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**Datasheet for the decision  
of 10 February 2022**

**Case Number:** T 0080/19 - 3.3.10

**Application Number:** 09810828.5

**Publication Number:** 2516366

**IPC:** C07C17/20, C07C21/18,  
C07C19/08, C07C17/087

**Language of the proceedings:** EN

**Title of invention:**

CATALYTIC GAS PHASE FLUORINATION OF 1233XF TO 1234YF

**Patent Proprietor:**

Arkema France

**Opponent:**

Daikin Industries, Ltd.

**Headword:**

**Relevant legal provisions:**

EPC Art. 100(a), 56

**Keyword:**

Inventive step - (no)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 0080/19 - 3.3.10

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.10**  
**of 10 February 2022**

**Appellant:** Arkema France  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 8 November 2018  
revoking European patent No. 2516366 pursuant to  
Article 101(3) (b) EPC.**

**Composition of the Board:**

**Chair** P. Gryczka  
**Members:** R. Pérez Carlón  
T. Bokor

## Summary of Facts and Submissions

- I. The appellant (patent proprietor) lodged an appeal against the decision of the opposition division revoking European patent No. 2 516 366.
- II. Notice of opposition had been filed on the ground of lack of novelty and inventive step (Article 100(a) EPC).
- III. The documents filed during the opposition proceedings are the following:

D1 WO 2009/003084 A1  
D2 WO 2008/008350 A1  
D3 ARTI Refrigerant 1999

- IV. The opposition division concluded that the claimed processes were novel. They were, however, not inventive.

Document D1 was the closest prior art and disclosed a process for preparing 2,3,3,3-tetrafluoropropene (1234yf). The claimed processes differed from that of D1

- (1) by requiring removal and not recycling of HCl,
- (2) by operating the reaction in a continuous mode and
- (3) by the composition of the separated streams.

The opposition division concluded that there was no synergy between these differences. They could thus be examined separately.

The problem underlying the claimed invention was to provide a process for producing 1234yf with better yield and higher efficiency. The claimed solution,

characterised by removing and not recycling HCl, by operating the reaction in a continuous mode and by the composition of the separated streams, would have been obvious for a skilled person and thus not inventive.

V. The appellant's main request corresponds to the patent as granted. It has two independent claims, directed to a process, which read as follows:

*"Claim 1. A process for preparing 2,3,3,3-tetrafluoropropene (1234yf), comprising:*

- (i) contacting 2-chloro-3,3,3-trifluoro-1-propene (1233xf) with hydrogen fluoride HF in gas phase in the presence of a fluorination catalyst under conditions sufficient to produce a reaction mixture;*
  - (ii) separating the reaction mixture into a first stream comprising HCl, 2,3,3,3-tetrafluoropropene (1234yf) and a second stream comprising HF, unreacted 2-chloro-3,3,3-trifluoro-1-propene (1233xf) and 1,1,1,2,2-pentafluoropropane (245cb);*
  - (iii) recycling at least a part of the second stream at least in part back to step (i),*
- wherein step (i) is carried out in the presence of O<sub>2</sub> and/or Cl<sub>2</sub>*  
*and wherein the process is continuous.*

*Claim 3. A process for preparing 2,3,3,3-tetrafluoropropene (1234yf), comprising:*

- (i) contacting 2-chloro-3,3,3-trifluoro-1-propene (1233xf) with hydrogen fluoride HF in gas phase in the presence of a fluorination catalyst under conditions sufficient to produce a reaction mixture;*

(ii) *separating the reaction mixture into HCl and a stream containing the fluorinated products;*

(iii) *separating said stream containing the fluorinated products into a first stream comprising 2,3,3,3-tetrafluoropropene (1234yf) and a second stream comprising HF, unreacted 2-chloro-3,3,3-trifluoro-1-propene (1233xf) and 1,1,1,2,2-pentafluoropropane (245cb);*

(iv) *recycling at least a part of the second stream at least in part back to step (i), wherein step (i) is carried out in the presence of O<sub>2</sub> and/or Cl<sub>2</sub> and wherein the process is continuous."*

VI. With the statement setting out the grounds of appeal, the appellant filed its first to fifteenth auxiliary requests. With a letter dated 2 April 2019, it replaced each of auxiliary requests 2, 3 and 6 to 8 by a new version thereof. Auxiliary request 16 was filed with a letter dated 25 September 2020.

VII. Claims 1 and 3 of auxiliary request 1 contain, in addition to the features of claims 1 of the main request, the following:

*"wherein the 245cb flowrate in the recycling loop is substantially constant and wherein 1233xf converts mainly into 1234yf"*

Claims 1 and 3 of auxiliary request 2 have the features of claims 1 and 3 of auxiliary request 1, with the exception of the term "substantially".

Claims 1 and 3 of auxiliary request 3 contain all the

features of claim 1 of the main request, adding

*"wherein the 245cb flowrate in the recycling loop is constant".*

Claims 1 and 3 of auxiliary request 4 to 7 have all the features of claims 1 and 3 of the main request and auxiliary requests 1 to 3 and, in addition, require step (i) to be carried out at a pressure from 5 to 10 bar.

Claims 1 and 3 of auxiliary requests 8 to 15 have the features of claims 1 of the main request and auxiliary requests 1 to 7 and further require the separation steps to be carried out by a distillation step.

Lastly, claims 1 and 3 of auxiliary request 16 require, in addition to the features of claim 1 of the main request, the following:

*"wherein step (i) is carried out with a molar ratio HF: 1233xf from 5:1 to 50:1; at a pressure from 5 to 10 bars; at a temperature of from 320 to 420°C; with a contact time from 15 to 50 sec; and the ratio of O<sub>2</sub> and/or Cl<sub>2</sub> with respect to 2-chloro-3,3,3-trifluoro-1-propene (1233xf) is 0.5 to 10 mole percent".*

VIII. The arguments of the appellant on the issue of inventive step were as follows:

Examples 2 to 4 of document D1 were the closest prior art. The claimed processes differed from these examples by requiring the process to be continuous, the separation to follow a specific sequence and by requiring recycling a feed which contained HF, 1233xf and 245cb.

The problem underlying the claimed invention was to provide an improved process which led to better yield. Examples 12 and 13 of the experimental evidence filed before the opposition division showed this problem to be credibly solved by the claimed processes.

The skilled person, seeking a process with better yield, would not have arrived at the claimed invention. The claimed processes thus involved an inventive step.

The additional features of claims 1 and 3 of auxiliary requests 1 to 3 addressed the respondent's objection that 245cb did not necessarily have to be recycled in the processes of the main request.

Claims 1 and 3 of auxiliary request 4 required step (i) to be carried out at 5 to 10 bars. This was a selection within the pressure range disclosed in D1 and was linked to an effect in view of examples 14 to 16 filed before the opposition division.

Claims 1 and 3 of auxiliary request 8 require the separation steps to be carried out by distillation and thus further differed from the process of D1.

Claims 1 and 3 of auxiliary requests 9 to 15, further to requiring separation by distillation, contained the features of claims 1 to 3 of auxiliary requests 1 to 7 and were inventive for the same reasons.

Lastly, claims 1 to 3 of auxiliary request 16 included the conditions required to obtain an improved process with better yield. Lacking any hint to these features, the processes of these claims were also inventive.



IX. The arguments of the respondent (opponent) on the issue of inventive step were as follows.

With respect to the claims' interpretation, it argued that claims 1 to 3 did not require recycling of 245cb in view of the wording of steps (iii) of claim 1 and (iv) of claim 3.

D1 was the closest prior art. Even if the problem underlying the claimed invention were to be considered as to provide an improved process for preparing 1234yf, the claimed solution, characterised by being carried out continuously, by recycling 245cb and by a specific separation sequence, would have been obvious in view of D1 and was thus not inventive.

The issue was not solved by the processes of claims 1 or 3 of any of the auxiliary requests on file.

X. Oral proceedings before the board of appeal took place on 10 February 2022. The final requests of the parties were as follows:

The appellant requested that the decision under appeal be set aside and the patent maintained as granted (main request) or with the claims of one of auxiliary requests 1 to 16, auxiliary requests 1, 4, 5 and 9 to 15 as filed with the statement of grounds of appeal, auxiliary requests 2, 3 and 6 to 8 as filed with a letter dated 2 April 2019, auxiliary request 16 as with a letter dated 25 September 2020.

The respondent requested that the appeal be dismissed.

XI. At the end of the oral proceedings, the decision was announced.

## Reasons for the Decision

1. The appeal is admissible.
2. Main request - inventive step
  - 2.1 Claims 1 and 3 of the patent relate to a process for preparing 2,3,3,3-tetrafluoropropene (1234yf).
  - 2.1.1 Both claims require a step (i) of contacting 2-chloro-3,3,3-trifluoropropene (1233xf) with HF in gas phase over a fluorinating catalyst. This step is carried out in the presence of oxygen or chlorine. The process is continuous.

Both claims include a step of recycling a part of a stream comprising HF, unreacted 1233xf and 1,1,1,2,2-pentafluoropropane (245cb) back to step (i).

- 2.1.2 Claims 1 and 3 differ by the separation sequence leading to the stream to be recycled, as follows:

The process of claim 1 requires the reaction mixture obtained in (i) to be separated into

- a first stream comprising HCl and 1234yf
- a second stream comprising HF, 1233xf and 245cb, a part of which is recycled.

The process of claim 3 requires the reaction mixture to be separated into

- HCl
- a stream containing 1234yf, HF, 1233xf and 245cb, further separated into
  - 1234yf

- a second stream containing HF, 1233xf and 245cb, a part of which is recycled.

2.1.3 The respondent argued that, by including a step worded "recycling at least a part of the second stream at least in part back to step (i)", claims 1 and 3 did not necessarily require 245cb to be recycled. The claims also included processes recycling only HF or 1233xf only.

The board will follow the appellant's view that the claimed processes require recycling of 245cb to step (i). Since, even in this case, the conclusion of the board on inventive step is negative for the reasons below, it is not needed to elaborate on this point.

## 2.2 Closest prior art

The parties agreed with the opposition division that document D1 was the closest prior art. The board sees no reason to differ.

D1 discloses (page 1, first paragraph) a process for producing a hydrofluoroolefin in two steps. D1 only discloses one hydrofluoroolefin, namely 1,1,1,2-tetrafluoropropene (1234yf). Formulated according to the IUPAC recommendations, 1234yf corresponds to 2,3,3,3-tetrafluoropropene and is the product of the processes of claims 1 and 2 of the patent.

The first step of D1 is the liquid phase, non-catalytic fluorination of 1230xa (1,1,2,3-tetrachloropropene).

The second step requires fluorinating the hydrochlorofluoroolefin arising from the first step, in gas phase, over a suitable catalyst.

Examples 2 to 4 of D1 disclose the gas phase fluorination of HCO-1233xf, which is the starting material required by step (i) of claims 1 and 3 of the patent, over an activated catalyst in the presence of oxygen (Table 3, third line). (These examples are hypothetical, not empirical). The temperature is 365°C; molar ratio HF to 1233xa is 10.6 or 21.1. The product, 1234yf, is obtained together with a comparable amount of 245cb.

Further details on the gas-phase fluorination are provided in the first full paragraph of page 3 of D1. It requires contacting 1233xf with HF, at a molar ratio of at least 1:1. Preferred temperature is 300°C to 500°C, preferred pressure is 20 to 200 psig (3.4 to 13.8 bar). Co-products such as 245cb are formed and can be recycled to the gas phase reactor.

The first full paragraph of page 4 discloses that oxygen or chlorine can be used as co-feed in order to extend the catalyst life time. The amount of oxygen or chlorine is 0.005 to about 1 mole% per mole of organic in the feed. Contact times are preferably from about 1 to about 50 seconds.

Lastly, the second paragraph on page 4 discloses the separation of the reaction mixture of the gas-phase fluorination step. By-products include 245cb and can be separated from the desired hydrofluoropropene in a series of two or more separations columns. The by-products are then recycled to the gas phase catalytic fluorination reaction.

- 2.3 The appellant argues that, within D1, examples 2 to 4 are closest to the invention. The respondent disagreed.

Since the board arrived at the conclusion that the claimed processes are not inventive over examples 2 to 4 of D1 for the reasons that follow, it is not necessary to examine whether other embodiments of D1 could come even closer to the claimed invention.

#### 2.4 Problem underlying the claimed invention

The appellant defined the problem underlying the claimed invention as to provide an improved process for preparing 1234yf with better yield.

#### 2.5 Solution

The claimed solution are the processes of claims 1 and 3, characterised by

- being continuous
- separating the reaction mixture so that a stream containing HF, 1233xf and 245cb is obtained, and
- recycling a part of that stream back to the reaction step.

#### 2.6 Success

The appellant argued that the experimental evidence filed as Examples 12 and 13 showed that the problem of increasing the reaction yield had been credibly solved by the claimed processes. The question however arises whether Example 12 reflects the conditions of any of Examples 2 to 4 of D1.

Be that as it may, examples 2 to 4 of D1 do not include any purification step, lack any recycling and are not continuous. By carrying out the process in a continuous

manner, and separating and recycling a stream containing the reagents (1233xa and HF) as required by claims 1 and 3, the yield will inevitably be improved over the process of the examples of D1, which lack those steps. The problem underlying the claimed invention is thus considered credibly solved.

2.7 It thus remains to be decided whether the proposed solution to the objective problem defined above would have been obvious for the skilled person in view of the prior art.

2.7.1 The skilled person would have expected that carrying out a process in a continuous manner would have been an obvious way of improving the "batch" processes of Examples 2 to 4. Recycling the starting materials back to the reactor is also expected to increase the overall yield of the process. This way of carrying out an industrial chemical process belongs to the basic common general knowledge of the skilled person.

2.7.2 It is further known from D1 that 245cb is a co-product of the process and that it can be recycled to the gas phase reactor (page 3, first full paragraph; page 4, second full paragraph). Feature (iii) of claim 1 and feature (iv) of claim 3 are thus also obvious in view of D1.

2.7.3 It remains to be examined whether the separation sequence of features (ii) of claim 1 and features (ii) and (iii) of claim 3 would also have been obvious to a skilled person.

The second full paragraph on page 4 of D1 discloses that the reaction product of the gas phase, which

corresponds to step (i) of claims 1 and 3, includes:

- the desired hydrofluoropropene (1234yf)
- unreacted hydrochlorofluoropropene (1233xf)
- 245cb
- 244bb

The last two components are by-products. They can be separated from 1234yf "in a series of two or more separation columns" and can be recycled to the gas phase catalytic fluorination reactor.

In the technical field of the invention, namely that of hydrofluoroolefins for refrigeration purposes (HFOs), separation columns are understood by the skilled reader as distillation columns. The separation thus relies on the boiling points of the species present. These are as follows:

Compound	bp (°C)
HCl	-85
1234yf	-30
245cb	-18
244bb	+14
HF	+19
1233xf	+27

1233xf and HF are the reagents used in the process. The skilled person, seeking to improve the yield of the process of examples 2 to 4 of D1, would thus have recycled them.

245cb (and 244bb) is to be recycled to the gas phase catalytic fluorination reaction, following D1. 244bb is included only for completeness, as it is not required

by the processes of claims 1 or 3.

1234yf is the reaction product sought. It should be thus purified and isolated.

HCl is a reaction product whose presence in the reaction media inevitably shifts any equilibrium towards the reagents. The skilled person would thus not have recycled HCl to the process.

From the above common general knowledge the skilled person would come to the following conclusions with regard to the components listed in the table above:

Compound	bp (°C)	
HCl	-85	not recycle
1234yf	-30	PRODUCT - ISOLATE
245cb	-18	recycle
244bb	+14	recycle
HF	+19	recycle
1233xf	+27	recycle

There is no reason to separate the four last products from each other, as all of them are to be recycled. With the above in mind, the skilled person would thus separate this mixture by one of the two following sequences.

- 2.7.4 The first option involves separating, in a first distillation, the most volatile compound HCl from the mixture. In a second distillation step, the reaction product 1234yf is separated from the compounds to be recycled. The two steps look as follows:



HCl	-85	not recycle
1234yf	-30	PRODUCT - ISOLATE
245cb	-18	recycle
244bb	+14	recycle
HF	+19	recycle
1233xf	+27	recycle

1234yf	-30	PRODUCT - ISOLATE
245cb	-18	recycle
244bb	+14	recycle
HF	+19	recycle
1233xf	+27	recycle

This obvious sequence of separations corresponds to steps (ii) and (iii) of claim 3.

2.7.5 The second option for recovering the desired product 1234yf from the reaction mixture involves separating, in a first step, the four compounds to be recycled. Subsequently, HCl is separated from the desired product, 1234yf. These two steps look as follows:

HCl	-85	not recycle
1234yf	-30	PRODUCT - ISOLATE
245cb	-18	recycle
244bb	+14	recycle
HF	+19	recycle
1233xf	+27	recycle

HCl	-85	not recycle
1234yf	-30	PRODUCT - ISOLATE

The first of these obvious separation steps corresponds to step (ii) of claim 1.

2.7.6 The skilled person, trying to improve the yield of the process of examples 2 to 4 of D1 by recycling useful chemicals, and following the teaching of D1 would have used one of these two separation sequences in order to separate those chemicals from the reaction mixture. By doing so, they would inevitably have arrived at the

claimed invention.

2.8 The claimed processes are thus not inventive (Article 56 EPC).

3. The appellant argued against the board's conclusion as follows:

3.1 *With respect to the recycling of 245cb*

The appellant argued that the skilled person could have recycled 245cb in the manner required by claim 1, but would not necessarily have done it for a number of reasons:

3.1.1 Claim 7 of document D1 disclosed recycling the so-called "second co-products", obtained in the gas phase fluorination step (b) according to the labeling in claim 1 of D1. These compounds, which included 245cb, were to be recycled to the first step (a) of claim 1 of D1 and not, as in the claimed invention, to the gas phase fluorination step (b). An embodiment reflected in the claims of an invention, such as that of claim 7 of D1, was inevitably preferred over any other option which could also be disclosed in D1.

Indeed claim 9 discloses recycling 245cb to the first reactor a) according to claim 1 of D1. However, no details on that embodiment are to be found anywhere else in D1.

In contrast, document D1 explicitly discloses on pages 3 and 4 recycling of 245cb back to the gas phase fluorination reactor, which is the second reactor according to D1. This disclosure is made in the context of the detailed explanation of the process of D1, and

is made twice, with equivalent but different wording.

Confronted with D1, the skilled person would thus have considered the detailed disclosure in the description as the preferred embodiment, not that of claim 9.

This argument is thus not convincing.

- 3.1.2 The appellant argued that D1 disclosed that 245cb "can" be recycled. Recycling was thus a mere option, and not necessarily a preferred one.

Indeed recycling of 245cb is preceded in both occurrences in D1, by the wording "can". The board agrees with the appellant that the recycling of 245cb is not mandatory. However, document D1 does not disclose any other fate for that compound: it does not disclose to dispose of it, it does not disclose isolating it, it does not disclose using it in a further process. D1 only discloses 245cb as a by-product to be recycled to the gas phase reactor (page 3, lines 18-19; page 4, second full paragraph).

The skilled person, trying to put forward a more efficient continuous process, would seek recycling or reusing any reagent and by-product. It would thus follow the teaching on pages 3 and 4 of the description of D1 and thus arrive at the claimed invention.

- 3.1.3 The appellant argued that page 3 of D1 disclosed recycling of 245cb and/or 244bb. Thus, recycling of the former could only arise from a selection within this disclosure.

However, the examples led to large amounts of 245cb, whereas 244bb is not always present (see example 4).

Recycling of the former would thus have been necessarily contemplated.

This argument is also not convincing.

- 3.1.4 The appellant further argued that the aim of D1 was to produce compounds which would not damage the ozone layer. 245cb was one of them, and for this reason the skilled person would not have considered recycling it. Instead, they would have isolated it for commercial use.

However, D1 relates to hydrofluoroolefins which would not damage the ozone layer (title, abstract, first and second paragraphs on page 1). 245cb is not unsaturated. Even though 245cb is obtained by the method of D1 either as a by-product (examples 2 and 3) or as the main product of the reaction (example 4), the aim of D1 is not its synthesis.

This argument thus fails to convince the board.

- 3.1.5 The appellant also argued that recycling of 245cb to a reactor containing an excess of HF could not lead to preparing additional 1234yf, as the required dehydrofluorination reaction would not be favoured. The skilled reader would thus have understood that there was no logical reason to recycle this compound. In fact 245cb did not react to produce 1234yf but merely prevented side reactions. This information could not be deduced from the disclosure of D1. The skilled person would for that reason not be prompted to recycle it in view of D1 when seeking to improve the reaction yield.

However, the explicit disclosure of D1 is to recycle 245cb to the gas phase, catalytic fluorination reactor.

This mode of operation is thus beneficial according to D1. What mechanism could be involved in the benefit is irrelevant in this respect.

In addition, the skilled person would have understood from D1 that 245cb does not accumulate in the gas phase reactor, and that it does not produce further side-products. Otherwise, recycling would serve no purpose.

This argument is not convincing, either.

### 3.2 *With respect to the separation sequence*

3.2.1 The appellant argued that compound 245cb was a known and valuable refrigerant on its own. For that reason, the skilled person would not consider sequences A and B above as the sole separation options, but would also consider those leading to isolate 245cb.

However, D1 explicitly teaches to recycle 245cb. Even if the skilled person could in theory envisage to isolate it, this is not what D1 explicitly teaches.

This argument is not convincing.

3.2.2 The appellant also argued that the difference of boiling point between 1234yf and 245cb, only 11°C, was too small for a good separation. Also for this reason the skilled person would not have contemplated the separation sequences A and B above.

However, 1234yf is the desired product of the process of D1. It should thus be purified and this requires to separate it from 245cb, despite their close boiling points. The appellant has also not provided evidence that the separation of compounds having this boiling

point difference would not be technically feasible.

This argument is not convincing, either.

- 3.2.3 The appellant further argued that the skilled person would have envisaged to recycle 244bb, and not 245cb, back into the process in view of its boiling point, which was closer to that of 1233xf and HF.

However, claim 1 is silent on the separation or recycling of 244bb. The teaching of D1 with respect to that compound is thus irrelevant for the issue of inventive step of claim 1 for this reason alone. What is decisive is the teaching of D1 concerning 245cb.

This argument also fails to convince the board.

- 3.3 The board thus arrived at the conclusion that the ground under Article 100(a) EPC precludes the maintenance of the patent as granted.

#### 4. Auxiliary requests

- 4.1 Auxiliary request 1 requires the 245cb flowrate in the recycling loop to be substantially constant and 1233xf to convert mainly into 1234yf.

By the appellant's own argument, these features intended to overcome the respondent's objection that claim 1 of the main request would not require recycling of 245cb. As the board has examined the main request under the assumption that 245cb needed to be recycled, the situation with respect to inventive step does not thus differ. This was not contested.

4.2 Claims 1 and 3 of auxiliary request 2 differ from its preceding request by deleting the term "substantially".

Claims 1 and 3 of auxiliary request 3 differ from those of the main request by requiring 245cb in the recycling loop to be constant.

The arguments with respect to inventive step remain thus the same as in the previous point.

4.3 Claims 1 and 3 of auxiliary request 4 requires step (i) to be carried out at a pressure from 5 to 10 bar.

Examples 2 and 3 of D1 were carried out at 3.3 bar; Example 4 at 11.6 bar. The most preferred pressure in D1 is 3.4 to 13.8 bar (20 to 200 psig, first full paragraph on page 3, penultimate line). The pressure required by claims 1 and 3 of auxiliary request 4 falls thus squarely within the most preferred pressure range disclosed in D1.

The appellant relied on the experimental evidence filed as Examples 14 to 16 for showing that the pressure required by claim 1 was linked to an unexpected effect.

Notwithstanding that the central part of the most preferred interval would arguably be considered by the skilled reader as the most suitable, the experimental evidence provided by the appellant shows in fact the opposite. Experiment 16, carried out at the lower end of the pressure set in claims 1 and 3 (5 bar) led to a selectivity towards 1234yf lower than that achieved at 1 bar and 3 bar. Thus, no unexpected improvement is obtained in the pressure range selected. This difference thus does not contribute to solving the problem of providing a higher yield of 1234yf; it thus

only serves to achieve an alternative. Having regard to D1, the skilled person would have considered to operate at the center of the pressure interval defined. The claimed processes are thus not inventive.

4.4 Claims 1 and 3 of auxiliary requests 5 to 7 combine the amendments carried out in auxiliary requests 4 (preferred pressure) and those in claims 1 and 3 of auxiliary requests 1 to 3. The arguments provided with respect to auxiliary request 4 thus also apply to claims 1 and 3 of these requests.

4.5 Claims 1 and 3 of auxiliary request 8 require the different feeds to be separated by a distillation step.

Document D1 discloses that the compounds can be separated "in a series of two or more separation columns". In the context of hydrofluoroolefins, the skilled person would have considered those separation columns to be distillation columns. The examination of inventive step thus does not differ from that of claims 1 and 3 of the main request, which has been examined considering that D1 disclosed separation by means of distillation columns.

4.6 Claims 1 and 3 of auxiliary requests 9 to 15 combine the requirement that the feeds are separated by a distillation step and the features of claims 1 and 3 of auxiliary requests 1 to 7. The situation with respect to inventive step thus does not change.

4.7 Lastly, claims 1 and 3 of auxiliary request 16 require step (i) to be carried out at defined molar ratio HF: 1233xf pressure, temperature, contact time and relative amount of oxygen or chlorine with respect to 1233xf.



Of these features, only the pressure and the contact time are not disclosed by Examples 2 to 4 of D1.

The issue with respect to the pressure has been already examined in the context of auxiliary request 4.

The contact times disclosed in examples 2 to 4 of D1 are 3.9 s, 4 s and 14 s. The contact time required by claim 1, 15 to 50 seconds, is thus longer. D1 teaches nevertheless that the most preferred contact times are between 1 to 50 seconds. As no improvement in terms of reaction yield linked to that conditions has been put forward or is immediately apparent, the contact time required by claim 1 would only contribute to solve the problem of providing an alternative, is extremely close to the contact time in the examples provided, and would have been obvious for the skilled person seeking an alternative.

5. The board concluded for these reasons that none of the appellant's requests relates to inventive subject-matter (Article 56 EPC), with the consequence that none of them is allowable.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chair:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated