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Inland Transport Committee

Working Party on the Transport of Dangerous Goods

Ninety-eighth session

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Item 6 (b) of the provisional agenda

**Proposals for amendments to annexes A and B of ADR:
miscellaneous proposals**

8 April 2015

Report of the informal working group on the electrical system of vehicles carrying dangerous goods

Transmitted by the Government of the Netherlands

Introduction

The informal working group met for the second session on 13 and 14 January in The Hague. The meeting was attended by 15 experts and was chaired by Mr. de Putter of the Netherlands.

The original mandate was given by the November 2013 WP.15 meeting and read:

- (a) Evaluate the current requirements of Part 9 in relation to electrical equipment on vehicles;
- (b) Evaluate the interaction between Chapters 9.2, 9.3, 9.7 and 9.8, in particular in relation to the relevant requirements for the application of 9.7.8.1, as amended;
- (c) Consider whether new requirements were necessary in the light of technical progress.

The mandate was extended in the May 2014 meeting of WP.15 to deal with other issues concerning Part 9.

Summary

After a discussion on explosives versus electricity, other issues related to the carriage of explosives, electrical connections and the application of a battery master switch for EX/II vehicles the draft amendments were discussed. Being a first version many changes were made to the draft. This amended draft, including the discussions will be presented as annex 1 to the report.

Due to time restraints and sending draft documents just before the meeting only two of the additional questions mentioned in the report of the first session were discussed. The first one concerning simplification of vehicle categories not related to electrical provisions and the other the interaction between 9.1,9.2 and 9.3 for one stage build type approved tractors for semi trailers. The later one could not be concluded.

A third session of the working group is needed to finalize the proposals for amendments.

Discussion

To bring the discussions forward a number of documents were made available. The most important ones, such as on explosives and draft amendments were provided a number of weeks before the meeting, other documents were presented at the begin of the meeting. The opportunity of having explosives experts round the table resulted in two additional documents, one concerning the construction of EX/III bodies and another concerning the limitations to compression ignition engines for EX vehicles. Although late the working group agreed to review these documents for a first impression.

Explosives and electricity

During the discussions of the first session of the working group it was found that expert knowledge on the carriage of explosives was needed. The participants of the WP.15 were requested to delegate experts on explosives to the working group, and 3 experts on explosives, from Germany, Spain and the Netherlands, were present at the meeting.

To bring the discussion forward the delegate of the Netherlands had provided two documents. The first document was a report of a meeting with national explosives experts and a second document containing additional information that describes the particulars of Xenon HID lighting systems which need a higher voltage than 24V in order to start the lamp.

The conclusion of the report of the meeting with the national explosives experts was that fire was the major risk to be prevented and an electrical system that was as safe as possible was found to be essential. The risks for setting off explosives by the electric sparks or magnetic pulse was found to be low as long as the voltage remained below the threshold of 1000 V A.C or 1500 V D.C. Higher Voltages could be considered if sufficient distance is achieved between the electrical system and the load compartment and prevention of sparks by the installation. It was also expressed that a battery master switch now mandatory on EX/III vehicles was highly valued for additional safety against development of a fire while the vehicle is parked. If this was so "valued" that it the requirement should be extended to EX/II vehicles could not be answered based on known incidents. In the report it is expressed that there should be no exposed wiring in the loading area.

The report was in general supported by the explosives experts during the second meeting of the informal working group.

For the starting system of Xenon lighting systems working on 15.000 V (maybe for 1 or 2 seconds) it was found acceptable if the starting device was integrated in or on the light source itself, preventing risks of external high tension wiring and connectors and providing extra shielding by the housing of the light unit.

Other issues related to the carriage of explosives

The additional document on the construction of EX/III bodies was presented. The principle statement was that when adopting the standard for the flammability of the construction material in subsection 9.3.4.2 in ADR 2005 too much of the previous provision was left out. It is now possible to construct bodies with a flame resistant inner lining while the construction of the body supporting the linings may fail in a fire, leaving the explosives exposed. In the document it was also stated that the heat insulation function was no longer mentioned. Also concerns were expressed over a body with folding side doors, after years of wear and tear it may be difficult to prevent penetration of flames between side doors and floor. The working group confirmed that the wording of 9.3 could be improved. A return to

the wording of ADR 2003 with the additional reference to the standard was not supported because this would lead to expensive tests.

The other additional document addressed the restriction on EX vehicles to have compression type ignition engines. Due to technical progress it can be questioned if the reasoning behind this restriction is still valid. It was based on 3 aspects, the flammability of the fuel, the development of vehicle engine fuel systems and the development of positive ignition systems.

If the argument of the limitation was based on flammability of the fuel it should be reminded that it is now possible to use Diesel and natural gas/LPG in dual fuel configurations, gaseous fuels which create a flammable mixture at a temperature below 55 °C. On the other hand developments in the vehicle engine fuel systems and positive ignition system have developed in such a way that the original risks of the 1990's have largely been overcome. It was suggested to improve the document further and investigate if this could be studied by a specialist meeting of explosives experts.

The expert of Norway gave additional information that were based on photos about the accident with the MEMU vehicle in Norway at the end of 2013. Because of the complete destruction of the vehicle by the blast it was difficult to pinpoint the exact cause, but an electrical cause was probable. It was also mentioned that the truck had recently been repaired in the area where the fire started. A report of the investigation in the English language was not yet available at the time of the meeting, but have later been made available to the participants of the working group.

Batteries and other electrical storage systems

Traditionally a vehicle was provided with one battery to start the engine and power the electrical system of the truck. However now the complexity of vehicles has increased, more batteries can be found on vehicles. For example an additional battery for an alarm system or electric/electronic trailer steering. Also smaller capacity power sources can be found for electronic systems for load control, computers or road taxation devices in the drivers cab. During the first session it was mentioned that especially the smaller batteries, in particular Lithium (Ion) batteries may present additional risks.

Although full electric drive for heavy goods vehicles is not considered a realistic option, hybrid drive systems are. In WP.29 a new regulation (GTR-15) is under approval concerning emissions of heavy goods hybrid vehicles. Regulation No. 100, dealing with the safety of the electrical drive systems, is already available covering also trucks. Because discussion of the subject would require other expert knowledge and existing time constraints it was decided not to deal with this subject at this session.

Since no additional information had become available it was decided to postpone further discussion to another session.

Amendments to the requirements for the electrical system.

During the first session of the working group each subsection was discussed to see the relation between the risk and vehicle category it is applicable for. It was also discussed if a number of requirements could be deleted because all normal road vehicles would comply anyway. This was however not carried by the majority of the group.

For example the risk when electrical connectors disengage during carriage and why this is specifically applicable to EX/III and FL.

Concerning the placing of the connectors it can be questioned if the probability of having an explosive atmosphere near or in the connectors is very low, especially for explosive substances. Only 8 entries for military class 1 articles, such as rockets, including propellant may create an explosive atmosphere. Even IP 54 does not mean gas tight but spray water tight. The conclusion can be drawn that prevention of ingress of water and a latch against disconnection is intended for reliability. It can be argued that working lighting and properly functioning braking systems are equally important to all vehicle categories!

Additionally to this the representative of Sweden suggested to reduce the number of vehicle categories, most motor vehicle manufacturers only have two variants to cover the 5 categories. This is basically the type with battery master switch, permanently energized circuits and a type without these systems.

For EX/II vehicles it was remarkable that only insulation of the terminals of the battery would apply, the general requirements on the electrical system being so basic that also EX/II vehicles can and should comply.

For detailed considerations and amendments developed so far see Annex 1 to this report.

Annex 1

Subsections electrical system of vehicles	
1	<p>1.6.5.16 New transitional measure</p> <p>The amendments proposed in this document may require a new transitional measure for existing vehicles. A number of amendments, such as for electrical connections and voltage limitations, allow approval of systems that are available on the market due to technical progress. Other amendments are based on discussion in the working group on the intention of the wording and may, for consistency, now become applicable to other vehicle categories as well.</p> <p>It is however not necessary to modify existing vehicles. For this reason this transitional measure can be open, with no end date, or running for a longer period of time to take the end of life of vehicles into account.</p> <p>The final wording of this transitional measure depends on the adoption of the various amendments and should be completed.</p> <p>The draft transitional measure below is proposed:</p> <p>1.6.5.16 <i>Vehicles first registered or entering into service before 1 April 2018 in accordance with the regulation in force up to 31 December 2016 but which do not comply with the regulation in force from 1 July 2017 concerning:</i> <i>[-requirement for cables and installation behind the drivers cab of EX/II, AT and OX vehicles....]</i> [-..] [-..] <i>may continue to be used.</i></p>
2	<p>9.2.1 Table technical specifications</p> <p>In the table represented below the various electrical requirements are represented in a new sequence. Where an [X] is given it is proposed to apply the requirement also to this category, where an X is given the requirement already applies to the vehicle category. In this new application 3 categories remain, the AT/OX category, the FL category and EX category.</p> <p>The following section of the table dealing with the electrical equipment is proposed:</p>

9.2.1							
	Vehicles						Comments
Technical specification		EX/II	EX/III	AT	FL	OX	
9.2.2	Electrical equipment						
9.2.2.1	<i>General provisions</i>	[X]	X	X	X	X	
9.2.2.2.1	<i>Wiring</i>	[X]	X	X	X	X	
9.2.2.2.2	<i>Additional protection</i>	[X]	X	[X]	X	[X]	
9.2.2.3	<i>Fuses and circuit breakers</i>	[X]	X	X	X	X	
9.2.2.4	<i>Batteries</i>	X	X	X	X	X	
9.2.2.5	<i>Lighting</i>	[X]	X	[X]	X	[X]	
9.2.2.6	<i>Electrical connections</i>	[X]	X	[X]	X	[X]	
9.2.2.7	<i>Voltage</i>	X	X	[X]	[X]	[X]	
9.2.2.8	<i>Battery master switch</i>	[X]	X		X		
9.2.2.9	<i>Permanently energized circuits</i>						
9.2.2.9.1					X		
9.2.2.9.2		[X]	X				
3	<p>9.2.2 Electrical equipment and 9.2.2.1 General provisions</p> <p>It was discussed that the general requirements should give the basic requirements the electrical equipment of a vehicle should comply to. Suitable wording was already present in the current 9.2.2.6, first sentence. The second sentence in this proposal is based on the original wording with up-dated references to subsections.</p> <p>The word “unintended” was introduced to allow for ignition systems of positive ignition engines used for petrol and mono fuel natural gas fuelled engines and ignition of combustion heaters.</p> <p>No extra costs or problems with the introduction are expected.</p> <p>The revised wording below is proposed:</p> <p>9.2.2 <i>Electrical equipment</i></p> <p>9.2.2.1 <i>General provisions</i></p> <p><i>The installation shall be so designed, constructed and protected that it cannot provoke any unintended ignition or short-circuit under normal conditions of use of vehicles The electrical installation as a whole shall meet the provisions of 9.2.2.2 to 9.2.2.9 in accordance with the table of 9.2.1.</i></p>						

4	<p>9.2.2.2 Wiring and 9.2.2.2.1 Cables</p> <p>Wiring or a wiring loom consisting of a composition of cables and additional items to hold them together or protect them.</p> <p>In the first sentence it was suggested to amend the wording to better express the requirement and not the effect (overheating). The second sentence giving the basic requirement for insulation remains unchanged.</p> <p>In the past it was felt that requirements for cables were not sufficiently specified in the regulation. However since 2006 ISO 6722 is available for cables with copper conductors in automotive application. This standard includes classes of cables for specific applications and test requirements such as for conductivity, electrical resistance of the insulation, mechanical strength, resistance to abrasion and chafing, chemical resistance to substances normally found on vehicles. In 2011 a new version was published with a correction in 2012. An additional part 2 of the standard was introduced for aluminum core cable. Although only the original version was available during the second session of the working group the revised version appears to cover the same requirements, there have been editorial changes and further detailing of tables but the basic test requirements remain the same. The new part 2 covers aluminum conductors but it follows part 1 for testing requirements.</p> <p>It was suggested by the representative of OICA to check also the applicability of ISO 16750, which comes in 5 parts. It was found that this standard defines the environmental criteria used in the ISO 6722. An additional reference to this standard has no additional value.</p> <p>Subsection 9.2.2.1 is at this moment applicable to all categories of vehicles except EX/II. It is however to be expected that all manufacturers use cable in conformity with this standard and that there will be no additional costs or problems expected to apply this subsection also to the EX/II category vehicles.</p>
	<p>The wording below is proposed:</p> <p>9.2.2.2 Wiring</p> <p>9.2.2.2.1 <i>Cables</i></p> <p><i>No cable in an electrical circuit shall carry a current in excess of that for which the cable is designed. Conductors shall be adequately insulated.</i></p> <p><i>The cables shall be suitable for the conditions in the area of the vehicle they are intended to be used.</i></p> <p><i>The cables shall be in conformity with standard ISO 6722-1:2011, Cor 01: 2012 or ISO 6722-2:2013.</i></p> <p><i>Cables shall be securely fastened and positioned to be protected against mechanical and thermal stresses.</i></p>
5	<p>9.2.2.2.2 Additional protection</p> <p>The additional protection is intended for the cables which are positioned behind the drivers cab. To prevent repetition of wording it was decided to place this section directly behind the section dealing with wiring in general. Additionally, the specific condition for "impact or deformation" of the current 9.2.2.6 remain in this subsection.</p> <p>In line with the reference to standards it is suggested to include an option to a multicore cable according to ISO 14572:2011 as an alternative to the example already given. The requirement for the additional protective layer is identical to that of the individual cables.</p> <p>Despite the remarks that the example in figure 2 is more demanding than figure 1, and figure 2 could therefore be deleted it is decided to keep the examples as a help to manufacturers and users.</p> <p>At the first session it was remarked that some competent authorities only allowed the examples to be used while this was not required by 9.2.2.6.1. The wording is amended to prevent this interpretation.</p> <p>The cables for the wheel speed sensors need no additional protection. Due to the vibration of the wheels/axles this additional stiff protection could lead to fatigue breakage. It was decided not to include this purpose in the wording. It</p>

was agreed to change only the wording from Anti-lock braking devices to Cable of wheel speed sensor because more systems (traction control, EVSC etc.) use the input of this sensor.

On heavy goods vehicles the wiring behind the driver's cab is more exposed to the elements. The risk for damage due to impact of road debris is more likely. Being only applicable to EX/III and FL the background was discussed. Where a flammable mixture could be envisaged for FL, this is not very likely for explosive substances and articles. Having an explosive atmosphere near the wiring on a moving vehicle and the absence of an explosive atmosphere for EX/III, it was felt that the common factor was reliability and development of fire of the vehicle. As this should also be prevented for the other vehicle categories it was suggested to extend this requirement to all categories.

Extending the application to other vehicle categories than FL and EX/III is expected to create limited extra costs as most manufacturers already have the FL/EX/III type of wiring for all vehicle categories, carrying two types of ADR wiring will increase costs.

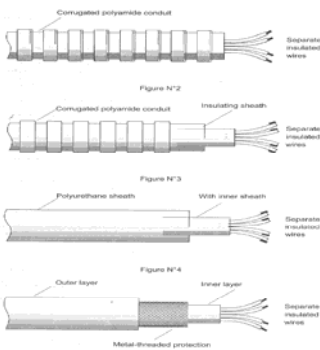
An exception is the application for mass produced panel vans of which only a small percentage is used as ADR vehicle of EX/II category. Most panel vans have the wiring inside the bodywork where it is protected. For consistency it is proposed to extend the additional protection to EX/II vehicles, in case they are heavy goods vehicles with sheeted loading platforms and exempting for light panel vans.

The following wording is proposed:

9.2.2.2.2 Additional protection

Cables located to the rear of the driver's cab and on trailers shall be additionally protected to minimize any unintended ignition or short-circuit in the event of an impact or deformation.

*The additional protection shall be suitable for the conditions during normal use of the vehicle.
The additional protection is complied with if multicore cable is used in compliance to ISO 14572:2011 or one of the examples in figures 1 to 4 below or another configuration that offers equally effective protection.*



Cables of wheel speed sensors do not need additional protection.

. One stage built panel vans of the vehicle category EX/II where the wiring behind the drivers cab is protected by the body need not to comply with this requirement.

6	<p>9.2.2.3 Fuses and circuit breakers</p> <p>Fuses and circuit breakers deserve a separate subsection as an essential part of the installation.</p> <p>The first sentence is the existing second sentence of 9.2.2.2.1.</p> <p>The exemptions are modified:</p> <ul style="list-style-type: none"> - the first indent “the stopping system of the engine” is deleted because this relates to old type of diesel injection systems. - “starter” is added to “battery”. Because more than one battery or electrical energy source can be found on modern vehicles it was suggested to limit these exemptions. <p>It should be noted that there is still discussion on interpretation that the unprotected circuits are “as short as possible” and the relative placing batteries and the battery master switch that should be “placed as close to the battery as practicable”. Lack of space on short wheelbase tractors for semi-trailers sees placing the batteries at inconvenient places under the load tank.</p> <p>After the meeting some delegates expressed that they would prefer to revisit this topic again.</p> <p>The requirement shall be applicable to all vehicle categories including EX/II, as basically no problem is expected with this extension to EX/II.</p> <p>The wording below is proposed:</p> <p>9.2.2.3 <i>Fuses and circuit breakers</i></p> <p style="padding-left: 40px;"><i>All circuits shall be protected by fuses or automatic circuit breakers, except for the following:</i></p> <ul style="list-style-type: none"> - <i>from the starter battery to the cold start system;</i> - <i>from the starter battery to the alternator;</i> - <i>from the alternator to the fuse or circuit breaker box;</i> - <i>from the starter battery to the starter motor;</i> - <i>from the starter battery to the power control housing of the endurance braking system (see 9.2.3.1.2), if this system is electrical or electromagnetic;</i> - <i>from the starter battery to the electrical lifting mechanism for lifting the bogie axle.</i> <p style="padding-left: 40px;"><i>The above unprotected circuits shall be as short as possible.</i></p>
7	<p>9.2.2.4 Batteries</p> <p>More than one battery may be found on a modern vehicle. This may be for trailer steering systems, alarms or to energize load handling systems.</p> <p>The insulation of the poles of all batteries was found to be of importance to all batteries.</p> <p>Not all types of battery vent gas to the outside. For this reason the vented box outside the engine compartment is only required when no ignitable gas is vented.</p> <p>The wording below is proposed:</p> <p>9.2.2.4 Batteries</p> <p style="padding-left: 40px;"><i>Battery terminals shall be electrically insulated or the battery shall be covered by an insulating cover. Batteries which may develop ignitable gas and are not located under the engine bonnet, shall be fitted in a vented box.</i></p>

<p>8</p>	<p>9.2.2.5 Lighting</p> <p>During the first session the risks of light sources with screw cap were discussed. Being applicable to EX/III and FL vehicles the risks for lamps coming loose in the fitting creating sparks and the low probability for an explosive atmosphere to be present inside a light unit which is sealed to prevent ingress of moist is not very likely; reliability of the lighting would have been the most probable purpose.</p> <p>It was stated that being in chapter 9.2 it related to the construction of a vehicle itself. Light sources with a screw cap are not part of the vehicle regulations (No. 37, No.99 or No.128) on vehicle lighting of WP.29 and should not be present in vehicle lighting anyway. Some participants were reluctant to delete the provision as suggested by the representative of the Netherlands.</p> <p>Despite a number of alternative wordings proposed the original wording was favored with a change from “lamp” to “light source”.</p> <p>At the moment (ADR 2015) this requirement is only applicable to lighting behind the drivers cab. Because of the new sequence of subsections additional wording is included so that it is only applicable behind the driver’s cab. For consistency this should be applicable for all vehicle categories.</p> <p>The following wording is proposed.</p> <p>9.2.2.5 Lighting</p> <p><i>In lamps behind the driver’s cab, light sources with a screw cap shall not be used.</i></p>
<p>9</p>	<p>9.2.2.6 <i>Electrical connections</i></p> <p>Since references to standards for electrical connectors have been made obligatory for EX/III and FL category vehicles connectors other than in compliance with the referenced standards may not be used. In particular this is a problem with rear view cameras on trailers. Additionally the development of automatic trailer coupling systems in WP.29 required adjustment of the provision.</p> <p>Based on the earlier discussion revised wording was proposed to WP.15 in the report of the first session. This more open alternative was not carried by the WP.15 with the remark that more work was needed.</p> <p>During the second session a new “compromise” wording has been agreed by the working group to forward to WP.15. In this proposal the basic requirements for connections are given, including a new reference to a standard to test the ability to withstand unintended disconnection. The previous system of two 7 pole connectors need not be tested according to this standard and cannot be used. The existing standards for connectors remain referenced but in a voluntary way.</p> <p>Based on the discussion on the purpose of the provision on connectors.</p> <p>It was suggested to make this applicable to all categories of vehicles. This would help interoperability between towing vehicles and trailers without having to use adaptors or special connector sets that accept both the 15 pole and the two 7 pole connectors. When adopting extension to all categories a transitional measure may be considered to limit the use on existing vehicles.</p> <p>The following wording is proposed:</p>
	<p>9.2.2.6 <i>Electrical connections</i></p> <p><i>Electrical connections between motor vehicles and trailers shall be durable and be designed to prevent accidental disconnection.</i></p> <p><i>To prevent ingress of moist and dirt the connected parts shall have a protection degree of at least IP54 in accordance with IEC 60529.</i></p> <p><i>To prevent accidental disconnection, connectors shall conform to the requirements given in clause 5.6 of ISO 4091:2003. Where the electrical connections are part of an automatic coupling system these requirements are</i></p>

	<p><i>deemed to be fulfilled.</i></p> <p><i>Connectors standardized for specific purposes e.g. ISO 12098:2004²³, ISO 7638:2003²³, EN 15207:2006²³ or ISO 25981:2008²³ shall be deemed to comply with the requirements of this section.</i></p> <p><i>Connections for other purposes concerning the proper functioning of the vehicles may be used provided they comply with the requirements of this section.</i></p>
10	<p>9.2.2.7 Voltage</p> <p>The voltage of the electrical system is limited to 24 V only for EX vehicles, at this moment in chapter 9.3. In particular Xenon HID lighting systems work on a higher voltage and the question if this could be allowed. The outcome of discussion during the first session of the working group revealed that more expertise was needed concerning the carriage of explosives.</p> <p>A report of a meeting of the delegate of the Netherlands with national explosives experts revealed that voltages below 1000 V A.C. and 1500 V D.C. would not present problems for explosives. This would mean that the value of the limit may be increased. A proposal to increase to 60V, which is low voltage in automotive applications, was not carried and it was decided to keep the 24V limit for the vehicle electrical system as a whole and create openings for systems which are electrically separated from the main system. 24Volts is to be understood as a nominal value; charging batteries requires a higher voltage of approximately 28 volts.</p> <p>It was mentioned that the voltage limit was placed in 9.3 deliberately and that it should not be moved to chapter 9.2 for the base vehicle. It was suggested to check with the UNECE secretariat if there would be arguments against moving this provision to chapter 9.2. The secretariat did a thorough investigation in the history of this provision and this showed no argument against placing it in chapter 9.2. The advice was given to keep it applicable in 9.3 also for later added equipment.</p> <p>Including the higher voltages can open discussion if positive ignition engines could be used for EX vehicles. However the limitation to compression ignition type in subsection 9.2.4.4 will prevent this.</p> <p>9.2.2.7 Voltage</p> <p><i>The nominal voltage of the electrical system shall not exceed 24V.</i></p> <p><i>Higher voltages are allowed in galvanically isolated parts of the electrical system provided those parts are not located within a perimeter of 0.5 metres from the outside of the load compartment.</i></p> <p><i>Systems working on a voltage higher than 1000V A.C. or 1500V D.C. shall be integrated in an enclosed housing.</i></p> <p><i>Only Xenon light sources with integrated starters are allowed (i.e. types D3R/S, D5S and D8S).</i></p>
11	<p>9.2.2.8 Battery master switch</p> <p>No changes are suggested at this moment for these subsections besides the numbering and a consequential amendment in the reference in 9.2.2.8.2 (9.2.2.5 => 9.2.2.9).</p> <p>However after the meeting some delegates expressed the wish to visit this topic in a future meeting. One topic is to limit the time between the actuation of the Switch and actual breaking of the electrical circuits (i.e. max 40 seconds in following of the after running time of the combustion heater in 9.2.4.7)</p>
12	<p>9.2.2.9 Permanently energized circuits</p>

²³ ISO 4009, referred to in this standard, need not be applied.

	No changes are foreseen for these subsections besides the numbering (9.2.2.5 to 9.2.2.5.2 => 9.2.2.9 to 9.2.2.9.2) and a consequential amendment in the reference in 9.2.2.9.1 (b) (9.2.2.3 => 9.2.2.8)	
13	9.3.7	Electrical equipment (additional requirements for EX vehicles)
	<p>The requirement for 24 Volts is moved to chapter 9.2. (see 9.2.2.7).</p> <p>The requirements which were differentiated in the past between EX/II and EX/III have been combined in subsections 9.3.7.2 and 9.3.7.3. The first subsection dealing with the tightness of the components against ingress of dust and gas, the second subsection dealing with the positioning of the wiring and components inside the load compartment. The first paragraph of the old 9.3.7.2 prescribing the placing of the internal lighting on the ceiling has been dropped because it was found to be to design restrictive. Especially in EX/II Panel Vans, that do not need additional lining of the interior, it is possible that the rear light units emit light into the load compartment and loading lifts can have warning lights on the outer edge.</p>	
	9.3.7	<i>Electrical equipment</i>
	9.3.7.1	<i>The electrical installation shall meet the relevant requirements of 9.2.2.2 9.2.2.3, 9.2.2.4, 9.2.2.5, 9.2.2.6, 9.2.2.7, 9.2.2.8 and 9.2.2.9.1.</i>
	9.3.7.2	<i>The electrical installation in the load compartment shall be dust-protected at least IP 54 according to IEC 60529 or equivalent. In the case carriage of items and articles of compatibility group J at least IP 65 according to IEC 60529 or equivalent.</i>
	9.3.7.3	<i>No wiring shall be positioned inside the load compartment. Electrical equipment accessible from the inside of the load compartment shall be sufficiently protected from mechanical impact from the inside.</i>
14	9.7.8	Electrical equipment.
	No changes are foreseen for the additional requirements for tank vehicles.	
---CdP---		