GUIDE

Guide
on Green Public Procurement

Construction Machines

Für Mensch & Umwelt

Umwelt Bundesamt

This guide is based on the criteria of the Blue Angel environmental label for Construction Machines (RAL-UZ 53), version of February 2015.

Contents

1. Introduction

Most construction machines are operated by combustion engines that – while doing so – generate a considerable amount of noises, exhaust gases and particles. Particularly in urban areas, the local air quality and the health of affected persons is thus considerably impaired. At the same time, many affected people think that the noises of construction machines and construction sites are a considerable noise pollution. To protect the health and the environment, European directives define limit values for admissible noise, exhaust gas and particle emissions by construction machines. They are determined by harmonized procedures and marked.

The present guide is based on the methods of the legal procedures and at the same time considers the advanced state of the exhaust gas, particle and noise reduction technology. The requirements and test values of the present guide for exhaust gas, particle and noise emissions are thus more demanding than the legal limit values. The procurement of low-noise and low-emission construction machines is to result in a reduction of the noise, exhaust gas and particle emissions.

2. How to use this guide

The guide itself contains the main information and recommendations which are relevant for the public procurement bodies for including environmental aspects in the tender and contractual documents. The tenderer questionnaire on green procurement of construction machines, which is provided in annex 1 and is separately published under www.beschaffung-info.de as Word document, is intended as annex to the specifications. With respect to the environmental requirements to the subject matter of the contract, thus, only a corresponding reference in the specifications is necessary in order to comply with the provision of the public procurement law according to which the performance is to be described unambiguously and comprehensively. On the other hand, the tenderer questionnaire is to be used for verification management. A corresponding formulation in the tender documents could be:

The construction machines shall comply with the minimum criteria indicated in the attached "Tenderer questionnaire on the green procurement of construction machines" in order to be taken into consideration when the decision on the award of the contract is made. For verification purposes, the filled-in tenderer questionnaire is to be provided with the respective individual verifications demanded therein for each offered product. If the product is labelled with the Blue Angel RAL-UZ 53 environmental label, the individual verifications may be omitted. The individual verifications may also be omitted if the product is marked with an equivalent environmental label which requires the compliance with all minimum criteria indicated in the tenderer questionnaire.

3. Scope

The guide applies to construction machine types that are defined according to Annex I of Directive 2000/14/EC [1] and recorded in Table 1.

Construction machines exceeding a guaranteed sound power level of 104 dB are excluded from the scope (in this connection also refer to 5.1.1.1).

Note: For special tasks, it may be necessary to use special construction machine types with very high power levels. In the individual case, they cannot comply with the required sound power level of 104 dB requested by the Blue Angel for technical reasons.

4. Verification management

Public procurement bodies may specify in the tender that the tenderer shall verify the compliance with the performance requirements by providing certificates issued by a conformity assessment body (as per § 33 Regulation on the Award of Public Contracts (Vergabeverordnung, *VgV*) 2016; § 7a, section 4 Rules for contracting for the award of public works contracts (*VOB/A- EU* 2016) or by labels (as per § 34 *VgV* 2016; § 7a *VOB/A-EU* 2016; § 24 UVgO (Unterschwellenvergabeordnung) 2017 [2].

4.1. Verification by means of certificates by conformity assessment bodies

The verification that the technical requirements are complied with may be effected via a certificate issued by a conformity assessment body [3] (e.g. TÜV, VDE, certified test laboratory) or a certification issued by them (as per § 33 sec. 1 sentence 1 *VgV* 2016, § 7a sec. 5 no. 1 *VOB/A-EU* 2016).

If the public procurement body demands a certificate from a specific conformity assessment body, they must also recognize certificates from equivalent other

1 Directive 2000/14/EC of the European Parliament and of the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use out-doors, callable at: http://eur-lex.europa.eu/legal-content/DE/TXT/?uri=URISERV:l28048 (so on 6 June 2017).

2 As a Rule of Procedure, *UVgO* is put into effect with the new revision of the General Administrative Regulation on § 55 of the Federal Budget Regulations or with respective state-law regulations for the states. At national level, UVgO was put into effect on September 2, 2017 (circular letter of the Federal Ministry of Finance from January 9, 2017 – II A 3 - H 1012-6/16/10003:003). For implementation of *UVgO*, the budgetary provisions of the states are to be updated in the coming months.

3 A conformity assessment is the examination and certification of the compliance with stipulated requirements for products and services. The conformity assessment bodies implementing these activities are accredited. This means that the competence of the conformity assessment body has been verified by an independent authority.

conformity assessment bodies (as per § 33 sec. 1 sentence 2 *VgV* 2016; § 7a sec. 5 no. 1 *VOB/A-EU* 2016). The public procurement body shall also admit other forms of verification, for instance the technical file of the manufacturer (as per § 33 sec. 2 *VgV* 2016; § 7a sec. 5 no. 2 *VOB/A-EU* 2016). As a precondition, the tenderer:

- had no access to the required certificates issued by a conformity assessment body or to the verifications provided by an equivalent body or
- is not responsible for not being able to obtain the verifications from the conformity assessment body before the submission deadline for the tender.

In the two versions indicated above, the tenderer bears the burden of proof; this means that, if they are unable to verify that their offered performance complies with the technical requirements, they are excluded from the award procedure.

4.2 Verification by labels

The public procurement body may require a specific label for verifying the compliance with the technical specification, such as the Blue Angel environmental label (*VgV* 2016, *VOB/A-EU*, *UVgO* 2017). In such case they must also accept labels which post equivalent requirements on the performance (§ 34 sec. 4 *VgV* 2016, § 7a sec. 6 no. 3 *VOB/A-EU* 2016; § 24 sec. 4 *UVgO* 2017); in particular, this applies to labels of other EU member states.

If the performance does not have to meet all requirements of a label, the public procurement body shall indicate the respective requirements of the label (§ 34 sec. 3 *VgV* 2016; § 7a sec. 6 no. 2 *VOB/A-EU* 2016; § 24 sec. 3 *UVgO* 2017).

If the tenderer is unable to provide the demanded label or an equivalent label within an adequate period, and if they are not responsible for this circumstance, the public procurement body shall also accept other suitable verification options, e.g. technical files or test reports of acknowledged bodies (§ 34 sec. 5 *VgV* 2016; § 7a sec. 6 no. 4 *VOB/A-EU* 2016, § 24 sec. 5 *UvGO* 2017). The tenderer bears the burden of proof that they meet the specific requirements of the label with their alternative verification option.

4.3 Recommendations for verification requirements

An exclusive verification of the compliance with the performance specifications by a label, e.g. the Blue Angel environmental label, is only recommended if there is a sufficient number of products from different manufacturers which bear the label. Only then, a competition amongst the tenderers can be guaranteed. In case of the construction machines, it is thus recommended to the procurement body to check on the Internet page of the environmental label (www.blauer-engel.de) first whether sufficient (e.g.: more than three) products are labelled and available in the market. If this is not the case, it is recommended to also accept individual verifications regarding compliance with the performance specifications in addition to the environmental label as well as equivalent environmental labels, e.g. in the form of certificates from conformity assessment bodies (e.g. test results

of test laboratories) or technical dossiers of the manufacturer.

The tenderer questionnaire in the annex to this guide considers all three verification options (environmental label, equivalent label, individual verifications).

Note: For special tasks, it may be necessary to use special construction machine types with very high power levels. In the individual case, they cannot comply with the required sound power level of 104 dB requested by the Blue Angel for technical reasons. **In this case, the environmental label cannot be required as verification.**

5. Environmental requirements

In the following, one differentiates between environmental requirements on the subject matter of the contract in the form of minimum criteria (section 5.1) as well as environmental contract performance clauses (section 5.2).

5.1 Environmental requirements on the subject matter of the contract

5.1.1. Noise emissions

5.1.1.1. Operating noises

Criterion: Minimum

Verification: Blue Angel environmental label for construction machines (RAL-UZ 53), equivalent label or test report

The assessment of the operating noises of construction machines is based on the measurement [4] and labelling of the guaranteed sound power level in dB.

The guaranteed/declared, A-weighted sound power level $L_{WA,d}$ of the operating noises of construction machines must not be greater than the test values specified in *table 1*.

The sound power level is to be specified.

In the *procurement of a single construction machine*, a sound power level measurement has to be carried out at the machine (cf. above). The guaranteed sound power level L_{WAd} is the commercially rounded integer total of the measured sound power level L_{WA1} and the reproducibility standard deviation σ_R.

$$L_{WAd} = L_{WA1} + \sigma_R$$

σ_R of the relevant construction machine type can be seen from table 1 of RfU 07-003 R2. [5]

4 The measurement procedures that are in each case to be used for the relevant construction machines are described in Annex III of Directive 2000/14/EC.

5 Rules for the determination and verification of the guaranteed sound power level (Working Group of Notified Body's 2000/14/EC Recommendation for Use No. 07-003 R2), callable at: http://ec.europa.eu/DocsRoom/documents/16062/ (so on 6 June 2017).

In the *procurement of several structurally identical construction machines*, the sound power level measurements must usually be carried out at five and more structurally identical construction machines. Der garantierte Schallleistungspegel L_{WAd} ist die kaufmännisch gerundete ganzzahlige Summe aus dem arithmetischen Mittelwert der gemessenen Schallleistungspegel L_{WAm} und dem Unsicherheitsfaktor K:

$$L_{WAd} = L_{WAm} + K$$

K is calculated according to RfU 07-003 R2 [6]. If only one measurement is possible at one single construction machine, $K = 3$ dB.

Table 1 Test values for operating noises of construction machines

Construction machine type (in brackets: No. according to Annex I of Directive 2000/14/EC)	**Installed effective power P in kW** **Electrical rated P_{el} in kW**	**Maximum test value for the guaranteed sound power level* L_{WAd} in dB** **$L_{WAd} \leq 104$ dB**
(8) Vibrating plates, vibrating rollers, vibratory rammers	$P \leq 8$	103
	$P > 8$	104
(1) Lifting platforms with combustion engine (16) Bulldozers (21) Chain backhoe loaders (37) Chain loaders (43) Pipe layers with chain drive	$P \leq 55$	101
	$P > 55$	$82 + 11 \lg P$
(8) non-vibrating rollers (13) Hoisting and spraying machines for concrete and mortar (16) Graders on wheels (17) Drilling equipment (18) Dumpers (21) Backhoe loaders on wheels	$P \leq 55$	99
(23) Graders (29) Hydraulic power units (36) Counterbalance forklift trucks with combustion engine (37) Wheel loaders (38) Mobile cranes (41) Road finishers (43) Pipe layers with wheel drive	$P > 55$	$80 + 11 \lg P$

6 Rules for the determination and verification of the guaranteed sound power level (Working Group of Notified Body's 2000/14/EC Recommendation for Use No. 07-003 R2), callable at: http://ec.europa.eu/DocsRoom/documents/16062/ (so on 6 June 2017).

Construction machine type (in brackets: No. according to Annex I of Directive 2000/14/EC)	**Installed effective power** ***P* in kW** **Electrical rated** **P_{el} in kW**	**Maximum test value for the guaranteed sound power level*** **L_{WAd} in dB** **$L_{WAd} \leq 104$ dB**
(3) Builder's hoists for the material transport (12) Lifting jacks (20) Excavators	$P \leq 15$	91
	$P > 15$	$78 + 11 \lg P$
(14) Conveyor belts (55) Ready-mixed concrete mixers	all	98
(4) Construction site band saw machines (5) Construction site circular sawing machines 10) Hand-guided concrete breakers, breaker and bush hammers and spades (28) Hydraulic hammers (30) Joint cutters (48) Road mills	all	104
(53) Tower cranes	all	$94 + \lg P$
(45) Power current generators (57) Welding current generators	P_{el}** ≤ 5	91
	$5 < P_{el}$** ≤ 10	94
	P_{el}** > 10	95
(9) Compressors (11) Concrete and mortar mixers	$P \leq 15$	95
	$P > 15$	$93 + 2 \lg P$

* The test value is integer. It is to be commercially rounded.

** P_{el} for welding current generators: conventional welding current multiplied by the conventional welding voltage for the lowest value of the switch-on duration according to manufacturer's specifications.
P_{el} for power current generators: variable continuous power unit power according to ISO 8528-1:1993, section 13.3.2.

Note: For special tasks, it may be necessary to use special construction machine types with very high power levels. In the individual case, they cannot comply with the required sound power level of 104 dB requested by the Blue Angel for technical reasons. In this case, verification using the Blue Angle environmental label is not possible. **In these cases, the sound power level should be included in the tender as evaluation criterion.**

5.1.1.2. Workplace noises

Criterion: Minimum

Verification: Blue Angel environmental label for construction machines (RAL-UZ 53), equivalent label or test report

The assessment of the workplace noises is based on the specification of the emission sound pressure level at the workplace in dB(A)[7], measured in the same operating cycle.

7 The emission sound pressure level at the workplace is determined according to DIN EN ISO 11201.

The sound pressure level at the workplace of the construction machine operator is ≤ 80 dB(A).

The sound pressure level is to be specified.

Note: For devices without defined workplace/place of operation, this requirement is omitted.

5.1.2. Exhaust gas requirements: Limit values for air pollutants

Criterion: Minimum

Verification: Blue Angel environmental label for construction machines (RAL-UZ 53), equivalent label or test report

With regard to the air pollutant emissions, the construction machine types listed in table 1 must comply with the current proposals (last update 25 September 2014) for the exhaust gas values of emission level V of the EU regulation. [8]

For diesel engines, the proposals for level V of the Regulation are listed in table 2.

Table 2 Limit values for construction machines with diesel engine

Power in kW	**CO** in g/kWh	**Particle mass** in g/kWh	**Particle number**[9] Particles per kWh	**NOx** in g/kWh	**HC** in g/kWh
› 560	3.5	0.045	1 x 10^{12}	3.5	0.19
130–560	3.5	0.015	1 x 10^{12}	0.4	0.19
56–130	5.0	0.015	1 x 10^{12}	0.4	0.19
37–56	5.0	0.015	1 x 10^{12}	4.7	
19–37	5.0	0.015	1 x 10^{12}	4.7	
8–19	6.6	0.4		7.5	
0–8	8	0.4		7.5	

8 Proposal for an EU regulation on requirements relating to emission limits and type approval for internal combustion engines for non-road mobile machinery, callable at: http://eur-lex.europa.eu/resource.html?uri=cellar:60e6a946-44c6-11e4-a0cb-01aa75ed71a1.0012.03/DOC_2&format=PDF (so on 6 June 2017).

9 The particle number has to be determined according to Annex XV of the Regulation on heavy duty vehicles (EU) no. 582/2011, callable at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0582&from=DE (so on 6 June 2017).

5.2. Environmental contract performance clauses

The subsequently mentioned conditions should be included as contractual conditions in the tender documents. [10]

5.2.1. Permanent compliance with the emission level

Tenderer presents the guarantee for the durability of the emission-reducing technology in case of proper use and maintenance for five years and/or for the number of operating hours prescribed according to Directive 97/68/EC [11]. During this period, they shall – on the basis of the Swiss provisions [12] – present proof of the controls of functionality of the exhaust gas treatment systems as CoP (conformity of production). For these controls, a technical service shall be commissioned. Per year, at least five construction machines of each type shall be checked. The reports shall be presented to the tendering authority upon request.

5.2.2. User information to avoid manipulation

Tenderer shall supply the construction machine with printed user information at least comprising the following information:

- At the construction machines, no changes must be carried out leading to an increase in the noise emissions or exhaust gas emissions.

10 Compare § 128, section 2 GWB: "Public contracting authorities may moreover define special conditions for the execution of an order (execution conditions) if they are connected to the subject matter of the order according to § 27, paragraph 3. The execution conditions must result from the order notification or the tender documents. They may particularly comprise economic, innovation-related, environmental, social or employment policy matters or the protection of the confidentiality of information."

11 Cf. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1997L0068:20090807:DE:PDF (so on 6 June 2017).

12 Exhaust gas maintenance and control of machines and equipment on construction sites.
Technical instruction for the implementation of the Air Pollution Control Ordinance LRV (based on the LRV change dated 19 September 2008 and on the adjusted Construction Directive - Air dated 1 January 2009), callable at: http://www.vsbm.ch/fileadmin/vsbm/dokumente/Technische_Anleitung_Abgaswartung_und_Kontrolle_von_Baumaschinen-Aktualisierung_2009_v2Feb2010.pdf (so on 6 June 2017).

6. Tender evaluation

In the framework of the tender evaluation, the criteria justified by the object of the tender, among others the environmental characteristics and life cycle costs, may be taken into consideration. [13]

Energy efficiency must be taken into account as an appropriate criterion for the procurement of energy-related goods. [14] This can be done both by taking life cycle costs into account [15] and by evaluating specific energy consumption data. [16]

If the evaluation of life cycle costs is intended, you should for construction machine – in addition to the procurement costs – particularly consider the fuel costs and costs for emission-reducing technologies during the use phase, if applicable. To do so, we recommend specifying a use pattern of the system (e.g. annual operating hours) already during the invitation to tender and to query the fuel consumption on this basis. The life cycle costs can be determined using one of the calculation aids specified under this Internet reference:

https://www.umweltbundesamt.de/en/topics/economics-consumption/green-procurement/life-cycle-costing

13 See §16 section 8 VOL/A 2009; §43 section 2 & 4 UVgO 2017; § 127 GWB 2016 in conjunction with § 58 section 2 VgV 2016; §16d section 2 VOB/A-EU 2016.

14 Siehe §16 Abs. 8 VOL/A 2009; §43 Abs. 2 & 4 UVgO 2017; § 127 GWB 2016 i.V.m. § 58 Abs. 2 VgV 2016 ; §16d Abs. 2 VOB/A-EU 2016

15 §59 VgV 2016; §16d Abs. 2 VOB/A-EU 2016; §43 Abs. 4 UVgO 2017

16 Calculation of life cycle costs and references to suitable calculation tools (LCC tools) can be found in the training scripts “Green Public Procurement”. See training script 5, “Introduction to Life Cycle Cost Calculation and Use of Life Cycle Costs in Procurement”; http://www.umweltbundesamt.de/publikationen/umweltfreundliche-beschaffung-schulungsskript-5.

Annex 1: Tenderer questionnaire on green procurement of construction machines

Note: The tenderer questionnaire is intended for the procurement of construction machines with a maximum sound power level of 104 dB. For special tasks, it may be necessary to use special construction machine types with very high power levels. In the individual case, they cannot comply with the required sound power level of 104 dB requested by the Blue Angel for technical reasons. **In this case, this tenderer questionnaire cannot be used.**

Product name	
Manufacturer	
Tenderer	
Tenderers contact details	

Is the Blue Angel environmental label present?	
The construction machine is certified with the Blue Angle environmental label for construction machines (RAL-UZ 53)[17], version of February 2015. Label usage contract no.: _____ If this is the case, additional documents (attachments) for verification of compliance with the criteria stated in the following questionnaire are not required. However, the values requested in the questionnaire must be provided and confirmed by the provider.	☐ Yes
Equivalent label present?	
The construction machine is certified with an equivalent label. Designation of the label: _____ If this is the case, the tenderer has the option to alternatively present equivalent labels. On the basis of the following questionnaire and the required attachments, the tenderer is required to demonstrate that equivalence is given.	☐ Yes
Is there no equivalent label present?	
The construction machine is neither certified with the Blue Angel environmental label for construction machines nor with an equivalent label. On the basis of the following questionnaire and the verifications required there, the tenderer is required to demonstrate that the product meets the specified criteria.	☐ Yes

17 Criteria for awarding the Blue Angle environmental label for construction machines (RAL-UZ 53); https://www.blauer-engel.de/en/products/business/construction-machinery.

No.	Criterion	Comment	Criterion fulfilled and verification provided[18] (To be filled in by the tenderer)
1	**Noise emissions**		
1.1	Operating noises		
	The construction machine/-s comply/-ies with the Test values for operating noises of construction machines (see annex 2). The measurement procedures that are in each case to be used for the relevant construction machines are described in Annex III of Directive 2000/14/EC.[19] The sound power level of the construction machine(s) is: Sound power level = _____ dB	Minimum criterion Verification: Test report	☐
1.2	Workplace noises		
	The sound pressure level at the workplace of the construction machine operator is maximally 80 dB(A). This is determined according to DIN EN ISO 11201. Sound pressure level = _____ dB(A) **Note:** For devices without defined workplace/place of operation, this requirement is omitted.	Minimum criterion Verification: Test report	☐

18 As verification, the documents indicated under "comment" shall be attached to the filled in questionnaire.

19 Rules for the determination and verification of the guaranteed sound power level (Working Group of Notified Body's 2000/14/EC Recommendation for Use No. 07-003 R2), callable at: http://ec.europa.eu/DocsRoom/documents/16062/.

<table>
<tr><th>No.</th><th>Criterion</th><th>Comment</th><th>Criterion fulfilled and verification provided [18] (To be filled in by the tenderer)</th></tr>
<tr><td>2</td><td>Limit values for air pollutants</td><td></td><td></td></tr>
<tr><td></td><td>With regard to the air pollutant emissions, the construction machine types (see annex 2) must comply with the current proposals (last update 25 September 2014) for the exhaust gas values of emission level V of the EU regulation. [20] For diesel engines, the proposals for level V of the regulation are listed in the following table:
<table>
<tr><th>Power in kW</th><th>CO in g/kWh</th><th>Particle mass in g/kWh</th><th>Particle number [21] Particles per kWh</th><th>NOx in g/kWh</th><th>HC in g/kWh</th></tr>
<tr><td>› 560</td><td>3.5</td><td>0.045</td><td>1 x 10¹²</td><td>3.5</td><td>0.19</td></tr>
<tr><td>130–560</td><td>3.5</td><td>0.015</td><td>1 x 10¹²</td><td>0.4</td><td>0.19</td></tr>
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<tr><td>0–8</td><td>8</td><td>0.4</td><td></td><td colspan="2">7.5</td></tr>
</table></td><td>Minimum criterion

Verification: Test report</td><td>☐</td></tr>
</table>

20 Proposal for an EU regulation on requirements relating to emission limits and type approval for internal combustion engines for non-road mobile machinery, callable at: http://eur-lex.europa.eu/resource.html?uri=cellar:60e6a946-44c6-11e4-a0cb-01aa75ed71a1.0012.03/DOC_2&format=PDF (so on 14 December 2016).

21 The particle number has to be determined according to Annex XV of the Regulation on heavy duty vehicles (EU) no. 582/2011, callable at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:167:0001:0168:EN:PDF (so on 6 June 2017).

Annex 2: Test values for operating noises of construction machines

Construction machine type (in brackets: No. according to Annex I of Directive 2000/14/EC)	**Installed effective power P in kW** **Electrical rated power P_{el} in kW**	**Maximum test value for the guaranteed sound power level* L_{WAd} in dB** **L_{WAd} ≤ 104 dB**
(8) Vibrating plates, vibrating rollers, vibratory rammers	$P \leq 8$	103
	$P > 8$	104
(1) Lifting platforms with combustion engine (16) Bulldozers (21) Chain backhoe loaders (37) Chain loaders (43) Pipe layers with chain drive	$P \leq 55$	101
	$P > 55$	82 + 11 lg P
(8) non-vibrating rollers (13) Hoisting and spraying machines for concrete and mor-tar (16) Graders on wheels (17) Drilling equipment (18) Dumpers (21) Backhoe loaders on wheels (23) Graders (29) Hydraulic power units (36) Counterbalance forklift trucks with combustion engine (37) Wheel loaders (38) Mobile cranes (41) Road finishers (43) Pipe layers with wheel drive	$P \leq 55$	99
	$P > 55$	80 + 11 lg P
(3) Builder's hoists for the material transport (12) Lifting jacks (20) Excavators	$P \leq 15$	91
	$P > 15$	78 +11 lg P
(14) Conveyor belts (55) Ready-mixed concrete mixers	all	98
(4) Construction site band saw machines (5) Construction site circular sawing machines 10) Hand-guided concrete breakers, breaker and bush hammers and spades (28) Hydraulic hammers (30) Joint cutters (48) Road mills	all	104
(53) Tower cranes	all	94 + lg P

Construction machine type (in brackets: No. according to Annex I of Directive 2000/14/EC)	**Installed effective power P in kW** **Electrical rated power P_{el} in kW**	**Maximum test value for the guaranteed sound power level* L_{WAd} in dB** **$L_{WAd} \leq 104$ dB**
(45) Power current generators (57) Welding current generators	P_{el} ** ≤ 5	91
	5 < P_{el} ** ≤ 10	94
	P_{el} ** > 10	95
(9) Compressors (11) Concrete and mortar mixers	$P \leq 15$	95
	$P > 15$	$93 + 2 \lg P$

* The test value is integer. It is to be commercially rounded.

** P_{el} for welding current generators: conventional welding current multiplied by the conventional welding voltage for the lowest value of the switch-on duration according to manufacturer's specifications.
P_{el} for power current generators: variable continuous power unit power according to ISO 8528-1:1993, section 13.3.2.

Imprint

Publisher:
German Environment Agency (UBA)
Section III 1.3
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www.beschaffung-info.de

/umweltbundesamt.de
/umweltbundesamt

Design:
KOMAG mbH Berlin

Link to publication:
https://www.umweltbundesamt.de/publikationen

Photo credits:
Cover photo: © Superingo/Fotolia.com

Last updated: October 2017