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Datasheet for the decision of 6 November 2025

Case Number: T 0117/24 - 3.2.03

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Language of the proceedings: EN

Title of invention:

HOT PRESS FORMING PLATED STEEL SHEET HAVING EXCELLENT IMPACT PROPERTY, HOT PRESS MOLDING MEMBER, AND MANUFACTURING METHOD THEREOF

Patent Proprietor:

Posco

Opponent:

ArcelorMittal

Relevant legal provisions:

EPC Art. 100(b), 54, 56, 13(2)
RPBA 2020 Art. 12(4)

Keyword:
Amendment after notification of Art. 15(1) RPBA communication - exceptional circumstances (yes) - mere deletion of claims - exceptional circumstances (yes)
Sufficiency of disclosure - (yes)
Novelty - (yes) - prior disclosure - implicit features (no)
Inventive step - (no) - comparative example as starting point - auxiliary request (yes) - comparative example as starting point

Decisions cited:
T 2114/16, T 1737/21, T 1800/21

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Case Number: T 0117/24 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 6 November 2025

Appellant: (Patent Proprietor)	Posco (Goedong-dong) 6261 Donghaean-ro Nam-gu Pohang-si, Gyeongsangbuk-do 37859 (KR)
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Representative:	Lavoix 2, place d'Estienne d'Orves 75441 Paris Cedex 09 (FR)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 29 November 2023 concerning maintenance of the European Patent No. 3561142 in amended form.**

Composition of the Board:

Chairman	C. Herberhold
Members:	B. Goers
	F. Bostedt

Summary of Facts and Submissions

I. European patent No. 3 561 142 relates to a hot press formed part having an excellent impact property, a manufacturing method for a hot press formed part, a plated steel sheet for hot press forming and a manufacturing method of a plated steel sheet for hot press forming.

II. In its interlocutory decision the opposition division concluded that the patent as amended according to auxiliary request 1 met the requirements of the EPC.

III. Both the patent proprietor and the opponent appealed against the decision; these designations of the parties will be retained in this decision for simplicity.

IV. At the end of the oral proceedings before the Board, the parties confirmed the following requests.

The patent proprietor requested that the decision under appeal be set aside and the patent be maintained as granted, or, in the alternative, that the patent be maintained in amended form on the basis of one of auxiliary requests 1, 1a, 2 to 21, 21A and 22 to 32, auxiliary requests 1 to 32 having been filed for the first time during the opposition proceedings and resubmitted with the reply to the opponent's appeal, auxiliary request 21A having been filed for the first time with the reply to the opponent's appeal (letter dated 5 August 2024) and auxiliary request 1a having been filed during oral proceedings before the Board.

The opponent requested that the decision under appeal be set aside, and the patent be revoked in its entirety.

V. Documents relevant to this decision

D1: US 2016 017452 A1
D2: EP 2 086 755 B1 (published 29 November 2017)
D2a: WO 2008/053273 A1
D3: Malinowski, Z. et al., "Implementation of the axially symmetrical and three-dimensional finite element models to the determination of the heat transfer coefficient distribution on the hot plate surface cooled by the water spray nozzle", Key Engineering Materials, Vols. 504-506, pp. 1055-1060, 2012
D4: Honda, T. et al., "Temperature measurement technology in water cooling process and high accuracy cooling control technology for high tensile hot rolled strip", Nippon Steel & Sumitomo Metal Technical Report No. 111, MARCH 2016
D5a: McNutt, P. et al., "Run-out-table cooling models for high cooling rate products", Steel Rolling 2006, conference proceedings
D5b: Program of the Steel Rolling 2006 conference
D6: "The book of steel", excerpt, pages 1221-1225, Lavoisier, 1995
D7: Quantin, D., "Galvanisation à chaud - procédés", Techniques de l'ingénieur, 2004
D8 Buscarlet, E., "Galvanisation et aluminage en continu", Techniques de l'ingénieur, 1996
D9: Wang, J., et al, "Effect of Prior Austenite Grain Size on Impact Toughness of Press Hardened Steel", SAE Int. J. Mater. Manf. 9(2): 488-493, 2016

D10: Jhajj, K.S., "Heat Transfer Modelling of Roller Hearth and Muffle Furnace", Waterloo University Ontario Canada Master Thesis, 2015

D11: Suehiro, M. et al., "Properties of aluminium-coated steels for hot-forming", Nippon Steel Technical Report No.88, July 2003

D12: "ISO 148-1: Charpy Impact Test Metals", ZwickRoell GmbH & Co KG, https://www.zwickroell.com/industries/materials-testing/impact-test/charpy-impact-test-metals-iso-148-1/, downloaded 22 March 2022

D13: US 2016/0362763 A1

D14: Fabrègue, P., "Métallurgie du laminage à chaud", Techniques de l'ingénieur, M7860 V1, 2000

D15: US 2013/0180305 A1

D16: Montmitonnet, P., "Laminage a chaud - Théorie du laminage", Techniques de l'ingénieur, M7840 V1, 1991

D17: Alberny, R., "Laminage à chaud des produits plats sur train à bandes. Partie 2", Techniques de l'ingénieur, M7941, 2007

D18: EP 2 518 181 A1

D19: Totten, G. E., "Steel heat treatment handbook - Metallurgy and technologies", Second edition, Taylor & Francis Group, LLC, 2006, excerpt, chapters 6.1.5 and 7.1 to 7.3.2.3

VI. Claim wording relevant to this decision

(a) Independent claims 1, 4, 7 and 12 of the main request (patent as granted) read:

Claim 1:

"[1.1] *A plated steel sheet for hot press forming, having an excellent impact property, comprising:*

[1.2] *a base steel sheet comprising, by wt%, 0.15-0.4% of C, 0.05-1.0% of Si, 0.6-3.0% of Mn, 0.001-0.05% of P, 0.0001-0.02% of S, 0.01-0.1% of Al, 0.001-0.02% of N, 0.001-0.01% of B, 0.01-0.5% of Cr, 0.01-0.05% of Ti, and the balance of Fe and inevitable impurities; and*
[1.3] *an Al-Si plated layer formed on the surface of the base steel sheet,*
[1.4] *wherein the base steel sheet optionally further comprises at least one selected from Mo, Nb, and V in such a manner that a sum thereof is 0.01 to 0.5 wt%,*
[1.5] *wherein the plated layer comprises, by wt%, 6-12% of Si, 1-4% of Fe, and a balance of Al and inevitable impurities,*
[1.6] *wherein a thickness of a carbon-depleted layer in a surface layer part of the base steel sheet is 5 μm or less, wherein the surface layer part means a region from the surface of the base steel sheet to a depth of 200 μm, and the carbon-depleted layer means a region which the carbon content is 50% or less of an average carbon amount (Co) of the base steel sheet,*
[1.7] *wherein in the base steel sheet, a ratio of a carbide fraction of the surface layer part (Fs) to a carbide fraction of a central part (Fc) (Fs/Fc) is 0.7 to 1.3, and wherein the surface layer part means a region from the surface of the base steel sheet to a depth of 200 μm, and the central portion means a region having a thickness of -100 μm to +100 μm from a thickness center of the base steel sheet."*

Claim 4:
"[4.1] *A manufacturing method of plated steel sheet for a hot press forming having an excellent impact property, the method comprising:*
[4.2a] *heating a slab, comprising, by wt%, 0.15-0.4% of C, 0.05-1.0% of Si, 0.6-3.0% of Mn, 0.001-0.05% of P,*

0.0001-0.02% of S, 0.01-0.1 % of Al, 0.001-0.02% of N, 0.001-0.01% of B, 0.01-0.5% of Cr, 0.01-0.05% of Ti, and the balance of Fe and inevitable impurities,
[4.2b] *to a temperature of 1050 to 1300°C;*
[4.3] *performing finishing hot-rolling on the heated slab to a temperature of 800 to 950°C to obtain a hot-rolled steel sheet;*
[4.4] *starting cooling the hot-rolled steel sheet within 30 seconds of performing the finishing hot-rolling*
[4.5] *and winding the hot-rolled steel sheet at a temperature of 450 to 750°C;*
[4.6] *heating the wound hot-rolled steel sheet to a temperature of 740 to 860°C and*
[4.7] *annealing in an atmosphere having a dew point temperature of -70 to -30°C; and*
[4.8] *plating the annealed hot-rolled steel sheet by dipping in an Al-Si plating bath,*
[4.9] *wherein the slab optionally further comprises at least one selected from Mo, Nb, and V in such a manner that a sum thereof is 0.01 to 0.5 wt%,*
[4.10] *wherein the Al-Si plating bath comprises, by wt%, 6-12% of Si, 1-4% of Fe, and a balance of Al and inevitable impurities.*"

Claim 7:
"[7.1] *A hot press formed part, having an excellent impact property, comprising:*
[7.2] *a base material comprising, by wt%, 0.15-0.4% of C, 0.1-1.0% of Si, 0.6-3.0% of Mn, 0.001-0.05% of P, 0.0001-0.02% of S, 0.01-0.1% of Al, 0.001-0.02% of N, 0.001-0.01% of B, 0.01-0.5% of Cr, 0.01-0.05% of Ti, and the balance of Fe and inevitable impurities; and*
[7.3] *an Al-Si plated layer formed on a surface of the base material,*

[7.4] *wherein the base material optionally further comprises at least one selected from Mo, Nb, and V in such a manner that a sum thereof is 0.05 to 0.5 wt%,*
[7.5] *wherein a carbon-enriched layer is formed in a surface layer part of the base material, and wherein the surface layer part means a region from the surface of the base material to a depth of 200 μm, and the carbon-enriched layer means a region which the carbon content is 110% or more of an average carbon amount (C_0) of the base material.*"

Claim 12:
"[12.1] *A manufacturing method of a hot press formed part, comprising:*
[12.2] *heating a plated steel sheet, manufactured by one of claims 4 to 6,*
[12.3] *to a temperature ranging from an Ac3 temperature to 980°C and maintaining for 1 to 1000 seconds;*
[12.4] *and hot press forming the heated plated steel sheet by a press while cooling to a martensite transformation finish temperature (Mf) or less at a cooling rate of 1 to 1000°C/sec.*"

(b) The sole amendment made to auxiliary request 1 (patent as maintained) compared with the main request is that claim 7 includes the following further feature:

"[7.6] *and wherein the carbon-enriched layer has a thickness of 10 to 150 μm*"

(c) Auxiliary request 1a corresponds to auxiliary request 1 with the only amendment being that claims 1 to 3 are deleted, the remaining claims being renumbered accordingly.

VII. The patent proprietor's arguments, where relevant to the present decision, can be summarised as follows.

(a) D2a and D13 to D19 - admittance

None of documents D2a and D13 to D19 should be admitted. It was the responsibility of the opponent to file a valid inventive-step objection based on prior art under Article 54(2) EPC. D2a was late filed in the absence of exceptional circumstances. The opposition division had erred in exercising its discretion to admit D13 to D17. D18 and D19 could and should have been filed during the opposition proceedings.

(b) Ground for opposition under Article 100(b) EPC

The invention was disclosed sufficiently clearly and completely. None of the opponent's arguments were persuasive, the embodiments in Tables 2 and 3 of the patent showed the impact of the relevant processing conditions. Technically non-sensitive solutions falling within the subject-matter of the claims were not an indication of insufficient disclosure.

(c) Main request, claim 7 - inventive step

The subject-matter of claim 7 involved an inventive step over D1 seen in combination with common general knowledge. The excellent impact properties of the steel composition and the plating composition were not disclosed in example 1 of D1. Even if the skilled person considered the alternative plating, the carbon-enriched layer was then not in accordance with feature [7.5] because of the changes in the carbon diffusion conditions and the varying thickness of the plating layer.

(d) Auxiliary request 1 - consideration in the appeal proceedings

Auxiliary request 1 was a request underlying the impugned decision and thus formed part of the appeal proceedings.

(e) Auxiliary request 1, claim 1 - inventive step

The subject-matter of claim 1 involved an inventive step over D1 seen in combination with common general knowledge. Example 1 at the dew point of -27°C would not have been considered as a starting point by the skilled person without using hindsight as this was a comparative example in D1. This example of D1 also failed to disclose the Fs/Fc ratio and the plating composition in accordance with claim 1. Even if this example were considered, the skilled person had no reason to use the Al-Si plating and it was also not clear what the resulting carbon-depleted layer and Fs/Fc ratio would be.

(f) Auxiliary request 1a - admittance

Auxiliary request 1a should be admitted. It was established case law that mere deletion of claims where all the remaining claims had already been discussed in substance established exceptional circumstances provided the amendment did not alter the legal and factual framework of the case, was procedurally efficient and did not jeopardise the legitimate interests of the opponent. All of these conditions applied.

(g) Auxiliary request 1a - novelty

D2/D2a was not novelty destroying for claims 1, 4 and 8. In particular, D2/D2a did not disclose the dew point temperature of the annealing step; D2/D2a was a patent document and there was no reason to assume that standard conditions were applied. Although it was mentioned in D2/D2a that the plating prevented substantial decarburisation, the patent's examples showed that the dew point temperature had a significant impact on the carbon profiles.

(h) Auxiliary request 1a - inventive step

The subject-matter of claims 1, 4 and 8 involved an inventive step.

None of documents D1, D2a and D13 disclosed the annealing condition of feature [4.7] and the carbon profile of feature [7.6]. Moreover, none of the documents at hand - including D19 - mentioned an impact property in terms of the impact energy dynamically measured with the Charpy test, let alone rendered it obvious that the dew point temperature of feature [4.7] led to a carbon profile of feature [7.6] and the corresponding impact properties.

VIII. The opponent's arguments, where relevant to the present decision, can be summarised as follows.

(a) D2a and D13 to D19 - admittance

D2a should be admitted. Exceptional circumstances lie in the fact that the prior art status was clarified for the first time in the communication of the Board and

the disclosure of D2a was identical to D2. In addition, D2a was referred to in D2.

D13 to D17 had been admitted by the opposition division which had correctly exercised its discretion. D18 and D19 were evidence for common general knowledge. All these documents should thus also be considered in the appeal proceedings.

(b) Ground for opposition under Article 100(b) EPC

The invention was not disclosed in a sufficiently clear and complete manner. The invention defined by claims 1 to 3 was not workable over the whole range claimed. The excellent impact property was not achievable for every plated steel sheet covered by claim 1 or every hot press formed part covered by claim 7. In addition, the location of the carbon-depleted or -enriched layers within the surface layer part was not defined in the claim. The patent also did not disclose the point in the annealing furnace at which the dew point had to be controlled and how the parameter "impact absorption energy IE" was determined.

(c) Main request, claim 7 - inventive step

The subject-matter of claim 7 did not involve an inventive step over D1 seen in combination with common general knowledge. The plating composition was the sole distinguishing feature, and it was not convincing that the carbon-enriched layer according to Figure 11 was not present in the case of an Al-Si coating, which D1 disclosed as an equally suitable alternative plating.

(d) Auxiliary request 1 - consideration in the appeal proceedings

Auxiliary request 1 was not maintained by the patent proprietor in their appeal case and should not be considered in the appeal proceedings.

(e) Auxiliary request 1, claim 1 - inventive step

The subject-matter of claim 1 did not involve an inventive step over D1 seen in combination with common general knowledge. The skilled person would have started from any of the examples in D1 including that annealed at a dew point temperature of -27°C ("example -27°"). Although example -27° was a comparative example in D1, it was not a non-working example and the objective of improving an impact property was different from that in D1 (improving the bending properties), such that the results of D1 did not discourage from example -27° as the starting point. The only distinguishing feature was the plating material composition of features [1.3] and [1.5], the only other alternative disclosed in D1 was a plating composition as claimed which was disclosed in D1 as equally suitable alternative.

(f) Auxiliary request 1a - admittance

Auxiliary request 1a should not be admitted as it was surprisingly filed at the last opportunity in the appeal oral proceedings in the absence of exceptional circumstances.

(g) Auxiliary request 1a - novelty

The subject-matter of claims 1, 4 and 8 was not novel over D2/D2a. The carbon profiles and the dew point temperature in accordance with the claims were implicitly disclosed in D2/D2a.

(h) Auxiliary request 1a - inventive step

The subject-matter of claims 1, 4 and 8 was not inventive in view of all of documents D1, D2a and D13 as starting point. Although none of the starting documents disclosed the dew point temperature of the annealing step (feature [4.7]), this temperature was standard in the prior art. The technical problem thus was only to limit decarburisation, and this was obvious in view of D15 and D19 (chapter 7.1) and even in view of D1. Even if the technical problem was to provide an excellent impact property it was obvious in view of chapter 7.3.1 of D19 to locally improve hardenability by providing a carbon-enriched layer. D19 was common general knowledge which had to be taken into account, and which was also confirmed in D1, paragraph [0108] and mentioned in paragraph [0022] of the patent. There was only a single window in the D1 process available where an adaptation to achieve the carbon-enriched layer, e.g. by carburisation or by preventing decarburisation as suggested in D19 for hardening the surface, could be implemented, which was before plating and after hot-rolling. It was also known that the usual dew point temperatures in the annealing step served that purpose. This selection was, moreover, obvious when starting from D13 which disclosed the objective of minimising the ferrite content in the boundary layer, which required the application of low dew point temperatures. When the annealing step was conducted in

accordance with feature [4.7], the claimed carbon profile (feature [7.6]) and the beneficial impact property was inherently also achieved.

Reasons for the Decision

1. Admittance of documents D2a and D13 to D19

1.1 D2a

D2a and the inventive-step objections involving D2a are admitted into the appeal proceedings.

1.1.1 Some of the opponent's inventive-step objections were based on D2 as the starting point. These objections were dealt with in substance in the decision under appeal.

In its communication under Article 15(1) RPBA, the Board informed the parties that D2 is state of the art under Article 54(3) EPC and thus cannot be cited against the patent under Article 56 EPC.

In response to this communication, the opponent submitted document D2a, which is the WO-publication of the application on which the B-publication D2 was based (which is also indicated on the cover page of D2). D2a is state of the art under Article 54(2) EPC and it was not disputed that the disclosure is substantially identical. The opponent declared that it wished to maintain its objections under Article 56 EPC, using D2a instead of D2.

This is an amendment under Article 13(2) RPBA which can only be admitted in the presence of exceptional circumstances justified by cogent reasons.

1.1.2 In the opponent's view, the fact that the state-of-the-art status of D2 was never challenged before in the

proceedings constituted exceptional circumstances in its favour.

The Board agreed that exceptional circumstances were present and decided to admit D2a and the corresponding objections under Article 56 EPC into the appeal proceedings.

It is true that it is the responsibility of the opponent to file valid objections and therefore also to check the prior art status of the documents on which its objections are based. However, in the case at hand, D2 is replaced by D2a, which is substantially identical, and which is also indicated on the cover sheet of D2 as the application on which D2 is based. Therefore, all the objections and arguments apply in the same way when referring to D2a instead of D2. D2a was further submitted in an immediate response to the Board's communication such that the patent proprietor had ample time to prepare to the rather formal adaptation of the objection. As the patent proprietor and the opposition division have also dealt in full with the previous objection based on D2, obviously unaware of its Article 54(3) EPC status, the amendment does not require any substantive adaptation of the inventive-step discussion either.

1.2 D13 to D17, D18 and D19

D13 to D17 are considered to be in the appeal proceedings. D19 is admitted into the appeal proceedings, while D18 is not.

1.2.1 The patent proprietor requested that D13 to D17 filed during the opposition proceedings by letter dated 8 August 2023 (i.e. before the date set under

Rule 116(1) EPC by the opposition division) as well as evidence D18 and D19 filed with the statement of grounds of appeal not be admitted into the proceedings.

1.2.2 In exercising its discretion, the opposition division admitted D13 to D17 into the proceedings. It is not for the Board to review all the facts and circumstances of the case as if it were in that department's place and decide whether it would have exercised discretion in the same way (see Case Law of the Boards of Appeal, 11th edn., 2025, V.A.3.4.1 b). The Board has no reason to assume that the opposition division exercised its discretion when admitting D13 to D17 on the basis of the wrong principles, without taking the right principles into account or in an arbitrary or unreasonable way.

In addition, at least documents D13 to D15 were also referred to in the decision and so formed part of the decision on which the appeal is based.

There is thus no reason to set aside the discretionary decision of the opposition division to admit documents D13 to D17 into the proceedings.

1.2.3 The textbook excerpt D19 is a document which represents common general knowledge with respect to steel decarburisation and carburisation conditions. D19 solely complements arguments previously raised. The Board thus sees no reason to disregard D19.

1.2.4 D18 was filed to support the opponent's assertion that very low dew points were commonly applied at the filing date, to supplement the evidence of D7 and D15 which were already on file. However, as a patent document D18 is not representative of common general knowledge, and

the Board thus decided not to consider it in the appeal proceedings.

2. Ground for opposition under Article 100(b) EPC

The opponent raised the following objections of lack of sufficiency of disclosure against the main request.

(a) The invention defined by claims 1 to 3 was not workable over the whole range claimed, since the Fs/Fc range (feature [1.7]) encompassed the lower value of 0.7, and the plated steel in accordance with example A4 did not achieve an excellent impact property (see example A4-1), despite falling within this range. Hence, the claimed effect according to features [1.1], [4.1] and [7.1] (excellent impact property) was also not achievable for every plated steel sheet covered by claim 1 or every hot press formed part covered by claim 7.

(b) As the location of the carbon-depleted layer within the surface layer part was not defined in the claim (see feature [1.6]), all embodiments in which the depleted layer was not located directly adjacent to the surface of the base steel were insufficiently disclosed, as it was not shown how such embodiments could be achieved.

(c) The patent did not disclose the point in the annealing furnace at which the dew point had to be controlled in accordance with feature [4.7].

(d) Feature [7.5] did not specify a minimum thickness for the carbon-enriched layer, thereby encompassing thicknesses of zero or close to zero microns, which contradicts the description of what is essential for achieving the effect of the invention (e.g.

paragraph [0082]). Therefore, claim 7 encompassed non-working embodiments.

(e) Analogously to objection (b) above, claims 7 to 11 did not specify the location of the carbon-enriched layer within the surface layer. Carbon-enriched layers that were not directly adjacent to the surface of the base sheet did not achieve the excellent impact property claimed (at least a maximum allowable gap was also not disclosed) and the patent did not disclose how to obtain such layers either.

(f) The patent did not disclose how to determine the parameter "impact absorption energy IE" defined in claims 10 and 11.

The objections are not convincing for the following reasons:

2.1 Objection (a) - range Fs/Fc

2.1.1 According to the patent (see the examples documented in Tables 1 to 3), a hot pressed formed part with an excellent impact property from a plated steel sheet is achieved by:

- a first step, wherein a plated steel sheet for hot press forming with a defined composition and carbon/ carbide distribution according to features [1.6] and [1.7] is obtained (see claim 4 and Table 2) and
- a second hot pressing step, wherein a carbon-enriched layer according to feature [7.5] is obtained (see claim 12 and Table 3).

2.1.2 The first step thus only defines the requirements for the precursor plated steel sheet prior to hot-pressing

(claims 1 and 4 merely define that the sheet is suitable "for hot press forming having an excellent impact property"). In addition to the composition of the base sheet, the critical conditions for obtaining a precursor plated steel sheet according to the invention are defined in claim 4 (see also the results of the comparative examples in table 2). The invention is only defined by the interaction of all these conditions.

Therefore, this precursor sheet does not need to have excellent impact properties. These are only imparted to the suitable plated precursor steel sheet when the hot-pressing step is also carried out in accordance with the invention (see claims 12 and 13 and the comparative examples in Table 3).

With regard to examples A4 and A4-1 cited by the opponent, it is noted that the precursor sheet (A4) itself does not fulfil all the specifications of the invention according to claim 1. This is because the carbon-depleted layer extends to 12 microns, which is far beyond the maximum allowable thickness of 5 microns defined by feature [1.6]. Steel sheet A4 is also not produced in accordance with the method of the invention defined in claim 4 because the slab heating temperature in example A4 (1370°C) falls outside the defined range (1050 to 1300°C). Therefore, example A4 is not in accordance with the invention and cannot prove that an Fs/Fc ratio of 0.7 would not be capable (in combination with the further essential conditions) of achieving an excellent impact property. The opponent also did not present any further evidence in this respect.

2.2 Objections (b) and (e) - location of the carbon-depleted/ -enriched layer

According to generally accepted technical understanding, the heating and cooling steps (carried out in a controlled atmosphere) affect the carbon composition of the surface layers of the base steel sheet and the plated steel sheet. Indeed, these process conditions define and limit the location where the carbon-enriched, or carbon-depleted zones can be formed within the surface layer part. For this reason, the location of these zones within the surface layer part (and the respective "gap" to the actual surface) is not completely and freely adjustable over the whole range claimed.

However, the opponent has not demonstrated that certain depths of the carbon depletion or enrichment zones within the surface layer part (200 microns) are not achievable at all. Regarding the opponent's reference to hypothetical embodiments that would fall within the claimed range but for which it was not shown how they could be produced (e.g. a carbon depletion layer that only starts at a depth of 190 microns), the Board agrees with the opposition division's conclusion that the skilled person would simply not consider such embodiments to be lack of sufficient disclosure.

The diffusion of carbon, as well as the formation and dissolution of carbide, depends on the concentration and temperature profiles, which are not freely adjustable. Therefore, the opponent's understanding of the claim that any concentration profile falling within the claim must be workable is artificial and does not take due account of the technical understanding of the skilled person in the relevant field.

2.3 Objection (c) - determination of the dew point temperature

The Board agrees with the opposition division's conclusion that features [4.6] and [4.7], when considered together, clearly define that the annealing step is to be conducted at a temperature ranging from 740°C to 860°C in an atmosphere in which the dew point is between -70 and -30°C (see also paragraphs [0068] and [0069]). This defines the dew point temperature as corresponding to the actual annealing step at the annealing temperature, rather than to other "locations" such as during pre-heating or post-cooling steps.

2.4 Objection (d) - undefined thickness of carbon-enriched layer

In the absence of a lower limit, the range of thicknesses does indeed encompass very small carbon-enriched layers with at least 110% of the average carbon amount. However, the presence of a carbon-enriched layer is still a requirement defined by the claim. Hence, the skilled person would understand, in the light of the whole patent disclosure and their general knowledge, that the value of zero or technically insignificantly low values close to zero are not encompassed. While the exact delimitation to a technically feasible lower thickness value might give rise to a lack of clarity (not objectionable for the granted patent claims), the skilled person would still be able to carry out the invention.

Furthermore, the effect is only defined in relative terms in claim 7 ("excellent impact quality") and is not quantified. According to the patent, a layer

thickness of at least 10 microns is preferable (see paragraph [0084]). However, the TS*IE value achieved as a measure of the effect is already significantly higher for examples A1-5 and C2-1 (having a carbon-enriched layer with a thickness of 7.2 and 4.7 microns respectively) than for the comparative examples (see Table 3).

2.5 Objection (f) - determination of impact energy (IE)

The Charpy impact test is the only method mentioned in the patent for determining impact energy (see paragraph [0106]).

The opponent's argument that IE is an unusual parameter which does not allow a comparison with the prior art is not persuasive (the Charpy test is a long-established standard method, see e.g. the reference to the ISO standard in D12). Should the standard have changed over time (which has not been demonstrated by the opponent), variations in the resulting IE values would not constitute an issue of insufficient disclosure either (at most, this would be an issue under Article 84 EPC).

It is for the opponent to prove its allegation that the stated Charpy test is insufficiently reproducible. The opponent has not demonstrated that the skilled person would have insufficient information to determine the IE parameter using the Charpy test in a reproducible manner. Even if this were the case, this would instead be an issue of lack of clarity (see Case Law of the Boards of Appeal, 11. edn., 2025 II.5.5.1.c), since the claims do not define an IE value to be achieved.

3. Main request, claim 7 - inventive step

The subject-matter of claim 7 does not involve an inventive step starting from D1 and considering common general knowledge.

For this reason, it is not necessary to comment on the novelty objections against the main request based on D2.

3.1 Common features

The starting point considered for the subject-matter of claim 1 in D1 is example 1.

It was in dispute whether an excellent impact property according to feature [7.1] and a steel composition according to feature [7.2] was disclosed in D1, and whether the carbon-enriched layer in accordance with feature [7.5] was still obtained for example 1 when an Al-Si plating composition according to feature [7.3] was used.

The Board considers that the only distinguishing feature is the plating composition according to feature [7.3]. Example 1 of D1 does not disclose an Al-Si plated layer according to feature [7.3] but instead uses a zinc-aluminium alloy (see paragraph [0098]).

Example 1 discloses all other features as discussed below.

3.1.1 Feature [7.2]

The base steel sheet used in example 1 has a composition according to feature [7.2] (see paragraphs

[0097] to [0109]). It is true that the nitrogen content is not explicitly mentioned in D1. However, the range of nitrogen amounts specified in claim 7 (0.001-0.02 wt.%) encompasses values at impurity level. According to the patent itself, nitrogen is (solely) an impurity that can only be avoided with significant additional processing effort (patent, paragraph [0040]: "high manufacturing costs are incurred to control a content of nitrogen (N) to be less than 0.001%"). D1 does not mention such additional effort; in fact, paragraph [0097] mentions the presence of further "unavoidable impurities". According to paragraph [0040] a problematic reduction of high-temperature ductility occurs when the content of Nitrogen (N) is greater than 0.02%. Therefore, from the point of view of a skilled person, the argument that the composition in example 1 of D1 does not comprise nitrogen in the claimed range is not convincing.

3.1.2 Feature [7.1]

After hot pressing, the plated steel sheet of D1 has "high levels of tensile strength and bendability" (see paragraph [0008]) and Figure 6, favourable examples processed at dew point temperature higher than -15°C). The Board considers, that at least the example of Figure 11 at a dew point temperature of -7°C has an excellent impact property in accordance with feature [7.1].

As far as the patent proprietor argued that this does not anticipate the requirements of feature [7.1], and not the absolute values of TS and IE achieved in the patent, this argument is not convincing.

The feature "excellent impact property" of feature [7.1] is a relative definition which is not linked to any parametric value in the claims and there is no definition in the description either. Also, when considering the parameter TS*IE described in paragraph [0106] of the patent, there is no definition of a cut-off value from which on an "excellent impact property" is achieved. As an example, A1-5 and C2-1 of the patent exhibit relatively low IE and TS*IE values yet are still considered to be in accordance with the invention defined by claim 7 of the main request.

The patent proprietor itself stated that "even if the patent does not give an explicit limit about the meaning of the excellent impact property, it is clear from the context of the patent that steel sheets without a carbon-enriched layer do not have excellent impact properties" (see letter dated 5 August 2024, point 5.6). In other words, for compliance with feature [7.1], it is sufficient that a carbon-enriched layer in line with feature [7.5] is present.

3.1.3 Feature [7.5]

In example 1, the annealing step before plating was carried out at two different dew point temperatures, i.e. -7°C and -27°C (see paragraph [0106]).

According to Figure 11, after hot-press forming for both examples a carbon-enriched layer is present within a region from the surface to a depth of 200 microns (in Figure 11 in a region between approx. 1 to 4 microns from the surface) having a carbon concentration which has more than 110% of the average amount (approx. 120%) for the example processed at a dew point temperature of -7°C). Therefore, feature [7.5] is disclosed in example

1 of D1. It is true that a carbon depletion zone is also visible in Figure 11 directly adjacent the interface with the plating, however such a depletion zone is not excluded by claim 7. An explanation why feature [7.5] is still present when using a plating composition according to feature [7.3] is provided below.

3.2 Technical effect and objective technical problem

Feature [7.3] is the sole distinguishing feature. D1 discloses (see paragraph [0084]) that, as an equally suitable alternative to zinc-aluminium coatings, an Al-Si alloy having a composition in accordance with that suggested in the patent (compare with patent, paragraph [0075]) can be used. D1 discloses that a certain level of decarburisation is beneficial for the mechanical properties of a plated ("pre-coated") steel sheet before hot pressing (see paragraphs [0013] and [0014]. This effect is related to the carbon profile before and after hot pressing (Figures 10 showing the relative carbon content before hot-press forming, Figure 11 showing the relative carbon content after hot-press forming). According to paragraphs [0084] to [0086], the invention of D1 is applicable to a variety of plating alloys, including the one specified in claim 7, feature [7.3].

Therefore, the objective technical problem is that of providing an alternative hot-pressed plated steel sheet having the beneficial mechanical properties stated in D1.

3.3 Obviousness

The question with respect to obviousness is two-fold.

- Would the skilled person consider the alternative Al-Si plating?
- Would example 1, if plated with an Al-Si coating, still fall within feature [7.5]?

3.3.1 The skilled person would consider the alternative Al-Si plating alloy disclosed in paragraph [0084] of D1.

D1 does not teach that selecting the zinc plating alloy was essential for obtaining the desired carbon profiles and the resulting beneficial mechanical properties in D1. While D1 shows an effect of the obtained carbon profiles (Figure 11) on the resulting mechanical properties (Figure 6), it is not mentioned in D1 that the zinc-based coating is also essential to achieving this effect. On the contrary, Al-Si plating is disclosed as an equally suitable alternative plating alloy (see paragraph [0084] and claim 29). Steel sheets with plating based on both aluminium and zinc are also the considered alternatives in paragraph [0003] of D1 when discussing the starting point of the invention in D1 ("The pre-coating can be aluminium or an aluminium-based alloy, zinc or a zinc alloy").

The Board further agrees with the opponent that the only process parameter to be adjusted is the temperature of the galvanisation bath, a modification obvious to the skilled person in view of the known melting point of the alternative plating composition.

3.3.2 Example 1 if plated with Al-Si falls within feature [7.5].

The patent proprietor argued that, when Al-Si plating was used, the obtained carbon profile would exhibit a

smaller carbon peak compared with that shown in Figure 11 for zinc alloy plating and that it had thus not convincingly been shown that replacing the plating material in example 1 still resulted in a carbon profile in accordance with feature [7.5]. This was because changing metal diffusion conditions in the presence of the Al-Si plating alloy promoted carbon distribution and decarburisation.

However, this is not persuasive for the following reasons.

Contrary to the patent proprietor's view, the carbon peak according to feature [7.5] and visible in Figure 3 of the patent and Figure 11 of D1 is not only the result of a diffusion process. Diffusion transport occurs from a higher to a lower concentration, at least if the composition of the metal alloy does not significantly change. Instead, the carbon peak originates from carbides dissolved during hot pressing step during the martensitic transformation and the subsequent cooling (see patent paragraph [0052]).

As can be seen in Figure 3 of the patent, diffusion conditions for carbon are not substantially changed within the bulk of the steel sheet by the hot-press forming since the steel composition is not altered by the components of the plating composition. The iron content in the "base steel" part of the graphs is approximately constant, and no further plating alloy compounds are present (in particular there is no Si from the Al-Si coating) before as well as after hot-press forming. It is thus not persuasive - contrary to what was argued by the proprietor - that for an Al-Si coating carbon diffusion from the surface layer part into the base steel would be promoted by diffusion of

Si from the plating into the carbon-enriched layer, forming silicon-carbides which allegedly further diffused into the base material, thereby flattening the carbon peak in the surface layer part.

It is also not persuasive - contrary to what was argued by the opponent - that carbon diffusion would increase from the base steel sheet towards the outer surface for an Al-Si plating, thereby refilling the carbon peak. A diffusion process may flatten a peak or refill a depletion, but - in the absence of other mechanisms (such as the carbide dissolution discussed above) - will not create or conserve a local concentration maximum.

According to Figure 11 of D1 (zinc-plating), the relative carbon content falls to approx 0.7 (PR= -7°C) towards the surface, indicating decarburisation via the zinc layer during hot pressing.

Conversely, according to Figure 3 of the patent, the carbon content in the plated layer is almost zero (contrary for example to iron, which diffuses in significant amounts into the plated layer). Thus, Al-Si plating reduces carbon diffusion towards and decarburisation via the surface compared with zinc plating, (i.e. the decarburisation effect observed close to the surface of the base layer in D1 Figures 10 and 11 for a zinc-alloy is reduced). This is also persuasive in view of the high hot-pressing temperature of 880°C (D1, paragraph [0101]) and the fact that the melting points of aluminium plating alloys are significantly higher than those of zinc alloys. It is further confirmed by D2a which teaches that the Al-Si plating layer used herein "prevent[s] any decarburisation during hot-pressing" (page 16, lines 23

to 27). It is noted that to prevent decarburisation caused by melting of the plating layer heating must be carried out rapidly (see patent, paragraph [0094]). However, as discussed above, the aluminium alloy plating will be more effective at preventing decarburisation than the zinc plating due to its higher melting point.

Thus, there is no reason to assume that replacing the zinc plating of example 1 of D1 by an Al-Si plating, as suggested in paragraph [0084] of D1, will significantly flatten the carbon peak observed in Figures 10 and 11.

Therefore, also with the plating layer alloy being changed from the zinc-based alloy to Al-Si, a carbon enriched layer according to feature [7.5] will be present.

3.3.3 The patent proprietor also pointed to comparative examples A2-1 and A3-1, which in their view were very similar to the steel sheets processed in example 1 of D1 given their composition. It argued that the precursor was subjected to dew point temperatures during annealing in a similar range (0°C and -20°C), but according to the results of Table 3 a carbon distribution as defined by feature [7.5] was nevertheless not achieved for the final hot pressed steel sheets of examples A2-1 and A3-1.

However, as shown by the experiments of the patent, the resulting carbon profile is not only sensitive to the dew point temperature but also to other processing parameters such as the slab heating temperature (see example A4/ A4-1) or the cooling starting time and the heating rate (see example A5/A5-1). These further parameters are not disclosed for example 1 of D1. For

this reason, the carbon enrichment of examples A2-1 and A3-1 of the patent cannot be compared with that of example 1 of D1.

3.3.4 Consequently, claim 7 of the main request is not inventive starting from prior art D1

4. Consideration of auxiliary request 1

Auxiliary request 1 is considered in the appeal proceedings.

4.1 The opponent requested that auxiliary request 1 not be admitted into the appeal proceedings. In its view, the patent proprietor "did not maintain" this request in their notice of appeal and not in their statement setting out the grounds of appeal either.

4.2 However, auxiliary request 1 forms part of the decision under appeal on which the appeal is based (Article 12(2) RPBA) and corresponds to the request on which the opposition division maintained the patent in amended form and is therefore not an "amendment" within the meaning of Article 12(4). The Board has no discretion to disregard this request.

5. Auxiliary request 1, claim 1 - inventive step

The subject-matter of claim 1 does not involve an inventive step starting from D1 and seen in combination with common general knowledge.

5.1 Common and distinguishing features

5.1.1 D1 yields high levels of tensile strength (as likewise does the patent as a secondary condition, see Table 3) and bendability after press hardening of a plated steel sheet (D1, paragraph [0008]). Like the patent, D1 focuses on the improvement of mechanical properties imparted to a plated steel sheet during the martensite transformation in the boundary layer on hot pressing (see D1, paragraph [0008]). D1 concluded that decarburisation in the surface layer adjacent the plating layer in the case of the precursor, i.e. before hot pressing is decisive for the mechanical properties obtained for the final product (see D1, paragraph [0072]). Therefore, D1 is *per se* a starting point for the subject-matter of claim 1 which the skilled person would consider.

5.1.2 In example 1 of D1, two samples of plated steel sheets are annealed at different dew point temperatures (-27 and -7°C) and subsequently hot pressed. Figure 10 of D1 discloses the carbon profile of these samples obtained before hot pressing. In the sample annealed at -27°C (hereinafter "example -27°"), the carbon depletion zone as defined by feature [1.6] has a thickness of 3 microns (see D1, paragraph [0106]: "depth of decarburisation $p_{50\%}$" and Figure 10), i.e. within the range claimed. It was demonstrated in the patent that plated steel sheets with a carbon and carbide distribution according to claim 1 can be suitable precursors to obtain a hot-pressed part with an excellent impact property. For this reason, also feature [1.1] is anticipated by example -27°C.

5.1.3 Although not shown in Figure 10, the Fs/Fc ratio is implicitly within the range defined by feature [1.7]

(see the examples in the patent in Table 2: all embodiments with a thickness of 3 microns or lower fall within this range). This is also not inconsistent with comparative examples A2 and A3 of the patent, both falling outside the Fs/Fc ratio claimed but have a carbon depletion layer thickness of 4 and 12 microns respectively.

5.1.4 Therefore, the only difference between the plated steel sheets defined in claim 1 and example -27° of D1 is the Al-Si alloy plating as defined by features [1.3] and [1.5].

5.2 Example -27° as a realistic starting point

5.2.1 It was disputed that the skilled person would consider the plated steel sheet annealed at a dew point temperature of -27°C in example 1 of D1 (example -27°) to be the starting point.

The opposition division concluded that example -27° was not disclosed as being in line with the invention of D1. The skilled person was thus discouraged from choosing the "worse" comparative example -27° of D1 as the starting point. The patent proprietor added that example -27° was also an unrealistic starting point as the skilled person was not provided with any motivation or suggestion to use this example. It was selected in the knowledge of the invention, i.e. using hindsight.

This is, however, not persuasive, for the following reasons.

5.2.2 Whether a comparative example is a realistic starting point depends on the circumstances of the case. It depends, in particular, on the relationship between the

distinguishing feature, its relevance in the context of the invention of the patent and the teaching of the document disclosing such a comparative example.

Example -27° of D1 is a comparative example with respect to the invention considered in D1, the object of which is to improve the bending properties of the hot-pressed galvanized steel sheet (see paragraph [0108]: "bending results [...] not achieve the required level"). Even though there is a relationship between the bending and impact energy properties, it was neither shown nor argued by the patent proprietor, and it is not apparent from common general knowledge either, that the bending angle inevitably correlates with the impact energy. Example -27° is also not a defective, non-functioning example even though the final hot-pressed article obtained from the precursor of example -27° does not achieve the threshold of the bending angle defined as the object in D1 (see Figure 6).

A skilled person dealing with the improvement of an impact property would learn from D1 that the bending properties of plated steel sheets hardened by martensitic transformation during hot pressing and quenching can be improved (see Figure 6) even though there is - as shown in Figure 10 - decarburisation for the higher dew points (considered to belong to the D1 invention) during the annealing step. This is counter-intuitive in view of the common general knowledge referred to by the opponent that decarburisation is leading rather to reduced hardness (see the opponents' arguments with respect to D19 in the inventive step discussion in point 8.1.3.b below). It is clear to a skilled person in view of the teaching of D1 that a compromise must be found between the hard properties

and bendability. Even though the focus in D1 is bendability, all the various examples shown in Figure 6 of D1 are equally suitable starting points for forming a hardened plated steel sheet by hot pressing. This is also confirmed by the fact that both precursors of example 1 in D1 result in a hot-pressed part having a carbon enriched layer (see Figure 11).

The board in T 2114/16, cited by the patent proprietor, concluded that the comparative example considered there was not a suitable starting point. However, the case is not comparable to the present one since the comparative example had a property of low internal bond strength, which was in direct conflict with the objective technical problem of increasing paper strength (see Reasons 5.3.4).

5.3 Objective technical problem and obviousness

It was demonstrated in the patent that plated steel sheets with a carbon and carbide distribution according to claim 1 can be suitable precursors for obtaining a hot-pressed part with an excellent impact property. As shown above, the only structural difference between the subject-matter of claim 1 and example -27° is thus the plating material.

That the selection of the plating according to features [1.3] and [1.5] has an impact on the mechanical properties was not shown in the patent and it is not apparent from D1 either (see paragraphs [0003], [0084] and [0085]). This is consistent with the fact that the decisive parameter in D1 is the dew point temperature, a process step carried out before the application of the plating on the base steel sheet.

The objective technical problem is thus that of providing an alternative plated steel sheet for hot-press forming.

Zinc and aluminium based platings are disclosed in D1 as equally suitable alternatives for a plated steel sheet according to the invention in D1 (see paragraphs [0003], [0084] and [0085]).

Therefore, it is obvious to the skilled person to consider the Al-Si plating as an alternative. Using this alternative results in a plated steel sheet for hot press forming according to claim 1 is obtained since, by using the Al-Si alloy, decarburisation is further reduced compared with the zinc alloy, as shown in Figure 10, for the reasons already discussed for claim 7 of the main request.

5.4 As the subject-matter of claim 1 of auxiliary request 1 is not inventive over D1, the question whether it is novel over D2 can be left open.

6. Auxiliary request 1a - admittance

Auxiliary request 1a was admitted into the proceedings.

In line with a widely accepted line of case law (see Case Law of the Boards of Appeal of the EPO, 11th edn., 2025, V.A.4.2.3 d), the deletion of an entire independent claim with all its dependent claims as in present auxiliary request 1a constitutes an amendment to the appeal case as per Article 13(2) RPBA. The admittance of an amendment under Article 13(2) RPBA

requires the presence of exceptional circumstances justified with cogent reasons.

In the case in hand, at the time of filing of auxiliary request 1a, all objections against any of the remaining independent claims had already been discussed in depth and found not convincing. Auxiliary request 1a thus overcame *prima facie* all objections raised (including the opponent's line of arguments only raised during oral proceedings before the Board with respect to carburisation based on D19, chapter 7.3, see also point 8.1.3(b) below) without any change to the factual and legal framework of the case and without the necessity of re-evaluating any other matter. Therefore, admittance of this request is in line with the requirement of procedural economy and takes due account of the opponent's legitimate interests as all of its objections have been dealt with (see also T 1800/21, Reasons 3.4 in which a similar case is discussed). In addition, the deletion of claim 1 was already considered as a fallback position in the claim requests previously on file, for example, in auxiliary request 28.

All this, seen in combination, was considered to constitute exceptional circumstances in favour of the admittance of auxiliary request 1a.

7. Auxiliary request 1a - novelty

The subject-matter of claims 1, 4 and 8 is novel.

Initially, the opponent challenged the novelty of these claims only in view of the disclosure of D2, which is state of the art under Article 54(3) EPC. The following

assessment applies *mutatis mutandis* insofar as the opponent referred alternatively to D2a.

The feature references used for claims 1, 4 and 8 below correspond to those used for the respective identical claims 4, 7 and 12 of the main request (see point VI. above). The additional feature [7.6] ("wherein the carbon-enriched layer has a thickness of 10 to 150 um") in claim 4 of auxiliary request 1a is assigned the feature reference [7.6].

7.1 Claim 1

7.1.1 Examples 1 and 2 of D2 disclose a method for hot pressing a plated steel sheet. The base steel sheet has a composition falling within the specification of feature [4.2a] (further including Cu, Ni and Ca at an impurity level, see D2, paragraph [0075]) and an Al-Si plating layer in accordance with features [4.8] and [4.10] (see paragraph [0075], lines 25, 26). To produce the plated steel sheet, the steel slab can initially be subjected to hot-rolling and winding ("stored and transported in the form of a coil before coating", see paragraph [0041]).

D2 does not explicitly mention the parameters according to features [4.3] to [4.5], nor does it mention an annealing step before plating in accordance with features [4.6] and [4.7].

7.1.2 The opponent's novelty objection was based on the assertion that the process conditions defined by features [4.2b], [4.3] to [4.5] and [4.7] were applied for producing the plated steel sheets according to examples 1 and 2. According to the opponent, these conditions were standard conditions in steel production

and, therefore, implicitly disclosed in D2. In support of this argument, the opponent referred to documents D4, D5a, D6, D7, D8 and D15 (table 2: "standard conditions") as evidence for the alleged respective common general knowledge.

These objections are not convincing for the following reasons.

7.1.3 The opponent did not present a single document disclosing a standard process for producing a plated steel sheet, let alone for producing a plated steel sheet with the claimed composition, including all the features in question in combination. Instead, each of the cited documents discloses only some of the features.

- D4 describes the standard hot-rolling and coiling conditions for high tensile steels (thus disclosing at most a carbon content in the claimed range). These conditions fall within features [4.2b] and [4.3]. However, the coiling temperature can be below the range disclosed in feature [4.5] (see Figures 9, which states a target temperature of 450°C but with an accuracy of +- 20°C, and Figure 12, which discloses even lower coiling temperatures). In addition, no annealing and no plating step is mentioned.
- D5a describes cooling strategies for use after hot rolling and before coiling, depending on the steel grade being processed, at temperatures as low as 180°C (see chapter 5 "Applications").
- D6 describes general heat transformation and effects on phase formation during hot rolling and winding (see features [4.2b] to [4.5]).

- D7 describes an annealing step (up to 850°C, see point 2.2) before a plating step, but not for an Al-Si alloy. It is stated here that the dew point temperature of -30°C is important for controlling the migration of components to the surface (see point 2.3.3).
- D8 describes an annealing step (up to 850°C, page 4, first paragraph) and a plating step in which plating can comprise Al-Si; however, no specific guidance is provided with respect to the selection of the plating alloy composition. Furthermore, D8 addresses various steel grades that are not in accordance with the invention (see e.g. point 1.1.3.1.2, low carbon "IFS" steel).
- Table 2 of D15 mentions "conventional" annealing conditions (800°C, dew point temperature: -30°C).
- The opponent further referred to D14 and D16 to D19 to prove that the start cooling time according to feature [4.4] was conventional.

7.1.4 It can be derived from D4 (passage bridging pages 18 and 19) that features [4.2b] to [4.4] are standard conditions (i.e. recrystallisation at high temperatures without excessive decarburisation and subsequent rolling with a lower end temperature followed by coiling); the start of cooling according to feature [4.4] seems to be implicit given the high-speed processing.

In addition, annealing in accordance with features [4.6] and [4.7] is suggested in general for plating processes (D7, D15).

However, there is no basis for the assertion that all the standard conditions for hot rolling, winding and annealing are applied together in the process disclosed

in D2. For example, the dew point temperature might usually be at -30°C according to the information in D7 or D15, Table 2 (even though the latter is a patent document which does not normally represent common general knowledge). However, D1 explicitly proposes that the operation takes place at a temperature above -15°C (see e.g. paragraph [0036] and Figure 6), i.e. well above the claimed value. Hence, the assumption that the alleged standard conditions are inevitable and, therefore, implicitly disclosed in D2 is not convincing.

7.1.5 Even on the assumption that all the processing conditions according to features [4.2b], [4.3] to [4.5] and [4.7] would fall under a commonly known standard for producing plated steel sheets of the claimed composition, it is not apparent whether standard conditions were indeed intended for the examples of D2.

7.1.6 Consequently, the subject-matter of claim 1 is novel.

7.2 Claim 4 (hot press formed part) and claim 8 (manufacturing method for a hot press formed part)

7.2.1 Claim 8 (identical to claim 12 of the main request) defines a manufacturing method of a hot press formed part comprising the step of heating a plated steel sheet "manufactured by [a method as defined in claim 1 to 3]".

D2 discloses a manufacturing method including steps according to features [12.1], [12.3] and [12.4] (see temperatures and heating/cooling rates in paragraphs [0067] and [0069] as well as paragraphs [0076], [0077] and [0080]).

However, as explained above, D2 does not disclose a precursor plated steel sheet produced in accordance with the method of claim 1 for which it has to be assumed that it has the necessary carbon profiles of the precursor as shown in the examples of the patent in Table 2. Therefore, feature [12.2] of claim 8 is not disclosed in D2 and the subject-matter of claim 8 is thus novel over D2.

7.2.2 With the process disclosed in D2 not being the same as the process used in the patent, it cannot be concluded either, that the hot-press-formed part defined in claim 4 is the same as the one obtained by the process of D2 (using a "same process- same product"-argument). In particular, there is no direct and unambiguous disclosure of a carbon-enriched layer in accordance with feature [7.6] ("carbon enriched layer has a thickness of 10 to 150 um").

Thus, also the product defined by claim 4 is not disclosed by D2.

8. Auxiliary request 1a - inventive step

The subject-matter of claims 1, 4 and 8 involves an inventive step.

The opponent raised objections regarding a lack of inventive step with regard to the subject-matter of claims 1, 4 and 8 of auxiliary request 1a, starting from D1, D2a or D13.

None of these objections is persuasive for the reasons set out in the following paragraphs.

Remark: The feature references used below for claims 1, 4 and 8 correspond to those used for the respective claims 4, 7 and 12 of the main request (see point VI. above).

8.1 Inventive step objection based on D1 as the starting point

8.1.1 Distinguishing features

(a) Claim 1

The lowest dew point temperature applied at the annealing step in example 1 of D1 is -27°C ("example -27°"). Since claim 1 requires a dew point temperature of at least -30°C or lower, feature [4.7] of claim 1 is not disclosed in D1, even though example -27° is close to the defined end point of the range.

The fact that no example with an annealing step at a dew point temperature according to feature [4.7] is disclosed in D1 is also the decisive point with respect to novelty of the subject-matter of independent claims 4 and 8.

(b) Claim 8

The process defined in Claim 8 requires a precursor that is obtained by a process in accordance with claim 1 ("plated steel sheet, manufactured by one of claims 1 to 3"). There is no evidence that the precursor product according to claim 1, which is obtained at lower dew point temperatures than the ones used in D1, is structurally identical to those disclosed in D1. Consequently the method to obtain the final hot-pressed part using a plated steel sheet

manufactured by one of claims 1 to 3 (claim 8 of auxiliary request 1a) is different from the method disclosed in D1.

(c) Claim 4

The examples of the patent (see examples A2 and A3 in Table 2) show that a product according to claim 4, having a carbon profile in accordance with feature [7.6], is only obtained by, *inter alia*, an annealing step in accordance with feature [4.7]. Indeed, the carbon-enriched profile of example -27° is far out of the thickness range defined by feature [7.6] of claim 4.

8.1.2 Objective technical problem

According to comparative examples A2 and A3 of the patent, the conduction of the annealing step at dew point temperatures at or below -30°C when producing the precursor plated steel sheet has the effect that an improved impact property in accordance with the invention can be obtained after hot press forming in accordance with the invention.

The opponent referred to examples A1-5 and C2-1 which would not result in a hot-pressed part having an excellent impact property, even though the dew point temperature was within the claimed range. However, this is not in contradiction with the effect. These examples also show improved impact properties; however, they do not demonstrate these properties to the same extent as those of the examples with a carbon profile in accordance with feature [7.6] (which is not the object of the process directed to the formation of the precursor defined in claim 1).

The objective technical problem related to these differences is thus the same for all independent claims, namely, to further improve an impact property.

8.1.3 Obviousness

There is no indication in D1 for the skilled person to further decrease the dew point temperature to obtain this objective and to provide a product according to claim 4, and not in the common general knowledge either.

(a) Obviousness in view of the teaching of D1

As already discussed for claim 1 of auxiliary request 1, D1 teaches that annealing at higher dew point temperatures leads to hot pressed parts which are more bendable and thus deformable (see Figure 6 and paragraphs [0102], [0103] as well as paragraph [0108]: "the intrinsic toughness characteristics of the martensite created under these conditions depends on the decarburisation conditions which result in particular from the choice of the [dew point] temperature").

There is no direct link between the teaching of D1 (improved bending properties) and the impact properties as measured in the patent (i.e. in terms of the impact energy). However, even if the skilled person were to consider the teaching of D1, this teaching would indicate applying higher dew point temperatures in the annealing step, i.e. above -15°C (see Figure 6), to improve the deformation-related mechanical properties.

(b) Obviousness in view of the common general knowledge

The Board has no doubts that the relationship of low dew point temperatures and reduced decarburisation is common general knowledge. The principles underlying this effect are set out in D19 (see chapter 6.1.5 and 7.1 describing the principles of decarburisation due to oxidisation, which is the very reason for defining the low dew point temperature). This effect is also explained in D1, paragraphs [0076] and [0077] or in D15, paragraph [0028]. As shown in D15 (table 2) and D7 (point 2.3.3), values of e.g. -30°C are conventional and not an uncommon selection.

However, as shown above, D1 explicitly deviates from selecting such standard values in order to improve the mechanical properties.

In a second line of argument, which was only submitted in response to the Board's preliminary opinion, the opponent asserted that the skilled person would be aware that increasing the carbon content in the surface layer of the base steel sheet ("carburisation") would improve the hardness that is formed during the martensitic transformation of the steel in hot pressing. This was also stated in the patent as the underlying effect (paragraph [0022]), and was likewise common general knowledge, as shown in D19, chapter 7.3.1, first paragraph. In addition, this effect was also the effect referred to in paragraph [0108] of D1.

The patent proprietor requested that this argument not be admitted. However, as it is not persuasive, the admittance of this line of argument can be left undecided.

The Board has no doubt that the effect of surface carburisation of steel on its hardness properties in general is common general knowledge (note, however, that D19 does not concern plated steel sheets).

However, contrary to the opponent's assertion, there is no evidence that the carburisation of a plated steel sheet results in an improved **impact property** in terms of a higher impact energy. This effect was shown for a hot-pressed part having the combination of features of claim 4 in the patent. From the experimental data in the patent, it was derived that the carbon-enriched layer in accordance with feature [7.6] was one of the essential features to achieving this effect. However, this effect was derived from the examples in the patent and was not common general knowledge. Therefore, it is already unclear why the skilled person should seek to achieve such a carbon profiles through the prevention of decarburisation or by carburisation.

Furthermore, D19 provides no guidance where to implement a possible carburisation (or where to prevent a possible decarburisation) in a complex manufacturing process line such as the one disclosed in D1. The fact that the annealing step was the only possibility in this respect (the "only window" for the person skilled in the art) can at least not be derived from D19.

Moreover, selecting a dew point temperature in accordance with feature [4.7] is also not obvious. While D19 confirms that increasing the carbon concentration in the surface of a (non-plated) steel sheet impacts the hardness during martensitic transformation, it does not provide any guidance on controlling the carbon content during the formation of

a hot press formed part, having an excellent impact property or a suitable precursor for this. As discussed above, D1 shows that decarburised surface parts in the context of a plated steel sheet can also have favourable mechanical properties (see D1, Figures 6, 10 and 11)

Therefore, there is no incentive for the skilled person to act contrary to the teaching of D1 at dew point temperatures within the range defined by feature [4.7].

For the same reasons, a manufacturing method in accordance with claim 8, using a precursor produced in accordance with claim 1, and the hot press formed part in accordance with claim 4, are not obvious either.

8.2 Inventive step objections based on D2a as the starting point

8.2.1 D2a does not discuss or disclose resulting carbon and carbide distributions in the base steel sheet of the precursor. Since D2a also fails to disclose the essential process conditions for obtaining such a distribution (in particular not the dew point temperature according to feature [4.7]), such carbon profiles are also not implicitly disclosed, as discussed above (see point 7.1) for analogous reasons as explained above with regard to D1.

Therefore, the reference to the precursor steel sheet obtained by the method of claim 1 is a distinguishing feature for the method of claim 8. The carbon profile of the hot-pressed part (feature [7.6]) is thus not disclosed in D2a either.

Inasmuch as the opponent pointed to the statement on page 16, lines 23 to 26 of D2a, where it is stated that "[t]he presence of the coating at the time of thermal treatment of the parts makes it possible to prevent any decarburisation of the base metal as well as any oxidation", it cannot be derived from this statement that the carbon profiles of the precursor and the hot-pressed part are in accordance with the invention since the patent shows that the dew point nevertheless has a significant impact (see examples A2 and A3 in Table 2 of the patent).

8.2.2 According to the patent proprietor, the annealing step at a low dew point temperature according to feature [4.7] not only has the effect of lower decarburisation, but also produces a suitable precursor, in which, after further processing during hot pressing, a carbon-enriched layer can be provided having the beneficial excellent impact property. This was confirmed by the results in Tables 2 and 3.

D2a is a disclosure directed to a hot-pressed plated steel sheet. It is not directed to certain properties of the intermediate product before hot pressing. The intermediate product in D2a also does not, accidentally, anticipate the intermediate product obtained by the method of claim 1, as shown in the novelty discussion of D2 above. Therefore, the effect and the objective technical problem starting from D2 cannot be independent from the desired properties of the final product according to the invention. Therefore, the technical problem is not only to work out the teaching of the closest prior art, as argued by the opponent with reference to T 1737/21 (see headword 1).

The objective technical problem for claims 1, 4 and 8 is instead the provision of a hot-pressed part having an improved impact property, a method for its production and a method for forming a suitable plated steel sheet as intermediate product serving as a precursor for such a hot-pressed part (see also the related case law for the assessment of inventive step for intermediate products, Case Law of the Boards of Appeal, 11th edition, 2025, I.D.9.9.4).

8.2.3 The opponent argued that common technical knowledge taught that decarburisation could be avoided when annealing at dew point temperatures of -30°C or lower and that such conditions were routinely applied in D2a by the skilled person as they were standard conditions.

However, even assuming to the benefit of the opponent that the effects of the application of low dew point temperatures on decarburisation and carburisation during martensitic transformation are known to the skilled person, there is no common general knowledge indicating that the selecting a dew point temperature in accordance with feature [4.7] in combination with the further method features disclosed in D2a would address the objective technical problem and result in a product according to claim 4.

As shown above, D1 discourages the skilled person from using dew point temperatures in the claimed range for improving the mechanical properties.

The alleged common general knowledge that dew point temperatures of -30°C or lower are commonly applied in the annealing step does not lead to the claimed subject matter either. While such temperatures could indeed be applied in D2a, there is no indication to suggest that

the skilled person would recognise that such a selection would lead to the solution to the technical problem. D2 is not directed to a standard process but a patent document with the objective of improving the resistance to subsequent melting of the plating during travel on rollers (see page 3, lines 29 to 33).

The opponent further argued that, in view of the common general knowledge shown in D19, chapter 7.3.1, the annealing step was, from the perspective of the skilled person, the only process step available for affecting the surface properties of the base steel sheet by avoiding decarburisation and later carburisation during martensitic transformation.

However, as explained above, D19 is a teaching for non-plated steel sheets. The application of this teaching to one particular step (annealing) in a complex chain of process steps before plating including rolling and reheating steps in D2 is not a one-way street modification (leaving aside that hardening is not the same as reaching excellent impact properties - as they are defined and measured according to the patent in terms of the high TS*IE value - and that there is no teaching related to such an impact property in D19).

8.3 Inventive step objections based on D13 as the starting point

As will be apparent from the discussion below, also for D13 as the starting point the obviousness of feature [4.7] (annealing in an atmosphere having a dew point temperature in the claimed range) is decisive for the obviousness of all the independent claims. If the step according to feature [4.7] were considered obvious, the process of D13 would - according to the

technical teaching of the patent and the examples in the patent - inevitably result in a method according to claim 8 (as the only distinguishing feature is the precursor obtained by the method of claim 1) and the product of such a process would result in a product according to claim 4.

8.3.1 Burden of proof for allegedly implicit features

The opponent argued with reference to the teaching of D1 that "a carbon-enriched layer was very likely obtained in the examples of D13". The opponent asserted that the burden is on the patent proprietor to prove the opposite, "as the Patentee is the only party in possession of the details of the examples of D13" (D13 is a document of the patent proprietor).

However, the Board disagrees that the patent proprietor bears the burden of proof when it comes to showing that, in D13, a hot-pressed product with the claimed carbon-enriched layer is not obtained.

In opposition-appeal proceedings, each party bears the burden of proof for the facts they have alleged. In the case in hand, the opponent alleges that the carbon profile of the intermediate product in D13 (before hot pressing) and of the final product correspond to those claimed in claims 1 and 7. It is thus the opponent's responsibility to demonstrate this (e.g. by presenting relevant experimental results). The fact that D13 is a patent belonging to the patent proprietor does not shift the burden of proof.

8.3.2 Features in common with the independent claims

D13 discloses a plated steel sheet explicitly having a high impact resistance (paragraphs [0003], [0006] and [0007].

The base steel sheet in D13 has a composition according to feature [4.2a] and is plated with an alloy according to features [4.8] and [4.10] (see paragraph [0099]). The base steel sheet is processed in accordance with features [4.2b], [4.3] to [4.6] (see tables 1 and 2 and paragraphs [0094] and [0105] to [0107]). The Board is also convinced that feature [4.4] (cooling starting within 30 seconds after hot rolling) is implicitly disclosed. According to paragraph [0106] "the manufactured hot rolled steel sheet was pickled and then cold rolled". There is no reason to assume that heating of the sheet is not stopped directly after hot rolling step in this continuous process, this being identical to the start of cooling (described by the opponent as "air cooling", see also D6, page 1: "Outside the roll bite, it [the sheet] loses heat by radiation and convection"). It is to be noted that feature [4.4] does not define a particular (high) cooling rate which would avoid the decarburisation being accelerated as described in paragraph [0066] of the patent but simply that the temperature somehow decreases.

D13 also discloses the hot-press conditions defined by features [12.1], [12.3] and [12.4] of claim 8, i.e. the heating temperature, the holding time, the cooling rate and a martensite transformation finish temperature Mf of 200°C or lower (see D13, paragraphs [0100] to [0102]). The heating rate applied in the hot-pressing step in D13 is 1°C/sec or higher (see paragraph [0100])

and thus above the heating rates applied in examples A1-5 and C2-1 of the patent in which the thickness according to feature [7.6] was not obtained.

8.3.3 Distinguishing features

It was uncontested that D13 does not disclose feature [4.7] (defining the dew point temperature for the annealing step) as well as the resulting carbon profiles of the intermediate product (referred to in claim 8) and therefore also of the final hot-pressed part product (in particular feature [7.6]).

8.3.4 Objective technical problem

The opposition division concluded that the technical problem related to feature [4.7] was to provide a manufacturing method for a plated steel sheet that, when hot press formed, would lead to an improved impact property.

It is true that D13 also claims to achieve a plated steel hot-pressed product with excellent impact properties. However, the impact properties achieved by the present invention (in terms of the combination of tensile strength and impact energy; see point 8.3.2 above) are not addressed in D13.

As far as the opponent argued that excellent impact properties were implicitly present in D13 because the ferrite content was low this is not persuasive. It is not apparent that there is a simple correlation between the ferrite concentration and impact properties and the opponent did not provide evidence for such an effect.

The parameters related to the impact property in D13 are tensile strength (see paragraph [0007]) and bending angle (see paragraphs [0003], [0005] and [0044]). The tensile strength according to Table 3 of D13 corresponds to the TS values achieved in the patent (see Table 3). However, the second parameter is different. The patent uses the Charpy test (ISO 148-1) to (dynamically) determine energy absorption on impact (IE). D13 applies a (quasi-static) bending test (VDA 238). This is shown in table 3 of D13 as excellent in examples A to D. While the two tests might be related in that they determine mechanical properties under deformation conditions, the numerical results are not directly comparable and, as previously discussed, there is no evidence in the proceedings showing a correlation between bending angle and impact energy. Table 3 of D13 further shows that there is no correlation between yield strength (Y), tensile strength (TS) and elongation (E1) and the bending properties either.

The patent has credibly shown in examples in A1, A2 and A3 of Table 2 and examples A1-1, A2-1 and A3-1 of Table 3 that the dew point temperature according to feature [4.7] is an essential parameter for achieving the carbon profiles of the invention for both the intermediate and the final plated steel sheet product having the impact property in terms of the high TS*IE value.

This credible effect must be considered when formulating the objective technical problem, which is that of further improving the impact properties of the hot-pressed part and of providing a method for its production and a method for producing a suitable precursor.

The technical problem of limiting decarburisation during annealing proposed by the opponent is not persuasive. This problem includes parts of the solution, thereby involving hindsight as the selection of the dew point temperature for this purpose is only described in the patent, paragraph [0070], as part of the solution leading to the desired effect (and thus solving the problem) of obtaining an excellent impact property, but not in D13 or in the prior art, which is the starting point.

8.3.5 Obviousness of feature [4.7]

As already concluded with regard to the inventive-step attacks based on D1 and D2a, neither D13 nor any of the cited documents indicates that selecting a dew point temperature in the process of D13 to the claimed range leads to the claimed carbon profiles and thereby is effective in improving impact properties. Such common general knowledge is also not derivable from D19, which discusses neither steel sheets which are plated nor their impact properties.

An essential feature of the invention described in D13 is that, during the winding ("coiling") process, a ferrite phase is continuously or discontinuously formed on the surface of the base steel sheet to a thickness of 50 microns or thinner and a percentage of a ferrite phase in the surface is 5% or less (see claim 1 and paragraphs [0086] to [0088]).

8.3.6 Feature [4.7] is not a one-way street

The opponent argued with reference to paragraph [0088] that the object of D13 was to avoid decarburisation and

to promote carburisation of the hot-pressed steel sheet. Hardening by carburisation /prevention of decarburisation was common general knowledge according to D19, chapter 7.3.1. and the only available process step to promote hardening for a plated steel sheet was the annealing step. The skilled person would thus have selected a low dew point temperature atmosphere for the annealing step by applying common general knowledge according to which this measure avoided decarburisation.

However, as already set out above, it is not derivable from the common general knowledge on decarburisation and carburisation, that the provision of a carbon enriched layer of a plated steel sheet results in excellent impact properties as shown in the patent. Therefore, there is no indication to select the dew point in accordance with feature [4.7] or to head for a carbon profile in accordance with feature [7.6].

Moreover, according to D13, paragraph [0087], the remaining ferrite is a "very important phase in the surface of the base steel sheet". To control ferrite formation in a defined amount not exceeding 5 % in the surface area, D13 suggests in paragraphs [0088] and [0093] that "excessive decarburisation" is to be avoided to obtain the desired mechanical properties of the hot-pressed steel sheet. In view of this, the objective of D13 is not to completely avoid decarburisation but to control the decarburisation and adjust the surface ferrite concentration in the desired range. The opponent has not shown that this is achievable at dew point temperatures in the claimed range.

The patent, on the other hand, discloses that the microstructure of the base material is not limited (paragraph [0085]). An area fraction of 10% or less of ferrite is mentioned as an example, it being mentioned that an important effect of the carbon-enriched layer is to suppress the formation of ferrite in the surface layer to improve the impact property (see paragraph [0082] of the patent). Whether any ferrite is still present in the examples of the invention is not mentioned nor has it been convincingly shown by the opponent.

Therefore, since a certain amount of ferrite formation is desired in D13 and since only "excessive" decarburisation is to be avoided, selecting the dew point temperature in a range of at least -30°C is not obvious from D13 even when applying common general knowledge.

9. To conclude, the claims according to auxiliary request 1a are allowable. The description must be brought into line with the amended claims.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form with the following claims and a description to be adapted thereto:

   Claims:
   - No. 1 to 9 according to auxiliary request 1a filed during oral proceedings before the Board

The Registrar: The Chairman:

C. Spira C. Herberhold

Decision electronically authenticated