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Datasheet for the decision of 30 July 2010

Case Number: T 1389/08 - 3.3.09

Application Number: 02079517.5

Publication Number: 1291165

IPC: B32B 15/01

Language of the proceedings: EN

Title of invention:
Brazing sheet

Patent Proprietor:
Aleris Aluminum Koblenz GmbH

Opponent:
ALCAN

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2)
RPBA Art. 13

Relevant legal provisions (EPC 1973):
EPC Art. 76

Keyword:
"Admissibility of requests"
"Main request: novelty (no)"
"Auxiliary request: amendments (allowable) - novelty (yes) - Inventive step (yes)"

Decisions cited:
T 1170/02, T 0956/07

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1389/08 **-** 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 30 July 2010

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office announced orally on 8 April 2008 and posted 28 April 2008 revoking European patent No. 1291165 pursuant to Article 101(3)(b) EPC.

Composition of the Board:

Chairman: W. Sieber
Members: N. Perakis
K. Garnett

Summary of Facts and Submissions

I. Mention of the grant of European patent No 1 291 165 in respect of European patent application No 02079517.5 in the name of Corus Aluminium Walzprodukte GmbH (now Aleris Aluminum Koblenz GmbH), which had been filed as a divisional application of the earlier European patent application 00920702.8, was announced on 27 July 2005 (Bulletin 2005/30). The patent was granted with ten claims, Claim 1 reading as follows:

"1. Brazing sheet having either a two-layer structure having a core sheet made of an aluminium alloy core and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element and said two-layer structure is devoid of a sacrificial anode clad layer, or a three-layer structure having a core sheet made of an aluminium alloy core material and on both sides thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, wherein the aluminium alloy of the core sheet has the composition (in weight %):-

Mn	0.5 to 1.5
Cu	0.5 to 2.0
Si	0.3 to 0.4
Mg	< 0.05
Fe	< 0.4, preferably < 0.3
Ti	< 0.15
Cr	< 0.35
Zr and/or V	< 0.35 in total
Zn	< 0.25

balance aluminium and unavoidable impurities,
and wherein said brazing sheet has a post-braze 0.2% yield strength of at least 50 MPa and having a

corrosion life of more than 12 days in a SWAAT test without perforations in accordance with ASTM G-85."

II. A notice of opposition was filed against the patent by Pechiney (now Alcan France S.A.S.) on 10 April 2006. The opponent requested the revocation of the patent in its entirety, relying on Article 100(a) EPC, namely that the claimed subject-matter lacked novelty and inventive step, and on Article 100(b), namely that the European patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

During the opposition proceedings the following documents were cited:

D1: JP 610 82 992 (abstract and original Japanese document);
D1a: English Translation of D1;
D2: WO 94/22633 A1;
D3: US 4 649 087;
D4: R. Benedictus *et al* "Influence of Alloying Additions on Corrosion Behaviour of Aluminium Brazing Sheet", Aluminum Alloys, vol 3, Proceedings of the 6th ICAA, The Japan Institute of Light Metals, 5-10 July 1998, 1577-1582;
D5: EP 0 718 072 A1;
D6: EP 0 712 681 A2; and
D7: GB 2 321 869.

In the course of the opposition proceedings the patent proprietor filed a main and three auxiliary requests.

III. By a decision announced orally on 8 April 2008 and issued in writing on 28 April 2008 the Opposition Division revoked the patent. It considered that the subject-matter of Claim 1 of all requests (amended Main and Auxiliary Requests 1 to 3) lacked an inventive step.

IV. The Patent Proprietor (Appellant) appealed the decision of the Opposition Division on 24 June 2008 and paid the appeal fee on the same day. The statement setting out the grounds of appeal was submitted on 26 August 2008 together with three new requests, ***ie*** a main and two auxiliary requests.

V. In its observations dated 15 December 2008 and 26 October 2009 the Opponent (Respondent) principally defended the decision of the Opposition Division.

VI. With a communication dated 21 July 2010 the Board questioned the admissibility of the amendments to the claims of the new requests and expressed its concerns with regard to the issue of inventive step.

VII. With a fax dated 28 July 2010 the Appellant replaced all previous requests. Its Main Request corresponded to the granted claims. Its Auxiliary Requests 1 and 2 corresponded to two new sets of claims. Auxiliary Request 3 was for a referral of two questions to the Enlarged Board of Appeal.

VIII. Oral proceedings were held before the Board on 30 July 2010. During these proceedings the Appellant declared that it maintained its Main Request. Moreover, it filed a new First Auxiliary Request (hereinafter referred to as "the Auxiliary Request") and a description adapted

to it. Lastly, it withdrew the Second and Third Auxiliary Requests.

Claim 1 of the Auxiliary Request reads as follows:

"1. Brazing sheet having either a two-layer structure having a core sheet made of an aluminium alloy core and on one side thereof a brazing layer of an aluminium alloy containing silicon as main alloying element and said two-layer structure is devoid of a sacrificial anode clad layer, or a three-layer structure having a core sheet made of an aluminium alloy core material and on both sides thereof a brazing layer of an aluminium alloy containing silicon as main alloying element, wherein the aluminium alloy of the core sheet has the composition (in weight %):-

Mn	0.7 to 1.4
Cu	0.8 to 1.5
Si	0.3 to 0.4
Mg	< 0.03
Fe	< 0.3
Ti	< 0.15
Cr	0.05 to 0.25
Zr	0.05 to 0.25
Zn	< 0.25

balance aluminium and unavoidable impurities,
with the proviso (Cu+Mn) > 2.0,
and wherein said brazing sheet has a post-braze 0.2% yield strength of at least 50 MPa and having a corrosion life of more than 20 days in a SWAAT test without perforations in accordance with ASTM G-85."

IX. The Appellant (Patent Proprietor) requested that the decision under appeal be set aside and the patent be

maintained as granted, alternatively on the basis of the Auxiliary Request filed during the oral proceedings.

The Respondent (Opponent) requested that the appeal be dismissed.

X. The arguments put forward by the Appellant in its written submissions and at the oral proceedings can be summarized as follows:

- The subject-matter of the Main Request (granted claims) was novel. Claim 1 differed from the disclosure of D1/D1a (Alloy 20b) regarding the features of post-braze 0.2% yield strength and of corrosion life. Furthermore, the Respondent was wrong when it combined D2 and D4 with D1 in order to demonstrate that these properties were inherent in the brazing sheet of D1/D1a. For the assessment of novelty it was not appropriate to combine D1 with D2 and D4.
- The claims of the Auxiliary Request fulfilled the requirements of Articles 76 and 123 EPC. In particular Claim 1 was based on the combination of originally filed claims of the earlier application, with preferred embodiments taken from the originally filed description of the earlier application (Article 76 EPC) and on the same combination from the originally filed divisional application (Article 123(2) EPC). This was common practice.
- In particular, the Si-content of 0.3 to 0.4 wt% was derived from the combination of the lower value of the broader range of 0.3 to 1.5 wt% with the preferred lower value of 0.4 wt%. This combination was admissible according to the established case law.

Apart from this, the skilled person would seriously contemplate working within the claimed Si-content range: on the one hand in view of the general teaching concerning the Si-content in the originally filed earlier application (page 6-lines 20-25) and on the other hand in view of the fact that the majority of the examples had a Si-content which was very close to 0.4 wt%.

- For reasons which will become clear later, it is not necessary to recite the parties' arguments on inventive step as regards Claim 1 of the Main Request.
- As regards the subject-matter of Claim 1 of the Auxiliary Request, this was not obvious in view of the cited state of the art. D5 should be considered to represent the closest state of the art.
- The technical problem to be solved was the provision of a brazing sheet which met the requirements of excellent brazeability during flux brazing and had improved post-braze strength and good corrosion resistance. This problem was not addressed by D5, which was silent about brazeability during flux brazing.
- The effective solution of this problem was illustrated by the inventive Alloy 5 (Table 1). Though the Si-content of this alloy fell outside the now-claimed narrower range of Si-content, it fell within the originally-claimed broader range of 0.3-1.5 wt% and the preferred range of 0.3-0.8 wt% (Claim 1 and page 6, lines 20-25) of the originally filed earlier application. Thus the skilled person would consider it plausible on the balance of probabilities that the exemplified excellent combination of properties shown for a Si-content

falling within the range of 0.3-1.5 wt%, preferably 0.3-0.8 wt%, would also apply to the claimed range of 0.3-0.4 wt%. In support of this argument, the appellant compared the inventive alloys of Examples 5 and 7 (Table 1) with a Si-content of 0.47 and 0.75 wt%, respectively, and concluded that the linear extrapolation to a Si-content within the claimed range of 0.3-0.4 wt% would make it plausible that the claimed lower Si-content would provide a brazing sheet with equally good post-braze properties.

- The skilled person starting from D5 and seeking a brazing sheet which met the requirements of excellent brazeability during flux brazing while having improved post-braze strength and simultaneously having a good corrosion resistance, would, on the basis of his technical knowledge, eventually consider the reduction of the Mg-content. However he would not go against the teaching of D5 and reduce this content to values lower than the disclosed minimum content of 0.1 wt% (Claim 1), in particular when the best results for the post-braze properties were obtained by Alloy C8 with a Mg-content of 0.5 wt% (Table 1).
- Furthermore, the reduction of the Mg-content would unavoidably lead to the reduction of the post-braze yield strength, which meant that the skilled person would have to compensate for that reduction. Compensation by combining a specific amount of Cu - under the specific proviso regarding (Cu+Mn) - with a specific amount of Cr and Zr was not disclosed by D5 or any other document forming the state of the art. The reasoning of the Respondent in this respect was based on hindsight.

XI. The arguments put forward by the Respondent in its written submissions and at the oral proceedings can be summarized as follows:

- The brazing sheet of Claim 1 of the Main Request lacked novelty over Alloy 20b of D1/D1a. The values for post-braze 0.2% yield strength and the corrosion life, which were not explicitly disclosed, were inherent to Alloy 20b of D1/D1a. The values of these properties in the claimed subject-matter were banal and systematically obtained in a great number of alloys such as those of D1/D1a. This was supported by D2 and D4 which disclosed alloys similar to that of D1/D1a having the claimed post-braze properties. Additionally, the opposed patent did not disclose any specificity of the process used to manufacture the claimed brazing sheet, which could be the cause of any technical differences.
- The subject-matter of Claim 1 of the Auxiliary Request was not disclosed in the originally filed earlier application. The reason was that in a first step the Appellant defined the Si-content as being 0.3 to 0.4 wt% by combining the lower limit disclosed for its broader definition, namely 0.3-1.5 wt%, with the preferred lower limit of 0.4 wt%. This Si-content was then in a second step combined with a proviso that (Cu+Mn) > 2.0 wt%, coupled with specific values for the other elements of the core alloy. The combination of these values was not disclosed in the originally filed earlier application.
- In the present case it was not acceptable to amend each metal content independently as if there was no

interaction among these metals. In fact, D2 disclosed that at least Al, Mn and Si interacted with each other.

- The subject-matter of Claim 1 of the Auxiliary Request lacked an inventive step. In particular the brazing sheet of D5 resulting from the combination of Claims 1, 4 and 14, should be considered to represent the closest state of the art. The claimed brazing sheet differed from that disclosed by D5 at least as regards the Mg-content.
- The technical problem mentioned in the opposed patent [0005] was to provide a brazing sheet which met the requirements of excellent brazeability during flux brazing, while having improved post-braze strength and simultaneously having a good corrosion resistance. The opposed patent, however, did not contain any technical evidence, such as examples with the claimed Si-content of 0.3-0.4 wt%, in order to substantiate that the technical problem was indeed solved. The Appellant's argument in this context was based on a linear extrapolation from examples with a higher Si-content. This argument was, however, not correct because Si interacted with other elements and its behaviour in lower contents was not predictable.
- Notwithstanding this deficiency, the solution of the technical problem using the features of the claimed brazing sheet was obvious. Thus the skilled person departing from D5 and aiming at providing a brazing sheet which met the requirements of excellent brazeability during flux brazing, while having improved post-braze strength and simultaneously having a good corrosion resistance would know from his ordinary technical knowledge that the reduction

of the Mg-content would improve flux brazeability. He would therefore reduce the Mg-content in the core alloy to values within the claimed range without exercising any inventive skill. A hint in that direction was contained in D5 itself. Indeed the comparison of Alloys C6 and C8 showed that the reduction of the Mg-content did not jeopardize the excellent brazing sheet properties. A linear extrapolation of these properties from the exemplified Alloys C6/C8 to alloys with a lower Mg-content, in particular to those with a Mg-content within that claimed, would be expected to provide still acceptable values. Such an expectation was confirmed by D4, which disclosed advantageous brazing sheet properties for an alloy similar to that of D5 except that it did not contain any Mg at all.

- Contrary to the argument of the Appellant, D5 would not prevent the skilled person from reducing the Mg-content to values lower than the disclosed lower limit of 0.1 wt%. What D5 disclosed as a determining factor was the sum of Cu+Mg, the one amount compensating that of the other. D5 would not dissuade the skilled person from increasing the Cu-content given in the examples (0.3-0.75 wt%). This increase would not have a negative effect on yield strength since the examples at lower Cu-content had satisfactory values (Table 3). Furthermore the Cu-content claimed was very close to that exemplified in D5 (0.8 instead of 0.75 wt%).
- With regard to the alleged effect on the brazing sheet properties of the claimed sum (Cu+Mn) > 2.0, this was not substantiated. The combined effect was

the mere juxtaposition of the hardening effects of Cu and Mn.

– Finally with regard to Cr- and Zr-content, D5 disclosed the claimed ranges and the fact that these elements improved post-braze mechanical strength. Thus the skilled person would be motivated to make use of them in order to counterbalance the loss of mechanical strength resulting from the reduction of the Mg-content without involving any inventive skill.

Reasons for the Decision

1. The appeal is admissible.

2. Admissibility of the requests

2.1 The Main Request of the Appellant corresponds to the claims as granted. It was reinstated with the fax of 28 July 2010. The Respondent did not contest its admissibility and the board sees no reasons to do so.

2.2 The Auxiliary Request, filed as First Auxiliary Request during the oral proceedings held before the Board, was a reaction to the communication of the Board. The Respondent did not raise any objection concerning its admissibility. The Board also saw no reason to raise an objection on its own because the brazing sheet of Claim 1 of the Auxiliary Request was based on the brazing sheet as granted, which was further limited by features relating to preferred embodiments. Further, the claimed subject-matter was not complicated and did not require any measures to be taken at that state of the proceedings which would have had a detrimental

effect on procedural economy. Thus the Board, exercising its discretion under Article 13 RPBA, admitted the Auxiliary Request into the proceedings.

The Main Request

3. Novelty

3.1 The Respondent contested the novelty of the subject-matter of Claim 1 of the Main Request in view of the disclosure of D1/D1a.

3.2 Document D1/D1a relates to a brazing sheet with a two- or three-layer structure. Its core sheet is made of an aluminium alloy which has a brazing layer on one or both of its sides. The two-layer structure is devoid of a sacrificial anode clad layer. The brazing layer consists of an aluminium alloy containing silicon as main alloying element (see D1a: page 2, Tables 1 and 2 and first paragraph). D1a discloses in Table 3 Alloy 20b, a specific core alloy, having the following composition in wt%:

Alloy	Mn	Cu	Si	Fe	Ti
20b	1.2	0.5	0.3	0.15	0.014
Balance Al and unavoidable impurities					

Alloy 20b does not contain any Mg, Cr, Zr, V or Zn. Thus D1/D1a explicitly discloses the structure of the brazing sheet of Claim 1 of the Main Request.

3.3 D1/D1a does not explicitly disclose the post-braze 0.2% yield strength and the corrosion life of the brazing sheets. However, the Board, in agreement with the

Respondent, considers that the brazing sheets of D1/D1a with a core sheet having the composition of Alloy 20b of Table 3 inherently have a yield strength and a corrosion life value as required in Claim 1 of the Main Request.

3.4 The Board concurs with the Respondent that the patent specification (page 3, line 34-42; page 4, lines 43-54) does not disclose any particular preparation step for the brazing sheet which would impart specific properties to the brazing sheet with regard to a post-braze 0.2% yield strength compared to Alloy 20b of D1/D1a. In fact, the process disclosed in the prior art appears to be quite similar (see D1a: page 3, last paragraph, lines 1-9; page 4, penultimate paragraph). Thus, Alloy 20b, having a composition falling within Claim 1, must inherently possess the values for a post-braze 0.2% yield strength and corrosion life as required in Claim 1, all the more because the values required in Claim 1 are, as pointed out by the Respondent, commonplace, being rather low. This finding is supported by D2 and D3 (as regards post-braze yield strength) and by D4 (as regards corrosion life).

Document D2 (page 15, Table 1, Alloy 4) discloses a brazing sheet containing Si: 0.05%; Mn: 0.98%; Cu: 0.6%; Fe: 0.18%. Although Alloy 4 contains less Si and Mn (elements affecting post-braze yield strength) than Alloy 20b of D1/Da, it already has a post-braze yield strength of 54 MPa (page 18, Table 3).

The same conclusion can be drawn from D3 (column 4, Table 1, Alloy C) which discloses a brazing sheet containing Si: 0.2%, Fe: 0.6%, Mn: 1.0%, Cu: 0.44% and

Mg < 0.01%. Although Alloy C contains less Si and Mn than Alloy 20b of D1/D1a, its post-braze yield strength is already 7.7 ksi, corresponding to 53 MPa (column 6, Table 3).

D4 (page 1578, Table I, Alloy 6) discloses an alloy containing Mn: 1.1%, Cu: 0.70%, Si: 0.50%, Fe: 0.1% with a corrosion life of more than 22 days (page 1580, Table II). As pointed out by the Respondent, Alloy 20b of D1/D1a with a lower Cu- and Si-content but comparable Mn- and Fe-content would have a corrosion life of about 22 days, ***ie*** much longer than the 12days required in Claim 1.

3.5 Lastly, the Board observes that the Appellant, although having been aware of the Respondent's novelty objection since the filing of the notice of opposition, neither contested this objection nor filed any technical evidence which could have demonstrated that there was indeed a technical differentiation between the claimed and the disclosed brazing sheets.

3.6 In view of the above considerations the Board concludes that the subject-matter of Claim 1 lacks novelty over D1/D1a with the consequence that the Main Request is not allowable.

The Auxiliary Request

4. Amendments under Article 123 EPC
(disclosure in the divisional application as filed)

4.1 Claim 1 of the Auxiliary Request corresponds to Claim 1 as granted (and Claim 1 as filed, respectively) combined with preferred embodiments stemming from

- Claim 2 (≡ Claim 2 as filed; Mg-content),
- Claim 4 (≡ Claim 4 as filed; Mn-content),
- Claim 5 (≡ Claim 5 as filed; Cu-content),
- Claim 6 (≡ Claim 6 as filed; corrosion life),
- page 7, line 19 of the application as filed (more preferred Cr-content),
- page 7, line 24 of the application as filed (more preferred Zr-content),
- page 7, lines 12-13 of the application as filed (most preferred Fe-content),
- page 6, line 32 of the application as filed (most preferred proviso (Cu+Mn) > 2.0).

4.2 The Board is satisfied that all these features are disclosed in the originally filed divisional application and that their interrelation, which results from the combination of claimed subject-matter with most preferred embodiments taken from the description, is directly and unambiguously derivable from the originally filed divisional application. With regard to the latter, in the Board's opinion the skilled person would seriously contemplate combining the most preferred embodiments of features with the subject-matter of Claim 1 as granted and Claim 1 as filed, respectively. Hence, the subject-matter of Claim 1 fulfils the requirements of Article 123(2) EPC.

4.3 Claims 2 to 5 of the Auxiliary Request correspond to granted Claims 7 to 10, with back-references amended

where necessary. Thus, no objections under Article 123(2) EPC against these claims arise.

4.4 Finally the subject-matter of the claims of the Auxiliary Request is limited compared to the corresponding granted claims so that the claims of the auxiliary Request meet also the requirement of Article 123(3) EPC.

5. Amendments under Article 76(1) EPC 1973 (disclosure in the originally filed earlier application, hereinafter referred to as the parent application)

5.1 Claim 1 of the Auxiliary Request corresponds to Claim 1 of the parent application combined with preferred embodiments stemming, on the one hand, from dependent claims of the parent application as filed:

- Claim 8 (the two-layer structure is devoid of a sacrificial anode clad layer),
- Claim 2 (Mg < 0.03 wt%),
- Claim 4 (Mn: 0.4 to 1.4 wt%),
- Claim 5 (Cu: 0.8 to 1.5 wt%),
- Claim 7 (corrosion life of more than 20 days),

and, on the other, from preferred embodiments disclosed in the parent application as filed:

- page 7, lines 14-15 (most preferred Fe-content),
- page 6, lines 22-24 (Si-content),
- page 7, lines 20-21 (more preferred Cr-content),
- page 7, lines 25-26 (more preferred Zr-content), and
- page 7, lines 1-2 (most preferred proviso (Cu+Mn) > 2.0).

5.2 In particular with regard to the Si-content of 0.3 to 0.4 wt% required in Claim 1, this range is based on a combination of the lower limit of the general range for Si, namely 0.3 to 1.5 wt% (Claim 1, page 4, line 27), with the more suitable minimum level for Si of 0.40 wt% (page 6, line 24). Thus the claimed Si-content derives from the limitation of the originally filed Si-content of 0.3 to 1.5 wt% by splitting it into two ranges:

- one being a "suitable" range of 0.4 to 1.50 wt%, which corresponds to the preferred range of the parent application (page 6, line 24; page 10),
- the other being the implicitly considered "less suitable" range of 0.3 to 0.4 wt%, which is claimed in present opposed patent ("divisional").

The fact that the Si-content range of 0.3 to 0.4 wt% is considered less preferred would not prevent the skilled reader from applying "the invention" in this range. On the contrary, in the Board's opinion the skilled reader would seriously contemplate exploiting the **whole** Si-range disclosed, ***ie*** including core alloys having a Si-content of 0.3-0.4 wt%. There is also nothing in the parent application as filed or the common general knowledge which would cause the skilled reader to exclude the possibility of working in that range. This finding is, as pointed out by the Appellant, supported by T 1170/02 and T 956/07 (none of these decisions published in the OJ EPO). Finally, the Respondent did not provide any evidence that the invention would not work in this Si-content range.

5.3 With regard to the combination of a Si-content range of 0.3 to 0.4 wt% with preferred features stemming from dependent claims and the description, the Board

considers that this combination is directly and unambiguously derivable from the originally filed parent application. The skilled reader would seriously contemplate combining the most preferred embodiments with the **whole** originally disclosed Si-content range, ***ie*** also with the range of 0.3 to 0.4 wt%. Furthermore, the majority of the examples in the patent in suit had a Si-content very close to 0.4 wt%. Thus, the combinations leading to Claim 1 do not generate "new" subject-matter.

5.4 Claims 2 to 5 of the Auxiliary Request correspond to Claims 9 to 13 of the parent application as filed.

5.5 In view of the above considerations the subject-matter of the Auxiliary Request is considered to fulfil the requirements of Article 76 EPC 1973.

6. Novelty

The Respondent did not cite any document against the novelty of the subject-matter of the Auxiliary Request. The only document cited in the context of novelty was D1/D1a, but only as regards the Main Request. The Board acknowledges that D1/D1a is not relevant for the novelty of the subject-matter of the Auxiliary Request. The brazing sheet of Claim 1 differs from that of D1a (in particular page 5, Table 3, Alloy 20b) in that the aluminium alloy of the core sheet has a composition which contains Cr and Zr and which fulfils the requirement (Cu+Mn) > 2.0.

7. Inventive step

7.1 The closest state of the art

7.1.1 The patent in suit is directed to a brazing sheet which meets the requirements of excellent brazeability during flux brazing while having improved post-braze strength and simultaneously having good corrosion resistance (paragraphs [0005] and [0011] of the patent specification).

7.1.2 D5 relates to a brazing sheet having improved strength properties and at the same time good corrosion resistance without the need for a sacrificial anode (page 2, lines 7-10 and 30-32; page 4, lines 3-7; Claims 1, 13, 14, 21 and 23). The brazing sheet has a core sheet of an aluminium alloy core material and a brazing layer of an aluminium alloy having silicon as the main alloying element on at least one side of the core sheet. The brazing sheet achieves improved post-braze strength properties by ageing, *eg* 0.2% yield strength of at least 70 MPa, and has at the same time a good post-braze corrosion life as determined in a SWAAT (ASTM V85) corrosion test. Thus, D5 on the one hand lies in the same technical field as the claimed invention, and on the other hand it discloses technical effects, a purpose and an intended use, most similar to the claimed subject-matter. Therefore, the Board considers, in agreement with the parties, that D5 represents the closest state of the art and, hence, takes it as the starting point for the assessment of inventive step.

7.1.3 The brazing sheet of D5 resulting from the combination of Claim 1 with the particular embodiments of Claims 4, 9 and 10 constitutes the most relevant disclosure. The

core sheet aluminium alloy of this brazing sheet has the following composition (compared with the composition claimed in Claim 1 of the Auxiliary Request in italics):

D5			*Claim 1 aux. request*
Mn	0.7-1.5	Claim 1	*0.7-1.4*
Cu	0.2-2.0	Claim 1	*0.8-1.5*
Si	> 0.3 > 0.4	Claim 9 Claim 10	*0.3-0.4*
Mg	0.1-0.6	Claim 1	*< 0.03*
Fe	< 0.4	Claim 4	*< 0.3*
Ti	optional	Claim 1	*< 0.15*
Cr	optional	Claim 1	*0.05-0.25*
Zr	optional	Claim 1	*0.05-0.25*

The post-braze 0.2% yield strength of the brazing sheet is disclosed to be of at least 70 MPa *(at least 50 MPa according to Claim 1)* and the corrosion life of at least 25 days in a SWAAT test without perforations in accordance with ASTM G-85 *(of more than 20 days according to Claim 1)*.

7.1.4 The subject-matter of Claim 1 essentially differs from the specific brazing sheet of D5 with regard to:

(a) **the Mg-content**, which has to be < 0.03 in Claim 1, *ie* much lower than the values disclosed in D5,

(b) **the Cr-content,** which is mandatory whereas Cr is optional in D5,

(c) **the Zr-content,** which like Cr is mandatory whereas Zr is optional in D5, and

(d) **the proviso (Cu+Mn) > 2.0**, whereas there is no such requirement disclosed in D5.

7.2 The technical problem

7.2.1 As set out above, the opposed patent aims at the provision of a brazing sheet which meets the requirements of excellent brazeability during flux brazing, while having improved post-braze strength and simultaneously good corrosion resistance (paragraphs [0005] and [0011] of the patent specification).

7.2.2 Having regard to this technical problem the patent specification explicitly refers to D5. Thus, in paragraph [0005] it is stated: "From EP-A-0718072, brazing sheet is known having a core sheet of an aluminium alloy core material and on at least one side thereof a brazing layer of an aluminium alloy containing silicon as a main alloying element, wherein the aluminium alloy of the core sheet has the composition … . Although this brazing sheet may be processed by means of flux brazing, some difficulties are encountered due to the relatively high Mg content in the alloy which might influence the brazing flux applied during the brazing cycle. Further disadvantages of having a too high Mg-level in the core alloy, are that flow and/or wettabillity is decreased when applying the NOCOLOK brazing flux during the brazing cycle. However, lowering the Mg level in this known aluminium core material would drastically lower the strength levels obtainable after brazing."

7.2.3 Having regard to the alleged improvement in post-braze strength, in particular a post-braze 0.2% yield strength, it is conspicuous to the Board that Claim 1

of D5, *ie* the closest prior art, discloses a post-braze 0.2% yield strength of at least 70 MPa. This value is higher than the minimum value of 50 MPa required in Claim 1, and also better than the best values obtained in the examples of the patent in suit (66 and 69 MPa for Alloys 2 and 5, Table 2 in the patent specification). Therefore, an improvement in post-braze 0.2% yield strength cannot be part of the objective technical problem.

Under these circumstances the technical problem has to be reformulated in a less ambitious way. Hence, the objective technical problem has to be seen in the provision of a brazing sheet with balanced properties, *ie* a brazing sheet which meets the requirements of excellent brazeability during flux brazing, while having good post-braze 0.2% yield strength and simultaneously good corrosion resistance.

7.2.4 The proposed solution to the above defined technical problem is the brazing sheet as defined in Claim 1.

7.2.5 It is true that, as pointed out by the Respondent, that the opposed patent does not contain any direct technical evidence concerning the solution of the objective technical problem by the subject-matter of Claim 1. Nevertheless, there is indirect evidence in the patent specification which satisfies the Board that the above defined objective technical problem is credibly solved. Firstly, Alloy 5 with a Si-content of 0.49% (Table 1 of the patent specification) comes fairly close to the required Si-content of 0.3 to 0.4 wt% and demonstrates that this alloy solves the posed technical problem. Secondly, a comparison of

Alloys 4 and 7 (which differ basically only in the Si-content, namely 0.47 wt% versus 0.75 wt%) shows that the mechanical property and the corrosion life are not significantly affected by the variation of the Si-content (Table 2). The Board therefore accepts the Appellant's argument that the variation of the Si-content from the exemplified Si-content of 0.49 wt% of Alloy 5 to the neighbouring Si-content of 0.3 to 0.4 wt% would cause no noticeable difference in the above mentioned properties. Under these circumstances the Board concludes that Alloy 5 of Table 1 can be considered to constitute a fair exemplification of the subject-matter of Claim 1.

7.2.6 Alloy 5 (Tables 1 and 2) is a particularly successful alloy since it has an excellent **brazeability**, which is in fact the immediate result of the low Mg-content in the brazing sheet. This was not contested by the Respondent. Furthermore, the relation between brazeability and low Mg-content is, undeniably, very well documented in the art. The Respondent has filed several documents which explicitly disclose this relation, namely D2, D3, and D7.

Additionally, Alloy 5 shows a good **post-braze 0.2% yield strength** (69 MPa), the best of the exemplified alloys, while maintaining a good **corrosion resistance** (more than 28 days in the SWAAT-test). Thus the Board is satisfied that the above defined objective technical problem is actually solved.

7.3 Obviousness

7.3.1 The question which remains to be answered is whether the skilled person starting from the disclosure of D5, specifically from the subject-matter combining Claims 1, 4, 9, 10 and 14, and aiming at providing a brazing sheet with excellent brazeability, good mechanical strength and corrosion resistance, would find it obvious to modify the core aluminium alloy of D5:

(a) by reducing the Mg-content beyond the disclosure of D5, which reduction improves brazeability during flux brazing;

(b) by inserting Cr and Zr in amounts ranging between 0.05-0.25 wt%; and

(c) by maintaining the Cu- and Mn-content in such amounts that their sum (Cu+Mn) > 2.0 in order to counterbalance the post-braze properties of the alloy, namely the 0.2% yield strength and the corrosion resistance, due to the reduction of the Mg-content.

7.3.2 The Board concurs with the Respondent that the skilled person in the technical field of brazing aluminium alloy sheets would find ample information in the state of the art concerning (i) the detrimental effect of Mg-content on aluminium alloys during flux brazing and (ii) aluminium alloys having either a very low Mg-content or containing no Mg at all in order to provide satisfactory brazeability during flux brazing. This is reported, for example, in D2 (page 10, lines 27-31), D3 (column 3, lines 17-18) and D7 (page 16, lines 7-10). In view of this prior art, the argument of the Appellant that the skilled person would not go below the lower limit of 0.1 wt% disclosed in D5 for magnesium is not sustainable. On the contrary the Board accepts that the cited state of the art would

prompt the skilled person seeking to further improve brazeability to reduce the Mg-content below the lower limit disclosed in D5.

7.3.3 However, the present invention is not simply based on the finding that a lowering of the Mg-content below the 0.1% disclosed in D5 improves brazeability. The nub of the present invention specifically lies in the finding that **a carful choice of the core alloy composition** can compensate for the inevitable loss in strength levels when lowering the Mg-content (essentially using no magnesium at all), while it simultaneously provides good corrosion resistance.

Thus, even if the skilled person might have had an incentive to reduce the Mg-content disclosed in D5, the salient question is whether or not he would have amended the closest prior art in a manner to arrive at a brazing sheet falling within the scope of Claim 1 of the Auxiliary Request.

7.3.4 D5 itself provides no hint whatsoever as to how one could compensate for the reduction in Mg. In this context it has to be born in mind that Mg is a key element of the alloys disclosed in D5. In other words, according to the teaching of D5, the Mg-content has to be within the limits required in D5, namely 0.1-0.6 wt%. The statement at page 4, lines 30-31 that:

> "Preferably for strength and corrosion resistance (Cu+Mg) > 1.0, and in particular preferably > 1.2. Thereby not only a good corrosion resistance after Nocolok brazing, and also after vacuum brazing, is obtained."

therefore cannot be construed to mean that the proviso "(Cu+Mg) > 1.0" applies beyond the limits given in D5 for Mg, *ie* 0.1-0.6 wt%. Consequently, the Respondent's argument in this regard is, in the Board's view, a misinterpretation of the teaching of D5 which would only be arrived at with hindsight.

7.3.5 With regard to the now-required Cr- and Zr-content, it is conspicuous to the Board that the disclosure of D5 considers these metals as optional, in particular when none of the examples, which should correspond to the most preferred embodiments of the disclosed invention, contains such metals. Furthermore, there is no teaching whatsoever in D5 that these metals could compensate for a loss in mechanical strength on omitting Mg. Nor would the skilled person find a hint in that direction in the other prior art documents.

7.3.6 Furthermore, with regard to the requirement concerning the sum of Cu- and Mn-content, namely (Cu+Mn) > 2.0, neither D5 nor any cited prior art document discloses this proviso. The skilled person would also not find any hint in the state of the art that this feature would compensate for a mechanical strength on omitting Mg in combination with Cr and Zr.

7.4 On the basis of the above considerations the Board comes to the conclusion that the subject-matter of Claim 1 involves an inventive step. The subject-matter of Claims 2 and 3, which corresponds to preferred embodiments of the subject-matter of Claim 1, involves *mutatis mutandis* an inventive step. The same applies to the method of Claim 4 for the preparation of a product

according to Claims 1 to 3 and to the brazed assembly of Claim 5 comprising a brazing sheet according to Claims 1 to 4.

8. Lastly, the Appellant filed an amended description (pages 2 to 7) during the oral proceedings before the Board. The Respondent did not raise any objections. The Board is also satisfied that the amended description has been brought into conformity with the claims of the Auxiliary Request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is remitted to the Opposition Division with the order to maintain the patent on the basis of:

   (a) Claims 1-5 according to the First Auxiliary Request filed during the oral proceedings

   (b) The amended description pages numbered 2 to 7 as filed during the oral proceedings.

The Registrar: The Chairman:

G. Röhn W. Sieber