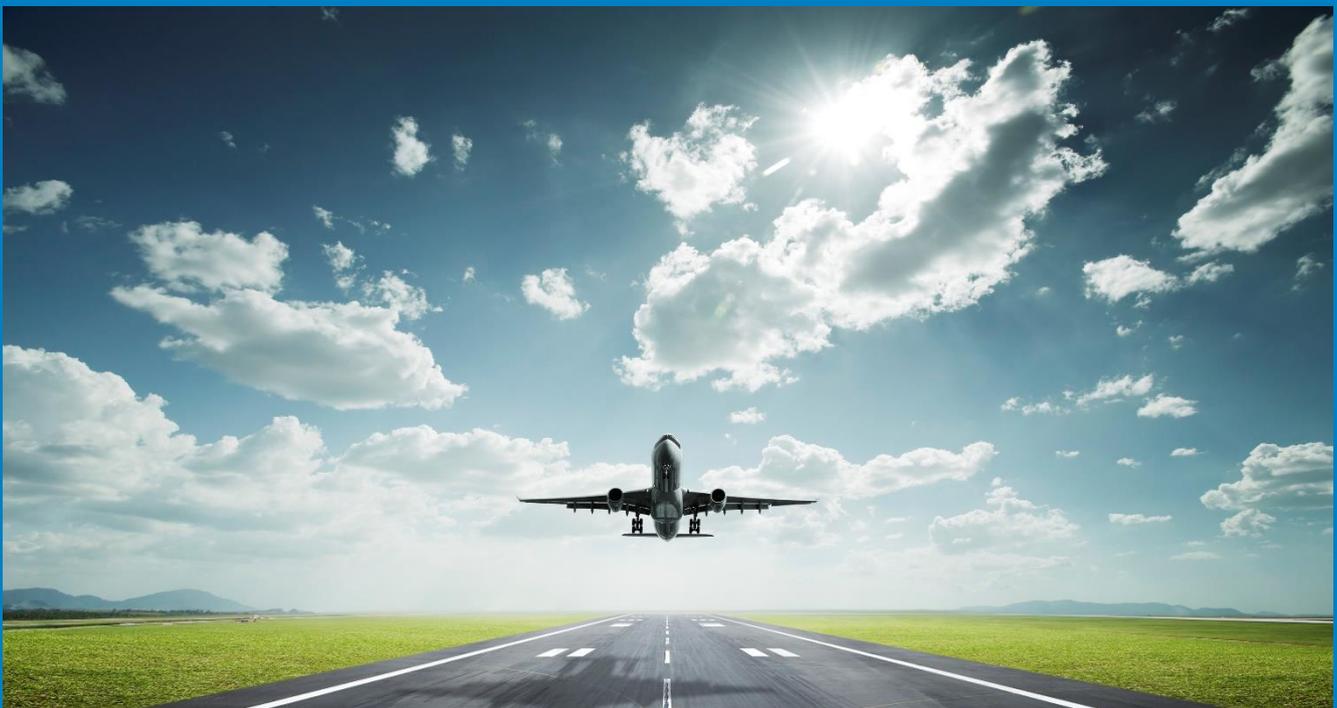


# Halon replacement in the aviation industry

**November 2019**



## Abbreviations

CA	certification authority
CofA	certificate of airworthiness
CS	certification specification
EASA	European Union Aviation Safety Agency
EU	European Union
FAA	US Federal Aviation Administration
ICAO	International Civil Aviation Organization
ODP	ozone-depleting potential
ODS	ozone-depleting substance
SoD	state of design
TC	type certificate
UV	ultraviolet
VA	validation authority

## Glossary

**certifying authority (CA):** this is the regulatory authority when it acts in relation to civil aeronautical products or articles that originate in the state or territory for which it acts legally;

**ozone-depleting potential (ODP):** a measure of how much damage a chemical can cause to the ozone layer compared with a similar mass of trichlorofluoromethane (CFC-11). CFC-11 with an ODP of 1.0 is used as the base figure for measuring ODP. The higher the ODP, the more damage a chemical can cause to the ozone layer;

**ozone-depleting substance (ODS):** a chemical that damages the ozone layer when released to the atmosphere;

**ozone layer:** region of the upper atmosphere (stratosphere) roughly 15-35 km above the Earth's surface, containing relatively high concentrations of ozone (O<sub>3</sub>) molecules and protecting humans and the environment from harmful levels of UV radiation from the sun;

**Ozone Regulation:** Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer;

**regulatory authority:** the government agency or entity that acts legally on behalf of the state of design (SoD) for matters relating to airworthiness and environmental protection standards (and the determination of compliance therewith) for civil aviation products or articles;

**state of design (SoD):** the state or territory that has jurisdiction over the organisation responsible for the type design and continued airworthiness of an aviation product or article, pursuant to the Chicago Convention on International Civil Aviation (ICAO Convention).

**validating authority (VA):** this is the regulatory authority when it acts in relation to civil aeronautical products or articles that originate in, and are imported from, a state or territory other than that for which it acts legally.

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# 1. Introduction

## 1.1. Background: ozone-depleting substances

The ozone layer is a region of the upper atmosphere containing relatively high concentrations of ozone (O<sub>3</sub>) molecules. It protects humans and other living things from harmful ultraviolet (UV) radiation from the sun and is therefore crucial to life on Earth.

In the 1970s, scientists discovered that continued emissions of ozone-depleting substances (ODSs) cause significant damage to the ozone layer. The international community adopted the Vienna Convention for the Protection of the Ozone Layer in 1985 and the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987 as a framework for legislative and practical action to protect the ozone layer.

The Montreal Protocol and its subsequent amendments are designed to reduce emissions of some 90 ODSs by phasing out their production and consumption. Subsequent action has produced clear evidence of a decrease in the atmospheric burden of ODSs and some early signs of stratospheric ozone recovery have been observed.

However, despite drastic (98%) reductions in global consumption of ODSs, the ozone layer is not projected to recover pre-1980 concentration levels before the middle of this century. Increased UV-B radiation resulting from ozone depletion persists as a significant threat to health and the environment. At the same time, most ODSs have very high global warming potential and are significant factors in raising the temperature of the planet.

Therefore, we need to take further effective measures to protect human health and the environment against adverse effects resulting from ODS emissions and avoid the risk of delaying the recovery of the ozone layer yet further. The production and use of ODSs must be minimised and eliminated wherever technically and economically feasible alternatives with low global warming potential are available.

While many ODSs are greenhouse gases, they are not controlled under the United Nations Framework Convention for Climate Change and its Kyoto Protocol, on the assumption that they will be phased-out under the Montreal Protocol. Despite the progress made under the Montreal Protocol, the phasing-out still needs to be completed in the EU and globally, although we have to bear in mind that many current alternatives also have high global warming potential.

The EU needs to take action to comply with its obligations under the Montreal Protocol. Since the 1980s, it has adopted a series of Ozone Regulations that have eliminated the most relevant ODSs and established it as a world leader on ozone policy.

The main objectives of the current **Ozone Regulation** (Regulation (EC) No 1005/2009)<sup>1</sup> are to:

- Ensure that the EU is compliant with the agreements that the international community has put in place to protect the ozone layer; and
- Have a high level of ambition for protecting the ozone layer and fighting climate change.

**Halon 1211, halon 1301 and halon 2402** are ODSs listed as controlled substances in the Ozone Regulation (Group III in Annex I). Their production in EU Member States has been banned since 1994, as required under the Montreal Protocol, but they may be placed on the EU market and used for ‘critical uses’, including some uses on aircraft (see section 2). In the light of the increased availability and implementation of alternatives, ‘cut-off dates’ and ‘end dates’<sup>2</sup> have been established for phasing-out these halons, after which their use will not be considered ‘critical’ and will no longer be permitted.

## 1.2. Purpose of this guide

The primary purpose of this guide is to clarify how the Ozone Regulation applies to **aeronautical products**.

In addition, it gives an overview of the rules applicable to the use of **halons in the aviation industry**.

## 1.3. Applicable EU Regulation

To regulate the production, import, export, placing on the market, use, recovery, recycling, reclamation and destruction of ODSs, the **Ozone Regulation** *inter alia* determines ‘critical uses’ of halons and lays down cut-off and end dates in each case.

Commission Regulation (EU) No 2017/605<sup>3</sup> amended the Ozone Regulation by clarifying that ‘[f]or **aircraft**, submission of a request for type certification refers to a submission of a request for a new aircraft type certification’.

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<sup>1</sup> [Regulation \(EC\) No 1005/2009](#)

<sup>2</sup> For the definitions of ‘cut-off date’ and ‘end date’, see Annex VI of the Ozone Regulation.

<sup>3</sup> [Commission Regulation \(EU\) 2017/605](#)

## 2. Critical uses of halons in aircraft

Article 5 of the Ozone Regulation prohibits the placing on the market and use<sup>4</sup> of the **controlled substances** listed in Annex I to the Regulation, including the following halons (listed in Group III in Annex I):

Substance			ODP
CF <sub>2</sub> BrCl	Halon-1211	Bromochlorodifluoromethane	3.0
CF <sub>3</sub> Br	Halon-1301	Bromotrifluoromethane	10.0
C <sub>2</sub> F <sub>4</sub> Br <sub>2</sub>	Halon-2402	Dibromotetrafluoroethane	6.0

**Table 1: Halon classification**

However, by way of exemption from Article 5, Article 13 allows the use of halons for certain **'critical uses'**; these are listed in Annex VI.

Halons are fire-extinguishing agents that have been used in aircraft fire-protection systems. Historically, it has been difficult to replace them with alternative agents with lower ODP, so **'critical uses'** (applications) of halons have been accepted, subject to:

- **'cut-off dates'**, after which halons cannot be used for fire extinguishers or fire-protection systems for **new equipment and new facilities** for the application; and
- **'end dates'**, after which halons cannot be used for the application and by which fire extinguishers and fire-protection systems containing halons must be **decommissioned**.

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<sup>4</sup> For the definitions of 'placing on the market' and 'use', see Article 3 of the Ozone Regulation.

Table 2 below is an extract from Annex VI to the Ozone Regulation showing application four (**halon uses in aircraft**) and the cut-off and end dates for each use:

Purpose	Type of extinguisher	Type of halon	Cut-off date (31 December)	End date (31 December)
Protection of normally unoccupied cargo compartments	Fixed system	1301 1211 2402	2018	2040
Protection of cabins and crew compartments	Portable extinguisher	1211 2402	2014	2025
Protection of engine nacelles and auxiliary power units	Fixed system	1301 1211 2402	2014	2040
Inerting of fuel tanks	Fixed system	1301 2402	2011	2040
Protection of lavatory waste receptacles	Fixed system	1301 1211 2402	2011	2020
Protection of dry bays	Fixed system	1301 1211 2402	2011	2040

**Table 2: Halon uses with cut-off and end dates**

### 3. EU rules in the context of the aviation industry

#### 3.1. Relation between the Ozone Regulation and Regulation (EU) No 748/2012

**Commission Regulation (EU) No 748/2012<sup>5</sup>** lays down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, and for the certification of design and production organisations.

In Annex I (Part-21), it sets out how the airworthiness and environmental protection requirements applicable to an aeronautical product (or to changes thereto) are determined.

In the context of the **Ozone Regulation**, aircraft are considered as ‘equipment’ and Annex VI states that ‘new equipment’ is equipment for which, by the cut-off date, neither of the following has occurred:

- ✘ signature of the relevant procurement or development contract; or

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<sup>5</sup> [Commission Regulation \(EU\) No 748/2012](#)

- ✘ submission of a request to the appropriate regulatory authority for type approval or type certification. For aircraft, ‘submission of a request for type certification’ means submission of a request for a new aircraft type certification (see above).

For the aviation industry, ‘new equipment’ is a **new product** (aircraft type design) and the cut-off date is to be compared with the date on which the application for the new type certificate is submitted<sup>6</sup>. This does not apply to a **changed product**, for which an application is made to change an existing type certificate or for a supplemental type certificate<sup>7</sup> (see example in section 4.1).

The cut-off dates are not considered as part of the **type-certification basis**,<sup>8</sup> nor as part of the **operational suitability data certification basis**<sup>9</sup>. In particular, point 21.A.15(f) in Part-21 of Annex I to Commission Regulation (EU) No 748/2012, which relates to the upgrading of the type-certification basis where the original application for a new type certificate is extended<sup>10</sup>, does not apply to the prohibition to use halons from the cut-off dates.

- ➔ *In other words, in the definition of ‘new equipment’ applicable to the aviation industry, the ‘date of submission of a request for type approval or type certification’ is the **date of the original application** and not the date of any request for its extension (see examples in section 4.2).*

### 3.2. EU vs non-EU products

Before products are brought onto the EU market, it must be ensured that they meet EU requirements as regards *inter alia* the protection of the environment. The Ozone Regulation provisions on halons (including the cut-off and end dates in Annex VI) apply to EU aeronautical products, but also to **non-EU aeronautical products** placed on the EU market. The EU rules therefore cover non-EU aircraft types registered in a Member State.

In the definition of the term ‘new equipment’ for the aviation industry (see above), the ‘appropriate **regulatory authority**’ is the certifying authority (never the validating authority); for example:

- ➔ for an aircraft designed by an organisation under the jurisdiction of an EASA member state, the appropriate regulatory authority is **EASA**; and
- ➔ for an aircraft designed by an organisation under the jurisdiction of the United States, the appropriate regulatory authority is the **FAA**.

See also the examples in section 4.3.

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<sup>6</sup> See subpart B of Part-21 in Annex I to Regulation (EU) No 748/2012.

<sup>7</sup> In line with subpart D or E of Part-21.

<sup>8</sup> See paragraph 21.B.80 of Part-21.

<sup>9</sup> See paragraph 21.B.82 of Part-21.

<sup>10</sup> i.e. beyond the time limit established in point 21.A.15(e).

### 3.3. Applicability to unusual designs or unconventional use of extinguishers

Annex VI to the Ozone Regulation applies to **critical uses** of halon 1301, halon 1211 and halon 2402, and of halon **blends**, i.e. mixtures of two or more different halons (e.g. halon 2402 + halon 1301).

Annex VI also applies to certain **unusual designs**, for example:

- a crew rest compartment equipped with a fixed fire-extinguishing system in addition to portable extinguishers and not normally occupied during certain flight phases; and
- certain cargo, baggage/luggage or maintenance compartments fitted with a fixed or mixed (fixed *and* portable) fire-extinguishing system in accordance with applicable CS provisions.

In both cases, if the fire-extinguishing system uses halon as an extinguishing agent, **the rule is deemed to apply**, with a cut-off date of 2014 for portable extinguishers and 2018 for fixed systems.

## 4. Examples

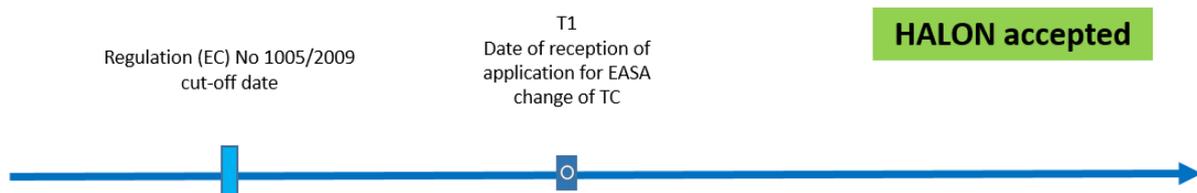
The sections below set out some examples to illustrate **possible scenarios** and clarify the **uses of halons** that are acceptable under the Ozone Regulation.

### 4.1. New product vs changed product

#### Example 1

EASA receives an application for a **change to the aircraft type certificate**, whereby the applicant wishes to completely replace the existing, approved cargo fire-extinguishing system using CO<sub>2</sub> as the extinguishing agent by a new system using halon 1301.

- ✓ *This is not 'new equipment' as defined in the Ozone Regulation; the use of halon is therefore accepted, even if the application for the change is received after the cut-off date in the Regulation. However, the end date applies.*
- ✓



**Figure 1: Application for change to aircraft type certificate**

### 4.2. Original application for type certification vs extension requests

## Example 2

EASA receives an application for a new aircraft type certificate **before** the cut-off date.

✓ *The use of halons is accepted.*



**Figure 2: Application for new type certificate received before the cut-off date**

## Example 3

EASA receives an application for a new aircraft type certificate **after** the cut-off date.

✗ *The use of halons is not accepted.*

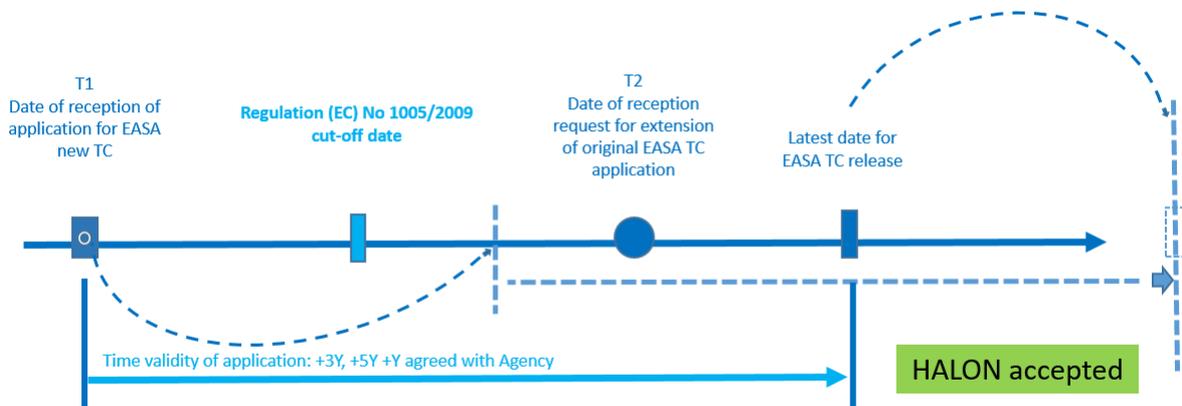


**Figure 3: Application for new type certificate received after the cut-off date**

### Example 4

EASA receives an original application for a new aircraft type certificate **before** the cut-off date, but an extension of the application is requested **after** the cut-off date.

✓ *The use of halons is accepted.*



**Figure 4: Request for extension of the application for new type certificate**

### 4.3. Non-EU products

#### Example 5

Applications for the certification of a new aircraft type are both submitted **before** the cut-off date to a foreign regulatory authority (certifying authority), **and** to EASA (validating authority).

✓ *The use of halons is accepted.*

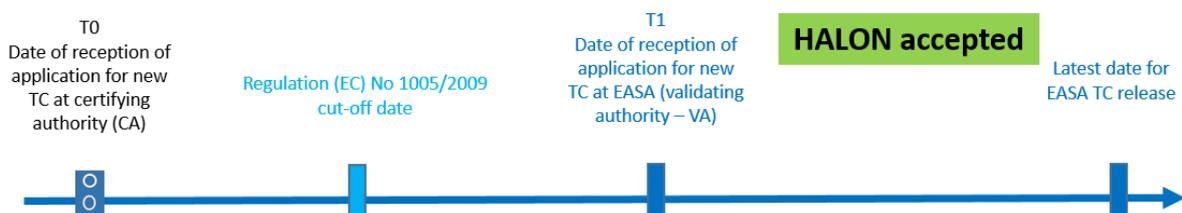


**Figure 5: Non-EU product, application to both CA and VA before the cut-off date**

### Example 6

Application for the certification of a new aircraft type to a foreign regulatory authority (certifying authority) is submitted **before** the cut-off date, and the similar application is submitted to EASA (validating authority) **after** the cut-off date.

- ✓ *The use of halons is accepted, as the appropriate regulatory authority is the certifying authority.*



**Figure 6: Non-EU product, application to CA before and to VA after the cut-off date**

### Example 7

Applications for a new type certificate to a foreign regulatory authority (certifying authority) and to EASA (validating authority), are both **after** the cut-off date.

- ✗ *The use of halons is not accepted.*



**Figure 7: Non-EU product, application to CA and VA after the cut-off date**

## 5. Derogations

Under Article 13(4) of the Ozone Regulation, **derogations from cut-off and end dates** may be granted in specific cases where it is demonstrated that no technically and economically feasible alternative is available. Such derogations can be granted only by the **European Commission** at the request of the competent authority of a Member State (individual companies may not submit derogation requests directly to the Commission). EASA is not the competent authority for granting such derogations.

Applicants who wish to file a derogation request must contact the authority in their Member State that is competent for ODS matters, which will then make the request to the Commission.

## 6. Other applicable standards for the use and replacement of halons

### 6.1. ICAO standards

In Annexes 6 and 8 to the Convention on International Civil Aviation, the ICAO has established **deadlines for the replacement of halons**.

Paragraph 6.2.2.1 of Annex 6 ('Operation of aircraft') provides that:

*'any agent used in a built-in fire extinguisher for each lavatory disposal receptacle for towels, paper or waste in an aeroplane for which the individual certificate of airworthiness is first issued on or after 31 December 2011 and any extinguishing agent used in a portable fire extinguisher in an aeroplane for which the individual certificate of airworthiness is first issued on or after 31 December 2018 shall:*

- a) meet the applicable minimum performance requirements of the State of Registry; and*
- b) not be of a type listed in the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer as it appears in the Eighth Edition of the Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Annex A, Group II'.*

In addition, Annex 8 (Chapter 1 § 1.2.5) provides that:

*'the approved design of an aircraft under Parts III B, IV B and V of this Annex shall use extinguishing agents that are not listed in the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer as it appears in the Eighth Edition of the Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Annex A, Group I, in the aircraft fire suppression or extinguishing systems in the lavatories, engines and auxiliary power unit'.*

This standard of Annex 8 is applicable to aircraft types for which an application for a new type certificate is submitted to the appropriate regulatory authority on or after **31 December 2014**.

Finally, aircraft for which an application for a new type certificate is submitted to the appropriate regulatory authority on or after **28 November 2024** must use an agent other than halons in the fire-suppression or extinguishing systems in the cargo compartment.

## 6.2. Commission Regulation (EU) 2015/640

Commission Regulation (EU) 2015/640<sup>11</sup> provides for the **replacement of halon in lavatories** (from 18 May 2019) and **handheld fire extinguishers** (from 18 February 2020) on newly produced aircraft (i.e. 'forward fit') based on existing aircraft type certificates. The dates differ from those in Annex 6 to the ICAO Convention (see section 6.1).

This provision will apply to large aeroplanes and large helicopters registered in an EU Member State or registered in a non-EU country and used by an operator for which an EU Member State ensures the oversight.

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<sup>11</sup> [Commission Regulation \(EU\) 2015/640](#)

## 7. Summary table of deadlines for halon replacement

Dates for halons replacement				
Purpose	Fire Extinguisher location	Ozone Regulation Regulation (EC) No 1005/2009 as amended by (EU) 744/2010	Aviation standards	
			ICAO Convention on International Civil Aviation	Regulation (EU) 2015/640 (Part-26) as amended by (EU) 2019/133
<b>Retrofit</b> (end date)	Unoccupied cargo compartments	2040	Not specified	Not specified
	Hand-held in cabin & crew compartments	2025		
	Lavatory waste receptacles	2020		
	Engine nacelle & Auxiliary Power Units	2040		
<b>Forward fit</b> (new CofA)	Unoccupied cargo compartments	Not specified	Not specified	Not specified
	Hand-held in cabin & crew compartments		2016 (Annex 6) 39th Assembly: shift to 2018	May 18, 2019
	Lavatory waste receptacles		2011	February 18, 2020
	Engine nacelle & Auxiliary Power Units		Not specified	Not specified
<b>Cut-off</b> (new application for type certificate)	Unoccupied cargo compartments	2018	2024 (Annex 8) 39th Assembly: will be adapted within 2 years.	Not specified
	Hand-held in cabin & crew compartments	2014	Not mentioned	
	Lavatory waste receptacles	2011	2014	
	Engine nacelle & Auxiliary Power Units	2014	2014	

**Table 3: Dates for halon replacement**

Note: if not specified otherwise, the date is 31 December of the year in question.



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