button-head (nib) with nut and flat washer 18.
  - Profile A:
    - Per butt 8 bolt M16x27 4.6 / button-head (nib) with nut and flat washer 18.
  - Front beam: drop-type hole
  - Back beam: round hole
  - Overlap butts in driving direction
  - Torque of all bolts: min. 70 Nm.

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Revision Date February 2012
Analog installation of profile A. Part no. beam profile A: Pos. 1.2

Profil A:

Profil B:

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