Emission limit values: Combustion plants in EU and USA

The present document contains information about emission limit values for combustion plants in the EU and the USA.

Please note that a companion document in the current database Emissions from stationary sources: Regulations provides an overview of regulations in the EU and USA for stationary sources in general.

Further note that there are two companion documents that provide comparative tables with emission limit values for combustion plants in the EU as reported by the member states:

- Emission limit values: Comparative tables for combustion plants, existing installations in the EU
- Emission limit values: Comparative tables for combustion plants, new or substantially changed installations in the EU

The emission limit values in those documents are meant to be representative values of permits issued in the Member States. Ideally, they should represent the limit value for the median installation in a given category.

It is not possible to produce comparative tables with emission limit values where EU is compared to US, because emission limit values are defined in different ways. In the EU values are defined in terms of mg/Nm^3, whereas in the US values are expressed as nanograms per joule heat input.

For the **EU**, emission limit values are defined in Annex III - VII in the Directive 2001/80/EC *on the limitation of emissions of certain pollutants into the air from large combustion plants* (the "LCP directive"). Emission limit values are defined for SO_2, NO_X and dust.

Furthermore, there are provisions for combustion plants co-incinerating waste in Annex II of the directive 2000/76/EC of 4 December 2000 *on the incineration of waste*.

Both of these directives can be accessed through the page http://europa.eu.int/comm/environment/air/legis.htm

For the **USA,** emission limit values related to combustion plants are given in Title 40 (Protection of Environment), Part 60 (Standards of Performance for New Stationary Sources) in the following Subparts:

- **Subpart D** -- *Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction is Commenced After August 17, 1971*. It gives standards for particulate matter (§ 60.42), for SO_2 (§ 60.43) and for NOX (§ 60.44).
- **Subpart Da** -- *Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978*. In § 60.42a - §60.44a standards for PM, SO_2 and NO_X are given.
- **Subpart Db** -- *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*. In § 60.42b -§60.44b standards for PM, SO_2 and NO_X are given.
- **Subpart Dc** -- *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*. In § 60.42c - §60.43c standards for PM and SO_2 are given.
- **Subpart GG** -- *Standards of Performance for Stationary Gas Turbines*. In §60.332 and §60.333 standards for, respectively, NO_X and SO_2 are given.

In order to access these standards, use the link below and select the paragraph you look for. The link is to a page with a long list of all paragraphs within Title 40 (Protection of Environment), Part 60 (Standards of Performance for New Stationary Sources):
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=474f779beade290997e4611971d078f4&tpl=/ecfrbrowse/Title40/40cfr60_main_02.tpl

Values

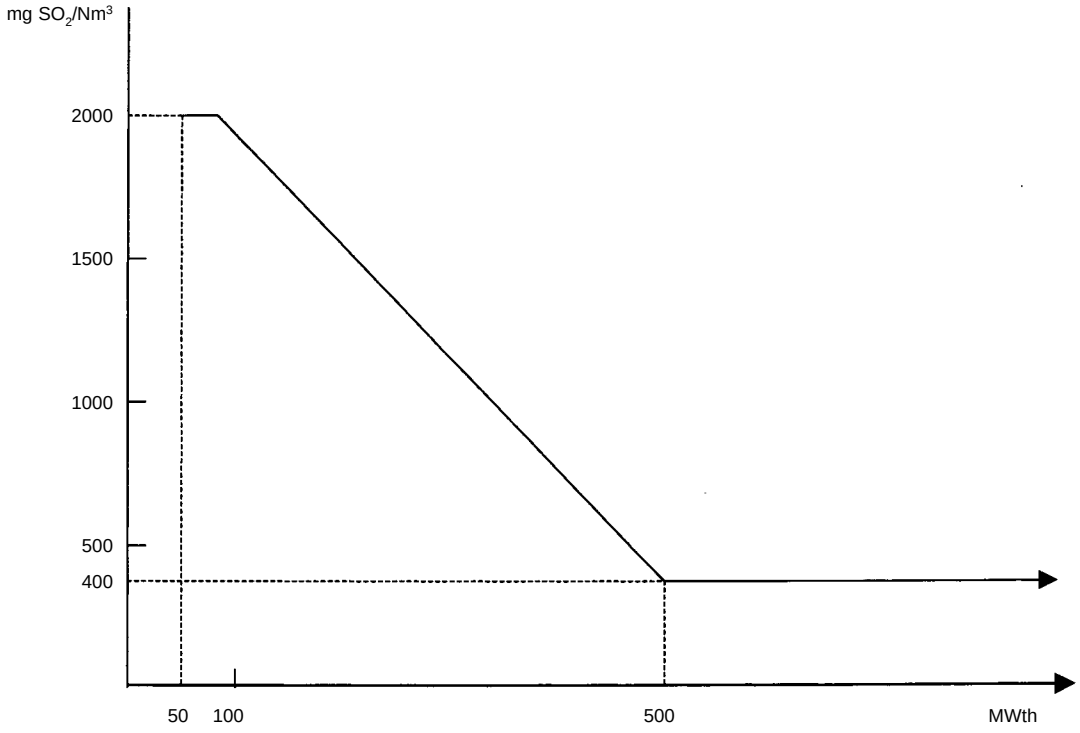
For easy reference, emission limit values in the EU according to the LCP Directive for SO_2, NO_X and dust are listed on the following pages (taken from the LCP Directive).

ANNEX III

EMISSION LIMIT VALUES FOR SO_2

Solid fuel

A. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 6 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3) respectively:



NB. Where the emission limit values above cannot be met due to the characteristics of the fuel, a rate of desulphurisation of at least 60 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 100 MWth, 75 % for plants greater than 100 MWth and less than or equal to 300 MWth and 90 % for plants greater than 300 MWth. For plants greater than 500 MWth, a desulphurisation rate of at least 94 % shall apply or of at least 92 % where a contract for the fitting of flue gas desulphurisation or lime injection equipment has been entered into, and work on its installation has commenced, before 1 January 2001.

B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 6 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines.

Type of fuel	50 to 100 MWth	100 to 300 MWth	> 300 MWth
Biomass	200	200	200
General case	850	200 ([1])	200

([1]) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm^3 (linear decrease) shall apply.

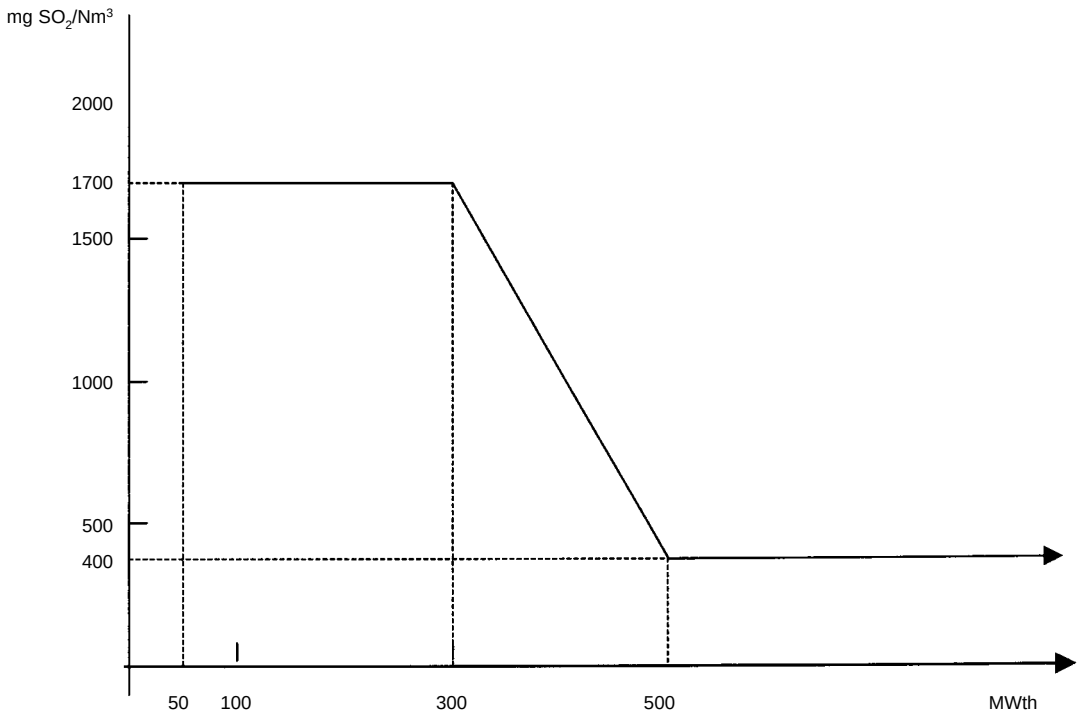
NB. Where the emission limit values above cannot be met due to the characteristics of the fuel, installations shall achieve 300 mg/Nm^3 SO_2, or a rate of desulphurisation of at least 92 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 300 MWth and in the case of plants with a rated thermal input greater than 300 MWth a rate of desulphurisation of at least 95 % together with a maximum permissible emission limit value of 400 mg/Nm^3 shall apply.

ANNEX IV

EMISSION LIMIT VALUES FOR SO_2

Liquid fuels

A. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:



B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines

50 to 100 MWth	100 to 300 MWth	> 300 MWth
850	400 to 200 (linear decrease) ([1])	200

([1]) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm^3 (linear decrease) shall apply.

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 1 700 mg/Nm^3 shall apply.

ANNEX V

EMISSION LIMIT VALUES FOR SO_2

Gaseous fuels

A. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel	Limit values (mg/Nm^3)
Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas	800
Gas from gasification of coal	([1])

([1]) The Council will fix the emission limit values applicable to such gas at a later stage on the basis of proposals from the Commission to be made in the light of further technical experience.

B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2):

Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from coke oven	400
Low caloric gases from blast furnace	200

ANNEX VI

EMISSION LIMIT VALUES FOR NO_X (MEASURED AS NO_2)

A. NO_x emission limit values expressed in mg/Nm³ (O_2 content 6 % for solid fuels, 3 % for liquid and gaseous fuels) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel:	Limit values (1) (mg/Nm³)
Solid (2), (3):	
50 to 500 MWth:	600
>500 MWth:	500
From 1 January 2016	
50 to 500 MWth:	600
>500 MWth:	200
Liquid:	
50 to 500 MWth:	450
>500 MWth:	400
Gaseous:	
50 to 500 MWth:	300
>500 MWth:	200

(1) Except in the case of the 'Outermost Regions' where the following values shall apply:
Solid in general: 650
Solid with < 10 % vol comps: 1 300
Liquid: 450
Gaseous: 350

(2) Until 31 December 2015 plants of a rated thermal input greater than 500 MW, which from 2008 onwards do not operate more than 2 000 hours a year (rolling average over a period of five years), shall:
— in the case of plant licensed in accordance with Article 4(3)(a), be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 600 mg/Nm³;
— In the case of plant subject to a national plan under Article 4(6), have their contribution to the national plan assessed on the basis of a limit value of 600 mg/Nm_3.
From 1 January 2016 such plants, which do not operate more than 1 500 hours a year (rolling average over a period of five years), shall be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 450 mg/Nm³.

(3) Until 1 January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10 %, 1 200 mg/Nm³ shall apply.

B. NO_x emission limit values expressed in mg/Nm^3 to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines

Solid fuels (O_2 content 6 %)

Type of fuel	50 to 100 MWth	100 to 300 MWth	> 300 MWth
Biomass	400	300	200
General case	400	200 ([1])	200

([1]) Except in the case of the 'Outermost Regions' where 300 mg/Nm^3 shall apply.

Liquid fuels (O_2 content 3 %)

50 to 100 MWth	100 to 300 MWth	> 300 MWth
400	200 ([1])	200

([1]) Except in the case of the 'Outermost Regions' where 300 mg/Nm^3 shall apply.

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 400 mg/Nm^3 shall apply.

Gaseous fuels (O_2 content 3 %)

	50 to 300 MWth	> 300 MWth
Natural gas (note 1)	150	100
Other gases	200	200

Gas Turbines

NO_x emission limit values expressed in mg/Nm^3 (O_2 content 15 %) to be applied by a single gas turbine unit pursuant to Article 4(2) (the limit values apply only above 70 % load):

	> 50 MWth (thermal input at ISO conditions)
Natural gas (Note 1)	50 (Note 2)
Liquid fuels (Note 3)	120
Gaseous fuels (other than natural gas)	120

Gas turbines for emergency use that operate less than 500 hours per year are excluded from these limit values. The operator of such plants is required to submit each year to the competent authority a record of such used time.

Note 1: Natural gas is naturally occurring methane with not more than 20 % (by volume) of inerts and other constituents.

Note 2: 75 mg/Nm^3 in the following cases, where the efficiency of the gas turbine is determined at ISO base load conditions:
- — gas turbines, used in combined heat and power systems having an overall efficiency greater than 75 %;
- — gas turbines used in combined cycle plants having an annual average overall electrical efficiency greater than 55 %;
- — gas turbines for mechanical drives.

For single cycle gas turbines not falling into any of the above categories, but having an efficiency greater than 35 % – determined at ISO base load conditions – the emission limit value shall be 50*η/35 where η is the gas turbine efficiency expressed as a percentage (and at ISO base load conditions).

Note 3: This emission limit value only applies to gas turbines firing light and middle distillates.

ANNEX VII

EMISSION LIMIT VALUES FOR DUST

A. Dust emission limit values expressed in mg/Nm^3 (O_2 content 6 % for solid fuels, 3 % for liquid and gaseous fuels) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel	Rated thermal input (MW)	Emission limit values (mg/Nm^3)
Solid	≥ 500 < 500	50 ([2]) 100
Liquid ([1])	all plants	50
Gaseous	all plants	5 as a rule 10 for blast furnace gas 50 for gases produced by the steel industry which can be used elsewhere

([1]) A limit value of 100 mg/Nm^3 may be applied to plants with a rated thermal input of less than 500 MWth burning liquid fuel with an ash content of more than 0,06 %.

([2]) A limit value of 100 mg/Nm^3 may be applied to plants licensed pursuant to Article 4(3) with a rated thermal input greater than or equal to 500 MWth burning solid fuel with a heat content of less than 5 800 kJ/kg (net calorific value), a moisture content greater than 45 % by weight, a combined moisture and ash content greater than 60 % by weight and a calcium oxide content greater than 10 %.

B. Dust emission limit values expressed in mg/Nm^3 to be applied by new plants, pursuant to Article 4(2) with the exception of gas turbines:

Solid fuels (O_2 content 6 %)

50 to 100 MWth	> 100 MWth
50	30

Liquid fuels (O_2 content 3 %)

50 to 100 MWth	> 100 MWth
50	30

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 50 mg/Nm^3 shall apply.

Gaseous fuels (O_2 content 3 %)

As a rule	5
For blast furnace gas	10
For gases produced by the steel industry which can be used elsewhere	30