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**APPROVED UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI  
AND THE NO<sub>x</sub> TECHNICAL CODE**

- 1 The Sub-Committee on Ship Design and Equipment, at its forty-eighth session (February 2005), agreed to a number of Unified Interpretations to MARPOL Annex VI and the NO<sub>x</sub> Technical Code and submitted them to the fifty-third session of the Marine Environment Protection Committee (MEPC 53), for approval.
- 2 The Marine Environment Protection Committee, at its fifty-third session (July 2005), approved the Unified Interpretations agreed by the Sub-Committee on Design and Equipment at its forty-eighth session. The Committee also approved two further Unified Interpretations.
- 3 All the Unified Interpretations, as approved by the Committee, are attached at annex hereto.

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**ANNEX****UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI  
AND THE NO<sub>x</sub> TECHNICAL CODE****MARPOL ANNEX VI****Regulation 1***Application*

Regulation 1 reads as follows:

The provisions of this Annex shall apply to all ships, except where expressly provided otherwise in regulations 3, 5, 6, 13, 15, 18 and 19 of this annex.

Interpretation:

For application of this regulation the term “all ships” should be interpreted as applicable to all ships (as defined by MARPOL 73 Article 2(4)).

**Regulation 2(4)***Ozone depleting substances*

Regulation 2(4) reads as follows:

New installations, in relation to regulation 12 of this annex, means the installation of systems, equipment, including new portable fire-extinguishing units, insulation, or other material on a ship after the date on which this Annex enters into force, but excludes repair or recharge of previously installed systems, equipment, insulation, or other material, or recharge of portable fire-extinguishing units.

Interpretation:

For application of this regulation the term “new installations” should be interpreted as follows:

- (a) For new ships, installations on board ships the keels of which are laid or which are at a similar stage of construction on or after 19 May 2005.
- (b) For existing ships, new installations with a contractual delivery date to the ship on or after 19 May 2005 or, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 19 May 2005.

The same interpretation should apply with regard to new HCFC installations but with the substitution of ‘1 January 2020’ in place of 19 May 2005.

**Regulation 13(1)(b)(i)**  
*Nitrogen oxides (NO<sub>x</sub>)*

Regulation 13(1)(b)(i) reads as follows:

This regulation does not apply to emergency diesel engines, engines installed in lifeboats and any device or equipment intended to be used solely in case of emergency.

Interpretation:

Regulation 13 does not apply to an engine which is used solely in response to emergencies on the ship on which the engine is installed.

**Regulation 13(1)(c)**  
*Nitrogen oxides (NO<sub>x</sub>)*

Regulation 13(1)(c) reads as follows:

Notwithstanding the provisions of subparagraph (a) of this paragraph, the Administration may allow exclusion from the application of this regulation to any diesel engine which is installed on a ship constructed, or on a ship which undergoes a major conversion, before the entry into force of the present Protocol, provided that the ship is solely engaged in voyages to ports or offshore terminals within the State of the flag of which the ship is entitled to fly.

Interpretation:

For application of this regulation the term “on a ship which undergoes a major conversion,” should be interpreted as an error inserting the concept of ‘ship’ in place of ‘engine’, ship conversion is not given elsewhere within the Annex. In order to be consistent with regulation 13(1)(a)(i) & (ii) this should be read as “or engine which undergoes a major conversion”.

**Regulation 13(2)(a)(iii)**  
*Nitrogen oxides (NO<sub>x</sub>)*

Regulation 13(2)(a)(iii) reads as follows:

For the purpose of this regulation, *major conversion* means a modification of an engine where the maximum continuous rating of the engine is increased by more than 10%.

Interpretation:

For application of this regulation in the case of ships built before 1 January 2000 the term “by more than 10%” should be interpreted as applicable to the pre 1 January 2000 maximum continuous rating.

**Regulation 16(2)(a)**  
*Shipboard incineration*

Regulation 16(2)(a) reads as follows:

Except as provided in subparagraph (b) of this paragraph, each incinerator installed on board a ship on or after 1 January 2000 shall meet the requirements contained in appendix IV to this annex. Each incinerator shall be approved by the Administration taking into account the standard specifications for shipboard incinerators developed by the Organization\*.

\* Refer to resolution MEPC.76(40), Standard specification for shipboard incinerators.

Interpretation:

For application of this regulation the term “installed on board a ship on or after 1 January 2000” should be interpreted as follows:

- (a) For new ships, installations on board ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2000.
- (b) For existing ships, new installations with a contractual delivery date to the ship on or after 1 January 2000 or, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 1 January 2000.

**Regulation 16(6)**  
*Shipboard incineration*

Regulation 16(6) reads as follows:

Shipboard incineration of polyvinyl chlorides (PVCs) shall be prohibited, except in shipboard incinerators for which IMO Type Approval Certificates have been issued.

Interpretation:

For application of this regulation it should be interpreted as applicable to incinerators meeting either resolution MEPC.59(33) or resolution MEPC.76(40) specifications.

**Regulation 16(7)**  
*Shipboard incineration*

Regulation 16(7) reads as follows:

All ships with incinerators subject to this regulation shall possess a manufacturer’s operating manual which shall specify how to operate the incinerator within the limits described in paragraph 2 of appendix IV to this annex.

Interpretation:

For application of this regulation it should be interpreted that possession of an operating manual is applicable only to resolution MEPC.76(40) incinerators installed on or after 1 January 2000.

**Regulation 16(8)**

*Shipboard incineration*

Regulation 16(8) reads as follows:

Personnel responsible for operation of any incinerator shall be trained and capable of implementing the guidance provided in the manufacturer's operating manual.

Interpretation:

For application of this regulation it should be interpreted that any incinerator refers to those specified in regulation 16(2).

**Regulation 16(9)**

Regulation 16 Shipboard Incinerators, reads as follows:

Monitoring of combustion flue gas outlet temperature shall be required at all times and waste shall not be fed into a continuous-feed shipboard incinerator when the temperature is below the minimum allowed temperature of 850°C. For batch-loaded shipboard incinerators, the unit shall be designed so that the temperature in the combustion chamber shall reach 600°C within five minutes after start-up.

Interpretation:

For application of the regulation it should be interpreted that the temperature restrictions as given are only applicable to Resolution MEPC.76(40) Incinerators installed on or after 1 January 2000.

**Regulation 18(1)**

Regulation 18 Fuel Oil Quality

Regulation 18(1) reads as follows:

Fuel oil for combustion purposes delivered to and used on board ships to which this Annex applies shall meet the following requirements:

Interpretation:

Fuel oil means any oil used in connection with the propulsion and operation of the ship.

## TECHNICAL CODE ON CONTROL OF EMISSION OF NITROGEN OXIDES FROM MARINE DIESEL ENGINES (NO<sub>x</sub> TECHNICAL CODE)

**Table 3 – Symbols and subscripts for terms and variables used in the formulae for the test-bed measurement methods**

Table 3 gives:

Symbol	Term	Dimension
$p_a$	Saturation vapour pressure of the engine intake air (in ISO 3046-1, 1995: $p_{sy}$ = PSY, test ambient vapour pressure)	kPa
$p_B$	Total barometric pressure (in ISO 3046-1, 1995: $p_x$ = PX, site ambient total pressure; $p_y$ = PY, test ambient total pressure)	kPa
$p_s$	Dry atmospheric pressure	kPa
$R_a$	Relative humidity of the intake air	%
$T_a$	Absolute temperature of the intake air	K

Interpretation:

For application of the term “ $p_s$ ” it should be interpreted that the dry atmospheric pressure is determined in accordance with the following formula:

$$p_s = p_B - \frac{R_a \bullet p_a}{100}$$

It should also be interpreted that the  $p_a$  term be determined using a temperature value for the intake air determined at the same physical location as the measurements for  $p_B$  and  $R_a$ .

Interpretation:

For application of the term “ $T_a$ ” it should be interpreted that the temperature of the intake air temperature is that determined at the engine/turbocharger intake suction filter.

### Chapter 1.3 Definitions

#### Chapter 1.3.10

Chapter 1.3.10 reads as follows:

*Marine diesel engine* means any reciprocating internal-combustion engine operating on liquid or dual fuel, to which regulations 5, 6 and 13 of Annex VI apply, including booster/compound systems if applied.

Interpretation:

Regulation 13 does apply to dual-fuel engines. For the application of this section it should be interpreted that if the engine is intended to be operated normally in the gas mode i.e. with the main fuel gas and only a small amount of liquid pilot fuel, the requirements of regulation 13 have to be met only for this operation mode. Operation on pure liquid fuel resulting from restricted gas supply in cases of failures should be exempted for the voyage to the next appropriate port for the repair of the failure.

## **Chapter 2.2 Procedures for pre-certification of an Engine Group**

### **Chapter 2.2.4**

Chapter 2.2.4 reads as follows:

There are engines which, due to their size, construction and delivery schedule, cannot be pre-certified on a test-bed. In such cases, the engine manufacturer, shipowner or ship builder shall make application to the Administration requesting an on-board test (see 2.1.2.2). The applicant must demonstrate to the Administration that the on-board test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of this Code. Such a survey may be accepted for one engine or for an engine group represented by the parent engine only, but it shall not be accepted for an engine family certification. In no case shall an allowance be granted for possible deviations of measurements if an initial survey is carried on board a ship without any valid pre-certification test.

Interpretation:

For engines undergoing an on-board certification test, to be issued with an EIAPP Certificate, the same procedures apply as if the engine had been pre-certified on a test-bed:

- (a) the survey on-board meets the pre-certification survey requirements; and
- (b) the on-board test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of the NO<sub>x</sub> Technical Code; and
- (c) the application average weighted NO<sub>x</sub> emission value meets the requirements of regulation 13 of Annex VI; and
- (d) the engine has an approved Technical File.

### **Chapter 2.2.8**

Chapter 2.2.8 reads as follows:

A flow chart providing guidance for compliance with the requirements of a pre-certification survey for marine diesel engines intended for installation on board of ships is provided in figure 1 of appendix 2 of this Code.



Interpretation:

The text in chapter 2 gives the certification procedures which should be followed. Where discrepancies exist with figure 1, the text of chapter 2 takes precedence.

## **Chapter 2.3 Procedures for certification of an engine**

### **Chapter 2.3.4**

Chapter 2.3.4 reads as follows:

The shipowner shall have the option of direct measurement of NO<sub>x</sub> emissions during engine operation. Such data may take the form of spot checks logged with other engine operating data on a regular basis and over the full range of engine operation or may result from continuous monitoring and data storage. Data must be current (taken within the last 30 days) and must have been acquired using the test procedures cited in this NO<sub>x</sub> Technical Code. These monitoring records shall be kept on board for three months for verification purposes by the Parties to the Protocol of 1997. Data shall also be corrected for ambient conditions and fuel specification, and measuring equipment must be checked for correct calibration and operation, in accordance with the procedures specified by the measurement equipment manufacturer in the engine's technical file. Where exhaust gas after-treatment devices are fitted which influence the NO<sub>x</sub> emissions, the measuring point(s) must be located downstream of such devices.

Interpretation:

For application of this section it should be interpreted that any system or procedure utilized to monitor engine NO<sub>x</sub> emissions by the direct measurement method shall meet the requirements of MEPC Resolution 103(49) 'Guidelines for On-board NO<sub>x</sub> Verification Procedure – Direct Measurement and Monitoring Method'.

### **Chapter 2.3.5**

Chapter 2.3.5 reads as follows:

To demonstrate compliance by the direct measurement method, sufficient data shall be collected to calculate the weighted average NO<sub>x</sub> emissions in accordance with this Code.

Interpretation:

For application of this section it should be interpreted that sufficient data shall be collected by the direct measurement method to enable the weighted average NO<sub>x</sub> emissions to be determined in accordance with MEPC Resolution 103(49) 'Guidelines for On-board NO<sub>x</sub> Verification Procedure – Direct Measurement and Monitoring Method'.

### **Chapter 2.3.6**

Chapter 2.3.6 reads as follows:

Every marine diesel engine installed on board a ship shall be provided with a technical file. The technical file shall be prepared by the engine manufacturer and approved by the Administration, and required to accompany an engine throughout its life on board ships. The technical file shall contain information as specified in 2.4.1.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.

### **Chapter 2.3.13**

Chapter 2.3.13 reads as follows:

Flow charts providing guidance for compliance with the requirements of an initial, periodical and intermediate surveys for certification of marine diesel engines installed on board ships are provided in figures 2 and 3 of appendix 2 of this Code.

Interpretation:

This section should be interpreted as follows:

The text in chapter 2 gives the certification procedures which should be followed. Where discrepancies exist with figures 2 and 3, the text of chapter 2 takes precedence.

## **Chapter 2.4 Technical file and on-board NO<sub>x</sub> verification procedures**

### **Chapter 2.4.1.1**

Chapter 2.4.1.1 reads as follows:

To enable an Administration to perform the engine surveys described in 2.1, the technical file required by 2.3.6 shall, at a minimum, contain the identification of those components, settings and operating values of the engine which influences its NO<sub>x</sub> emissions.

Interpretation:

This section should be interpreted as follows:

Where a NO<sub>x</sub> reducing device or system is fitted in order to achieve compliance with regulation 13 (in accordance with paragraph 2.2.5), these should be identified in the Technical File.

### **Chapter 2.4.4.3**

Chapter 2.4.4.3 reads as follows:

On-board NO<sub>x</sub> verification procedures shall be determined by using the direct measurement and monitoring method in accordance with 2.3.4, 2.3.5, 2.3.7, 2.3.8, 2.3.11, and 5.5.

Interpretation:

For application of this section it should be interpreted that the on-board NO<sub>x</sub> verification procedures have been approved by the Administration taking into account resolution MEPC.103(49) the 'Guidelines for On-board NO<sub>x</sub> Verification Procedure – Direct Measurement and Monitoring Method'.

### **Chapter 2.4.5**

Chapter 2.4.5 reads as follows:

When a NO<sub>x</sub> monitoring and recording device is specified as on-board NO<sub>x</sub> verification procedures, such device shall be approved by the Administration based on guidelines to be developed by the Organization. These guidelines shall include, but are not limited to, the following items:

- .1 a definition of continuous NO<sub>x</sub> monitoring, taking into account both steady-state and transitional operations of the engine;
- .2 data recording, processing and retention;
- .3 a specification for the equipment to ensure that its reliability is maintained during service;
- .4 a specification for environmental testing of the device;
- .5 a specification for the testing of the equipment to demonstrate that it has a suitable accuracy, repeatability and cross sensitivity compared with the applicable sections of this Code; and
- .6 the form of the approval certificate to be issued by the Administration.

Interpretation:

For application of this section it should be interpreted that resolution MEPC.103(49) 'Guidelines for On-board NO<sub>x</sub> Verification Procedure – Direct Measurement and Monitoring Method' defines the guidelines as developed by the Organization.

## **Chapter 4.4 Application of the engine group concept**

### **Chapter 4.4.4**

Chapter 4.4.4 reads as follows:

The application for the engine group concept, if requested by the engine manufacturer or another party, shall be considered for certification approval by the Administration. If the engine owner, with or without technical support from the engine manufacture, decides to perform modifications on a number of similar engines in the owner's fleet, the owner may apply for an engine group certification. The engine's group may include a test engine on the test bench. Typical applications are similar modifications of similar engines in service or similar engines in similar operational conditions.

Interpretation:

For application of this section it should be interpreted that the applicant for the engine certification takes on the responsibilities of the "engine manufacturer" as elsewhere given within the NO<sub>x</sub> Technical Code.

## **Chapter 5.2 Test conditions**

### **Chapter 5.2.2.2**

Chapter 5.2.2.2 reads as follows:

All engines when equipped as intended for installation on board ships must be capable of operating within the allowable NO<sub>x</sub> emission levels of regulation 13(3) of Annex VI at an ambient seawater temperature of 25°C.\*

\* 25°C seawater temperature is the reference ambient condition to comply with the NO<sub>x</sub> limits. An additional temperature increase due to heat exchangers installed on board, e.g. for the low-temperature cooling water system, shall be taken into consideration.

Interpretation:

For application of this section it should be interpreted that the 25°C seawater temperature defines an ambient reference value for which compliance with the NO<sub>x</sub> emission limits as defined by regulation 13(3) must be demonstrated (tested or calculated with T<sub>SC Ref</sub> specified by the manufacturer).

The application of this reference primary coolant value should be considered in accordance with the charge air cooling arrangement applicable to the individual installation as follows:

- (a) Direct seawater cooling to engine charge air coolers. Compliance with the NO<sub>x</sub> limits should be demonstrated (or otherwise justified) with a charge air/scavenge air cooler coolant inlet temperature of 25°C.

- (b) Intermediate ‘freshwater’ cooling to engine charge air coolers. Compliance with the NO<sub>x</sub> limits should be demonstrated (or otherwise justified) with the charge air/scavenge air cooling system operating with the highest allowable in service coolant inlet temperature regime comparable with an ambient seawater temperature of 25°C.

Demonstration of compliance at a Parent Engine test for a direct seawater cooled system, as given by (a) above, does not demonstrate compliance in accordance with the higher charge air temperature regime inherent with an intermediate ‘freshwater’ cooling arrangement as given under (b).

- (c) For those installations incorporating no seawater cooling, either direct or indirect, to the charge air coolers e.g. radiator cooled ‘freshwater’ systems, air/air charge air coolers, then it should be interpreted that compliance with the NO<sub>x</sub> limits should be demonstrated with the engine and charge air cooling systems operating “as intended for installation on board”.

## **Chapter 5.4 Measurement equipment**

### **Chapter 5.4.2**

Chapter 5.4.2 reads as follows:

Other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced in 5.4.1.

Interpretation:

For application of the term “equivalent” it should be interpreted that alternative systems or analysers would, as quantified by using recognized national or international standards (such as ISO 8178, Part 1:1996, section 7), yield equivalent results when used to measure diesel engine exhaust emission concentrations in terms of the requirements referenced in 5.4.1 of Appendix 3.

## **Chapter 5.5 Determination of exhaust gas flow**

### **Chapter 5.5.3 *Carbon-balance method***

Chapter 5.5.3 reads as follows:

This method involves exhaust gas mass flow calculation from fuel consumption and exhaust gas concentrations using the carbon and oxygen balance method as specified in appendix 6 of this Code.

Interpretation:

For calculation of the exhaust gas mass flow in accordance with “Method 2, universal, carbon/oxygen-balance” detailed under appendix 6 the “CW (soot)” term should be taken as zero.

## **Chapter 5.6 Permissible deviations of instruments for engine-related parameters and other essential parameters**

Chapter 5.6 reads as follows:

The calibration of all measuring instruments shall be traceable to recognized international standards and shall comply with the requirements as set out in 1.3.1 of appendix 4 of this Code.

Interpretation:

For application of this section it should be interpreted that the measuring instruments as detailed under appendix 4 is not to be considered a definitive listing. Where additional measuring instruments are required in order to define an engine's NO<sub>x</sub> emission performance, for example the measurement of peak cylinder or charge air pressures, then those measuring instruments should also be calibrated. As given by 1.3.1 of appendix 4 the recognized standards may be national or international.

## **Chapter 5.9 Test Run**

### **Chapter 5.9.2 *Main exhaust components to be analysed***

Chapter 5.9.2.1 reads as follows:

An analytical system for the determination of the gaseous emissions (CO, CO<sub>2</sub>, HC, NO<sub>x</sub>, O<sub>2</sub>) in the raw exhaust gas shall be based on the use of the following analysers:

- .1 HFID analyser for the measurement of hydrocarbons;
- .2 NDIR analyser for the measurement of carbon monoxide and carbon dioxide;
- .3 HCLD or equivalent analyser for the measurement of nitrogen oxides; and
- .4 PMD, ECS or ZRDO for the measurement of oxygen.

Interpretation:

For application of 5.9.2.1.3 the term "equivalent" in this instance should be interpreted as referring to the use of CLD analysers for the dry basis measurement of nitrogen oxides.

### **Chapter 5.9.7 *Analyser response***

Chapter 5.9.7 reads as follows:

The output of the analysers shall be recorded, both during the test and during all response checks (zero and span), on a strip chart recorder or measured with an equivalent data acquisition system with the exhaust gas flowing through the analysers at least during the last ten minutes of each mode.

Interpretation:

For application of this section it should be interpreted that the response must be of sufficient accuracy and resolution to enable verification of the zero and span response of the analysers in accordance with 5.9.9.

## **Chapter 5.12 Calculation of the gaseous emissions**

### **Chapter 5.12.4 Calculation of the emission mass flow rates**

Chapter 5.12.4.1 reads as follows:

The emission mass flow rates for each mode shall be calculated as follows (for the raw exhaust gas):

$$\text{Gas mass} = u \cdot \text{conc} \cdot G_{\text{EXHW}} \quad (15)$$

or

$$\text{Gas mass} = v \cdot \text{conc} \cdot V_{\text{EXHD}} \quad (16)$$

or

$$\text{Gas mass} = w \cdot \text{conc} \cdot V_{\text{EXHW}} \quad (17)$$

Interpretation:

For application of this section it should be interpreted that for equations (15) and (17) the term “conc” applies to the averaged gas concentrations, as determined in accordance with 5.11, measured or corrected in accordance with 5.12.2 (conc, dry/ $K_{w,r}$ ) to a wet basis and (in the case of  $\text{NO}_x$ ) multiplied by the  $K_{\text{HDIES}}$  correction factor for humidity and temperature in accordance with 5.12.3.

For equation (16) the term “conc” applies to the averaged gas concentrations, as determined in accordance with 5.11, measured or corrected in accordance with 5.12.2 (conc, wet  $\cdot K_{w,r}$ ) to a dry basis and (in the case of  $\text{NO}_x$ ) multiplied by the  $K_{\text{HDIES}}$  correction factor for humidity and temperature in accordance with 5.12.3.

## **Chapter 6.2 Engine parameter check method**

### **Chapter 6.2.3 Documentation for an engine parameter check method**

Chapter 6.2.3.4 List of  $\text{NO}_x$  –influencing parameters sometimes modified on board

Chapter 6.2.3.4.2 reads as follows:

The actual technical file of an engine may, based on the recommendations of the engine manufacturer and the approval of the Administration, include less components and/or parameters than discussed above depending on the particular engine and the specific design.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.

**Chapter 6.2.3.5 *Checklist for the engine parameter check method***

Chapter 6.2.3.5 reads as follows:

For some parameters, different survey possibilities exist. Approved by the Administration, the ship operator, supported by the engine manufacturer, may choose what method is applicable. Any one of, or a combination of, the methods listed in appendix 7 of this Code may be sufficient to show compliance.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.



## APPENDIX 4

### CALIBRATION OF THE ANALYTICAL INSTRUMENTS (REFER TO CHAPTER 5 OF THE NO<sub>x</sub> TECHNICAL CODE)

#### 1 Introduction

Chapter 1.1 reads as follows:

Each analyser used for the measurement of an engine's parameters shall be calibrated as often as necessary in accordance with the requirements of this appendix.

Tables 1, 2, 3 and 4 right hand column headers read as follows:

Calibration intervals (month).

Interpretation:

For application of this section it should be interpreted that the calibration intervals as defined by Tables 1, 2, 3, and 4 of appendix 4 represent the duration of calibration validity applicable to the particular measurement instruments listed.

All instruments used for the measurement of an engine's parameters should be verified as being within the defined calibration validity period at the time of the measurement.

#### 8 Interference effects with CO, CO<sub>2</sub>, NO<sub>x</sub> and O<sub>2</sub> analysers

##### 8.1 *CO analyser interference check*

8.1 reads as follows:

Water and CO<sub>2</sub> may interfere with the CO analyser performance. Therefore, a CO<sub>2</sub> span gas having a concentration of 80 to 100% of full scale of the maximum operating range used during testing shall be bubbled through water at room temperature and the analyser response recorded. The analyser shall not be more than 1% of full scale for ranges greater than or equal to 300 ppm or more than 3 ppm for ranges below 300 ppm.

Interpretation:

For application of this section the term "The analyser shall not be more than ..." should be interpreted as "The analyser response shall not be more than ..." to correctly reflect the intent of this statement and ISO 8178-1, section 8.9.1.