

ELONGATE RETAINING ELEMENT FOR BUILDING SHEETS

The present invention relates to an elongate retaining element for building sheets e.g. for a roof or façade, comprising an elongate engagement section with a head section at one end of said engagement section for engaging at least one building sheet, by flanging a free end of said building sheet over said head section, and an elongate base section for mounting the elongate retaining element on a support structure wherein the direction of elongation of the engagement section, base section and of the retaining element are the same. The present invention further relates to an assembly of at least one such elongate retaining element and at least one building sheet mounted thereby on a support structure and also to a connection section forming part of such an elongate retaining element.

An example of such an elongate retaining element is known from Dutch patent no. NL-190292. The known elongate retaining element comprises an elongate extruded aluminium “upside-down-T”-shaped profile. As seen in cross section perpendicular to its direction of elongation, the cross bar of the “upside-down-T”-shaped profile forms the base section, which is provided with drilled holes for connecting elements such as screws passed through the drilled holes to connect the elongate retaining element to a supporting structure of a building, such as for example supporting beams, T-bearers or similar structural elements manufactured from for example wood, steel, aluminium or concrete. An elongate engagement section extends perpendicularly from the elongate base section and comprises at its end a wider head section that in this specific example is substantially triangularly shaped in cross section. The direction of elongation of the engagement and base sections is the same as the direction of elongation of the retaining element. The free ends of the building sheets are flanged over the head section such as to allow for a longitudinal sliding movement of the building elements relative to the elongate retaining element. The known elongate retaining elements can be an “upside-down” T-shape, asymmetrically shaped, or it can even be an L-shape.

The known retaining element is formed wholly from metal, namely aluminium. Metal is a good heat conductor. When using the known retaining element a colder outer temperature and a warmer inner temperature leads to the possible formation of condensation on the interior of the supporting structure as well as heat loss from the

interior of the supporting structure. This occurs because the head section of the retaining element is in direct contact with the metal building sheets that are exterior to the support structure. The retaining element as a result cools and also cools the air surrounding it, which reduces the amount of water the air can hold and condensation can form. The condensation formation can lead to multiple problems within the support structure e.g. rotting of organic structures, corrosion of metallic structures. The known retaining element acts as a thermal-bridge. It also conducts heat to the interior if the exterior temperature is warmer than that of the interior. This phenomenon can lead to higher energy costs for cooling the building by e.g. air-conditioning.

10 It is an object of the invention to provide an improved elongate retaining element.

 It is a further object of the invention to provide an elongate retaining element that reduces the risk of the retaining element acting as a thermal-bridge between the building sheets and the support structure.

 One or more of these objects is achieved by connecting the engagement section and the base section by means for reducing the thermal conduction between the engagement section and the base section where the means has a lower thermal conductivity than the engagement section and base section.

 The means reduces the thermal flow in the retaining element when the exterior of the support structure is at a lower temperature than the interior as it has a lower thermal conductivity than the engagement and base sections. The parts of the retaining element below the means are thus at least partially insulated from the potentially cooler exterior temperatures and the problematic formation of condensation is reduced. The heat loss through the retaining element is also reduced. There is also a reduction in the interior warming effect when the exterior temperatures are warmer than the interior temperatures.

25 The means preferably comprise a connection section positioned in contact with the base section and engagement section and which separates the engagement section from the base section i.e. ensures they are not in direct contact with each other. The base section of the retaining element, which is mounted on the support structure, is thus at least partially insulated from the potentially cooler exterior temperatures.

30 The connection section preferably interlocks with said base section and/or said engagement section. In this embodiment the retaining element does not require chemical

bonding methods to ensure stability as the base section and/or engagement section engage mechanically with the connection section by overlapping or by the fitting together of projections and recesses. This structure has the advantage of improved mechanical stability as it reduces the likelihood of disengagement of the thermally insulating connection section from the engagement or base section. The retaining element requires considerable mechanical stability, as it needs to be able to withstand the loads exerted by the weight of the building sheets as well as any uplift caused by the wind acting on the building sheets.

The base and/or engagement section preferably comprise at least one groove for receiving part of the connection section. The connection section thus extends at least partially into the base and/or engagement section and is compressed between the base and engagement section thereby reducing the likelihood of disengagement.

Preferably at least one of the grooves is of substantially circular or truncated circular cross-section where the cross section is perpendicular to the direction of elongation of the retaining element. The connection section is thus firmly retained within the engagement and/or base section thereby further optimising mechanical stability.

Preferably at least one of the grooves varies in cross-sectional width as it extends into the engagement and/or base section, where the cross section is perpendicular to the direction of elongation of the retaining element. Upon assembly the connection section is thus firmly retained within the engagement and/or base section thereby further optimising mechanical stability.

The base section and engagement section preferably comprise at least two grooves each for receiving at least part of the connection section the mechanical stability of the retaining element is enhanced and the load diffusion between the engagement and base sections is improved. This improved load diffusion is particularly advantageous if the retaining element is used on a support structure exposed to snow fall as the retaining elements will need to be able to bear the load of the building sheets and a snow layer.

The engagement and base sections are preferably metallic. When used on a structure in which the building sheets are exposed to the elements the retaining elements need to be able to withstand temperatures ranging from sub-zero to 70°C and above. Metals such as aluminium, steel or aluminium alloys are strong and can easily withstand the temperatures at the higher and lower ends of the scale as well as the temperature changes

that will occur without their strength or stability being compromised to any significant extent. The present invention is particularly advantageous when the engagement and base sections are made from metal, as the high thermal conductivity of metals would otherwise lead to the occurrence of thermal-bridges.

5 The connection section is preferably made from a material with a thermal conductivity of less than 15 Watts/mK, preferably less than 10 Watts/mK or preferably less than 5 Watts/mK. The relatively low thermal conductivity of the material optimises the insulating effect of the connection section. In a particular embodiment the connection section may be made from a resilient plastic material. The resilience of the material has the
10 advantage that there is less likelihood of failure when the elongate retaining element is subjected to dynamic and static transverse loads. Plastics are also materials with low thermal conductivity. The resilient plastic material can be for example polyamide, polyester, polyethylene, polyurethane, cellulose or modifications of any of these polymers. This list is not exhaustive and is non-limitative. In a further embodiment the strength of the
15 connection section is increased by using reinforced resilient plastic material. The resilient plastic material can be reinforced with, for example metal or glass, polyester, aramid or carbon fibres.

The invention will now be illustrated by several non-limitative embodiments, with reference to the accompanying drawings, in which:

20 Figs 1 to 4 show in cross section retaining elements in accordance with the invention where the cross section is perpendicular to the direction of elongation of the retaining element.

Fig. 1 shows in cross-section a retaining element 1 in accordance with the present invention comprising an engagement section 22 made up of a head section 2 and an extended section 5, a base section 4 and means 36 connecting the base and engagement
25 section in the form of a connection section 6. The means 36 may be positioned at any point between head section 2 and base section 4. The base section 4 is provided with holes 9 for fixing means for joining it to a support structure, for example, of a building. The upper portion of the base section 4 is provided with a groove 7, which receives part of the connection section 6. The upper portion of the base section is opposite to the surface,
30 which, in use, is mounted on a support structure. The cross-section of groove 7 is wider in the interior of the base part 4 than at the opening 10 of the groove. The cross-section of the

groove 7 is substantially T-shaped but may also comprise triangular extensions from each outer corner of the horizontal bar of the T. The extended section 5 extends perpendicularly from the base section 4 to the head section 2 and comprises a substantially identical groove, in its end nearest the base section 4, to that in the base section 4. Connection section 6 fits into the grooves in both the extended section 5 and the base section 4 and separates the sections from each other. The cross section of connection section 6 is substantially "I-shaped" and may comprise triangular extensions from each outer corner of the horizontal bars of the "I". Connection section 6 interlocks with the base section 4 and extended section 5 and separates them from each other so that they are not in direct contact at any point. Connection section 6 has a lower thermal conductivity than that of the base section 4 and/or extended section 5. The cross-section of extended section 5 is wider in the region surrounding the groove than at the end joining the head section 2. The head section 2 engages and holds building sheet 3 as the free end of the building sheet is flanged over the head section. The advantages of such a retaining element are set out above.

The retaining element illustrated in Fig. 2 comprises a base section 4 having a groove of substantially circular cross-section. The groove 8 extends from an opening 11 in the upper surface of the base section 4. The extended section 5 extends perpendicularly from the base section 4 and comprises a groove 8, having a substantially circular cross-section, in its end nearest the base section 4. The groove has an opening 12 in the lower portion of the extended section 5. The engagement section 22 comprises the head section 2 and extended section 5. The cross-section of connection section 6 is substantially shaped as a "dumb-bell" or in other words shaped as a short bar 15 with a circular protrusion 16 on each end. Each of the protrusions 16 is received into the groove in the extended 5 or base section 4. The connection section 6 interlocks with the base 4 and extended sections 5. The bar section 15 of the cross section of connection section 6 maintains the separation of the base and extended sections. The bar section 15 of the connection section 6 is narrower than both the opening 11 of the groove in the base section 4 and than the opening 12 of the groove in the extended section 5. The upper surface 13 of the base section 4 in the region of the groove 8 is curved upwardly around the groove to the opening 11. Around the opening 12, in extended section 5, the lower surface 14 of the cross section curves downwardly on both sides of the groove 12. The head section 2 engages and holds building

sheet 3 as the free end of the building sheet is flanged over the head section. The advantages of such a retaining element are set out above.

Fig. 3 shows another retaining element according to the invention comprising a base section 4 having three grooves 17, of substantially truncated circular cross-section, in the upper surface of the base section. The three grooves 17 may extend from a shallow channel in the base section 4 as shown in figure 3. Engagement section 22 comprises head section 2 and extended section 5. The extended section 5 also has three grooves of substantially circular cross section 17 which may also extend from a shallow channel in the extended section. The grooves are in the end of the extended section 5 nearest the base section 4. The connection section interlocks with the base section 4 and extended section 5. The connection section 6 is shaped in cross section as a rectangle 18 with protruding circular sections 19 on its long sides, which are received in the grooves 17 in the base and extended sections. If the grooves in the base and extended sections extend from a shallow channel then part of the rectangular portion 18 of the connection section 6 (as seen in cross section) will be received in the shallow channels. The region of the extended section and the base section in this embodiment surrounding the grooves is wider than that of the embodiments shown in Figs 1 and 2, which have one groove in the base 4 and extended section 5 respectively. The head section 2 engages and holds building sheet 3 as the free end of the building sheet is flanged over the head section. The advantages of such a retaining element are set out above.

Fig. 4 shows a retaining element according to the present invention with a base section 4 comprising three grooves 20 having a substantially wedge-shaped cross section, which tapers towards the upper surface of the base section 4. The interior of the groove is thus wider than the opening. Engagement section 22 comprises head section 2 and extended section 5. The extended section 5 also has three grooves, having a substantially wedge-shaped cross section, in its end nearest the base section 4. The cross section of the grooves tapers towards the lower surface of the extended section 5, thus the surface closest to the base section 4. The three grooves 20 may extend from a shallow channel in the base section 4 and/or the extended section 5 as shown in figure 4. The connection section interlocks with the base section 4 and extended section 5. The connection section 6 is shaped in cross section as a rectangle 18 with protruding wedge-shaped sections 21 on its

long sides, which are received in the grooves 20 in the base and extended sections. If the grooves in the base and extended sections extend from a shallow channel then part of the rectangular portion 18 of the connection section 6 (as seen in cross section) will be received in the shallow channels. The head section 2 engages and holds building sheet 3 as the free end of the building sheet is flanged over the head section. The advantages of such a retaining element are set out above.

Only one building sheet 3 is shown in Figs. 1 to 4 but the free ends of two building sheets can be flanged over the head section 2, one from each side of the retaining element. The base section 4 and engagement section 22 are both elongate and the direction of elongation of the base and engagement sections is the same as that of the retaining element. The connection section 6 is also preferably elongate with a direction of elongation the same as that of the retaining element, base section and engagements section.

Any one or more of the base 4, head 2 or extended 5 sections may be formed of metal such as carbon steel, stainless steel, magnesium or aluminium alloys and may be formed by, for example, extrusion, forging or die-casting. Any one or more of the base 4, head 2 or extended 5 sections may be formed of plastic material optionally in combination with metal parts. The plastic material may be resilient and may be reinforced with, for example, glass, polyester, aramid or carbon fibres. The connection section 6 may be formed from resilient plastic material, optionally in combination with metal parts, which may be reinforced with for example, glass, polyester, aramid or carbon fibres. The connection section 6 may be formed of metal. The building sheets are preferably formed of metal and more preferably from an aluminium alloy.

The elongate retaining elements may be wholly or partially assembled prior to mounting on the support structure or may subsequently be assembled after the base section has been mounted on the support structure.

CLAIMS

1. An elongate retaining element (1) for building sheets comprising an elongate engagement section (22) with a head section (2) at one of said engagement section for engaging at least one building sheet (3), by flanging a free end of said building sheet over said head section (2), and an elongate base section (4) for mounting the elongate retaining element on a support structure wherein the direction of elongation of the engagement section, base section and of the retaining element are the same, characterised in that the engagement section and the base section are connected by means (36) for reducing the thermal conduction between the engagement section and the base section where the means has a lower thermal conductivity than the engagement section and base section.
2. An elongate retaining element according to claim 1 wherein said means comprise a connection section (6) positioned in contact with the base section and engagement section (22) and which separates the engagement section from the base section (4).
3. An elongate retaining element according to claim 1 or 2 wherein said connection section (6) interlocks with said base section (4) and/or said engagement section (5).
4. An elongate retaining element according to claim 2 or 3, wherein said base (4) and/or engagement section (22) comprise at least one groove (7) for receiving part of the connection section.
5. An elongate retaining element according to claim 4 wherein at least one groove is of substantially circular cross-section (8) or truncated circular cross-section (17), where the cross section is perpendicular to the direction of elongation of the retaining element.

6. An elongate retaining element according to claim 4 wherein at least one groove (20) varies in cross-section as it extends into the engagement (22) and/or base section (4), where the cross section is perpendicular to the direction of elongation of the retaining element.
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7. An elongate retaining element according to claim 4, 5 or 6 wherein said base section and engagement section (22) comprise at least two grooves (17,20), each for receiving part of the connection section (6).
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8. An elongate retaining element according to any preceding claim, wherein the engagement section (22) and base section (4) are metallic.
9. An elongate retaining element according to any preceding claim, wherein said connection section (6) is made from a material with thermal conductivity of less than 15 Watts/mK.
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10. An elongate retaining element according to any preceding claim, wherein said connection section (6) is made from resilient plastic material.
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11. An assembly comprising at least one building sheet and at least one elongate retaining element according to any one of claims 1 to 10 engaging said building sheet(s) to retain it on a support structure.