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| UNECE GRE IWG EMCChange Proposal Form**(One major comment per form.)** **(Shaded blocks for the use by the IWG Secretary only.)** |
| **IWG document Number:** | **IWG-EMC-xx-xx** | **Date:** 8 JAN 2024 |
| **Proposer’s Name, Affiliation, and E-mail:**CLEPA SEG EMCKlaus Pilatus (CLEPA, consultant.tr2@clepa.be)Andrea Scholl (Bosch, andreamarie.scholl@de.bosch.com, chair of the SEG EMC)Hyebin Yun (MOBIS, hyebin.yun@mobis.com) | **Paragraph:**7.3 and Annex 117.11 and Annex 17 | **Page:**19 to 20, 24 to 25, 114 to 115, 141 to 142 of [UN Regulation No. 10 - Rev.6](https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2019/E-ECE-324-Add.9-Rev.6.pdf) |
| **Summary of Change** (25 words or less)**:**It is necessary to clarify the criteria for harmonics limits for currents with a rated input current exceeding 16 A and up to and including 75 A per phase and incorporate the updated reference standards. |
| **Reason for Change** (Justification)**:**In R10.07, a note was added below the harmonics limit table (input current ≤ 16 A per phase) to clarify the requirements.This clarification was necessary because IEC 61000-3-2 specifies two distinct conditions for determining compliance with harmonic requirements:* Requirement 1: Directly applying the **average value** for individual harmonic currents to the limits specified in the table.
* Requirement 2: Applying 150% and 200% of the limit table values to the 1.5-second smoothed **r.m.s. harmonic current** values.

However, similar clarification has not been provided for IEC 61000-3-12 (input current > 16 A and ≤ 75 A).Additionally, based on the updated reference standard, it is necessary to revise the parameters in the limit table and include additional tables to address new conditions. |
| **Original text:****7.3. Specifications concerning emission of harmonics on AC power lines from vehicles**7.3.2.2. If measurements are made using the method described in Annex 11, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12, and given in given in Table 5, Table 6 and Table 7.Table 5Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio%* |
| --- | --- | --- |
|  | I3 | I5 | I7 | I9 | I11 | I13 | THD | PWHD |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the Total Harmonic Distortion (THD) and Partial Weighted Harmonic Distortion (PWHD) the same way than odd harmonics.Linear interpolation between successive values of Short Circuit Ratio of an Equipment (Rsce)is authorized. |

Table 6Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
|  | I5 | I7 | I11 | I13 | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the THD and PWHD the same way than odd harmonics.Linear interpolation between successive values of Rsce is authorized. |

Table 7Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
|  | I5 | I7 | I11 | I13 | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the THD and PWHD the same way than odd harmonics**.** |

**7.11. Specifications concerning emission of harmonics on AC power lines from ESAs**7.11.2.2. If measurements are made using the method described in Annex 17, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12 and given in Table 13, Table 14 and Table 15.Table 13Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I3* | *I5* | *I7* | *I9* | *I11* | *I13* | *THD* | *PWHD* |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way than odd harmonics.Linear interpolation between successive values of Rsce is authorized. |

Table 14Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I5* | *I7* | *I11* | *I13* | *THD* | *PWHD* |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way as odd harmonics.Linear interpolation between successive values of Rsce is authorized. |

Table 15Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions

| *Minimum Rsce* | *Acceptable individual harmonic current In/I1 %* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I5* | *I7* | *I11* | *I13* | *THD* | *PWHD* |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/n %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way as odd harmonics." |

**Annex 11**Method(s) of testing for emission of harmonics generated on AC power lines from vehicle4.3. The limits for single phase or other than balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 5 of paragraph 7.3.2.2. of this Regulation.4.4. The limits for balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 6 of paragraph 7.3.2.2. of this Regulation.4.5. For three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 7 of paragraph 7.3.2.2. of this Regulation can be applied.**Annex 17**Method(s) of testing for emission of harmonics generated on AC power lines from an ESA4.3. The limits for single phase or other than balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 13 of paragraph 7.11.2.2. of this Regulation.4.4. The limits for balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in paragraph Table 14 of 7.11.2.2. of this Regulation.4.5. For three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 15 of paragraph 7.11.2.2. of this Regulation can be applied. |
| **Revise To:***Paragraph 7.3.*, amend to read:**7.3. Specifications concerning emission of harmonics on AC power lines from vehicles**7.3.2.2. If measurements are made using the method described in Annex 11, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12, and given in given in Table 5, Table 6**,** **~~and~~**Table 7 **and Table 8**.Table 5Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current I****~~n~~h****/I****~~1~~ref****%* | *Maximum current harmonic ratio%* |
| --- | --- | --- |
| I3 | I5 | I7 | I9 | I11 | I13 | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the Total Harmonic **~~Distortion~~Current**(TH**~~D~~C**) and Partial Weighted Harmonic **~~Distortion~~Current**(PWH**~~D~~C**) the same way than odd harmonics.Linear interpolation between successive values of Short Circuit Ratio of an Equipment (Rsce)is authorized.**NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 6Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current I****~~n~~h****/I****~~1~~ref****%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
|  | I5 | I7 | I11 | I13 | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the TH**~~D~~C** and PWH**~~D~~C** the same way than odd harmonics.Linear interpolation between successive values of Rsce is authorized.**NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 7Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions (a, b, c)

| *Minimum Rsce* | *Acceptable individual harmonic current I****~~n~~h****/I****~~1~~ref*** *%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| I5 | I7 | I11 | I13 | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the TH**~~D~~C** and PWH**~~D~~C** the same way than odd harmonics**.****Linear interpolation between successive values of Rsce is authorized.****NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 8Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions (d, e, f)

| *Minimum Rsce* | *Acceptable individual harmonic current I****h****/I****ref*** *%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| I5 | I7 | I11 | I13 | I5 | I7 | I11 | I13 | I5 | I7 | I11 | I13 | *THC/ Iref* | *PWHC/ Iref* |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 2 | 1.5 | 1.5 | 1.5 | 1 | 1 | 1 | 1 | 13 | 22 |
| ≥ 250 | 25 | 17.3 | 12.1 | 10.7 | 8.4 | 7.8 | 6.8 | 6.5 | 5.4 | 5.2 | 4.9 | 4.7 | 35 | 70 |
| **For Rsce equal to 33, relative values of even harmonics lower or equal to 12 shall be lower than 16/h %. Relative values of all harmonics from I14 to I40 not listed above shall not exceed 1% of Iref****For Rsce ≥ 250, relative values of even harmonics greater than 12 shall be lower than 16/h %. Relative values of all harmonics from I14 to I40 not listed above shall not exceed 3% of Iref.****Linear interpolation between successive values of Rsce is authorized.****NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

*Paragraph 7.11.*, amend to read:**7.11. Specifications concerning emission of harmonics on AC power lines from ESAs**7.11.2.2. If measurements are made using the method described in Annex 17, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12 and given in Table 1**~~3~~4**, Table 1**~~4~~5,** **~~and~~** Table 1**~~5~~6** **and Table 17**.Table 1~~3~~4Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current* *I****~~n~~h****/I****~~1~~ref****%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I3* | *I5* | *I7* | *I9* | *I11* | *I13* | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the TH**~~D~~C** and PWH**~~D~~C** in the same way than odd harmonics.Linear interpolation between successive values of Rsce is authorized. **NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 1~~4~~5Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| *Minimum Rsce* | *Acceptable individual harmonic current I****~~n~~h****/I****~~1~~ref*** *%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I5* | *I7* | *I11* | *I13* | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the TH**~~D~~C** and PWH**~~D~~C** in the same way as odd harmonics.Linear interpolation between successive values of Rsce is authorized.**NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 1~~5~~6Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions

| *Minimum Rsce* | *Acceptable individual harmonic current I****~~n~~h****/I****~~1~~ref*** *%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| *I5* | *I7* | *I11* | *I13* | *TH****~~D~~C/ Iref*** | *PWH****~~D~~C/ Iref*** |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |
| Relative values of even harmonics lower or equal to 12 shall be lower than 16/**~~n~~h** %. Even harmonics greater than 12 are taken into account in the TH**~~D~~C** and PWH**~~D~~C** in the same way as odd harmonics.**Linear interpolation between successive values of Rsce is authorized.****NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

Table 17Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions (d, e, f)

| *Minimum Rsce* | *Acceptable individual harmonic current I****h****/I****ref*** *%* | *Maximum current harmonic ratio %* |
| --- | --- | --- |
| I5 | I7 | I11 | I13 | I5 | I7 | I11 | I13 | I5 | I7 | I11 | I13 | *THC/ Iref* | *PWHC/ Iref* |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 2 | 1.5 | 1.5 | 1.5 | 1 | 1 | 1 | 1 | 13 | 22 |
| ≥ 250 | 25 | 17.3 | 12.1 | 10.7 | 8.4 | 7.8 | 6.8 | 6.5 | 5.4 | 5.2 | 4.9 | 4.7 | 35 | 70 |
| **For *Rsce*equal to 33, relative values of even harmonics lower or equal to 12 shall be lower than 16/h %. Relative values of all harmonics from *I14* to *I40* not listed above shall not exceed 1% of *Iref*****For *Rsce*≥ 250, relative values of even harmonics greater than 12 shall be lower than 16/h %. Relative values of all harmonics from *I14* to *I40* not listed above shall not exceed 3% of *Iref*.****Linear interpolation between successive values of *Rsce*is authorized.****NOTE: For the application of limits, refer to IEC 61000-3-12, Paragraph 4.2.5.** |

*Annex 11* amend to read**:**4.3. The limits for single phase or other than balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 5 of paragraph 7.3.2.2. of this Regulation.4.4. The limits for balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 6 of paragraph 7.3.2.2. of this Regulation.4.5. For three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 7 of paragraph 7.3.2.2. of this Regulation can be applied.**4.6. For three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions d), e) or f) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 8 of paragraph 7.3.2.2. of this Regulation can be applied.***Annex 17* amend to read**:**4.3. The limits for single phase or other than balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 1**~~3~~4** of paragraph 7.11.2.2. of this Regulation.4.4. The limits for balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in paragraph Table 1**~~4~~5** of 7.11.2.2. of this Regulation.4.5. For three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 1**~~5~~6** of paragraph 7.11.2.2. of this Regulation can be applied.**4.6. For three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions d), e) or f) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 17 of paragraph 7.11.2.2. of this Regulation can be applied.** |
| **As Modified Text:** |
|  | **Accepted As Written** |  | **Withdrawn** |
|  | **Accepted As Modified** |  | **Rejected** |
|  | **Deferred** |  | **Other** |
| **Rejection Reason / Comments:** |
| **Proposal Deferred To:** |
| **Proposal Disposition By:** | **Date:** |
|  |  |