

The invention relates to a pipe connection made from plastic or metal, whereby the push fit end of one pipe, serving as the male section, is reduced in its outer diameter, thus forming a tapered transitional section, to the clear width of the follow-on pipe, serving as the female section.

German Patent 21 02 163 discloses a method for the manufacture of plastic pipes which are necked in at one end and are inserted into the clear width of the follow-on pipe by this neck-in. The known pipes are, for instance, used as gutter downpipes. In its first operation, the known method produces the pipe, which is expanded in a calibrator in the second operation and is then cooled. In a third operation, the free end of a length of pipe is then warmed approximately to the bellling temperature and, in this condition, placed over a cooled mandrel, the diameter of which corresponds approximately to that of the drawing mandrel in pipe manufacture. As a consequence of the cooling of the end of the pipe, the pipe contracts onto the cooled mandrel and the external diameter of the necked-in section thereby takes on approximately the clear width of the belled pipe.

The shrinking process on the pipe end causes the creation of a tapered transitional section between the drawn push fit end and the belled pipe.

When gutter downpipes manufactured by this process are inserted in one another, this tapered transitional section butts against the free end margin of the end of the follow-on pipe pushed over the insertion section, thereby maintaining the pipes in their seating. This process can be implemented in gutter downpipes, since only the weight of the inserted pipe has to be absorbed in the locating section of the follow-on pipe sections.

Pipe connections of this type do not withstand any additional loading, since with increasing load application the pipe end

serving as the female section tends to bulge or break, thus destroying the pipe connection made.

The invention may be used here, since its objective is to specify a pipe connection of the generic type, which can be subjected to pressure up to the ultimate loading level of the pipe. In accordance with the invention, it is proposed that at least one stop zone be provided running perpendicular to the pipe axis at the tapered transitional section of the pipe end serving as the male end and having stop faces for the butt end of the follow-on pipe serving as the female end.

It is advantageous if the height of the stop zone corresponds to the diameter of the pipe. The pressure-strength of the pipe connection can be further enhanced in this way.

The stop zone can comprise stop cams distributed evenly around the circumference on the transitional section. The individual stop cams may be separated from one another by partial zones of the tapered transitional section. Instead of the stop cams, the stop zone may also be formed in the shape of an annular expansion of the wall running around the circumference on the tapered transitional section. This expansion of the pipe wall can be additionally supported by axial supporting webs on the transitional section. Finally, there is also the possibility of forming the stop zone from a supporting ring tapered in the opposing direction to the tapered transitional section, mounted pressure-tight on the tapered transitional section.

The pipe connection in accordance with the invention represents an internal socket connection which is particularly used on pipe runs buried without trenching. In this case, it is necessary that the pipes have a smooth external surface so that they can be forced into or drawn through a duct in the ground. Earth ducts of this nature are

created before the pipe is inserted by earth augers, ground rockets or by flushing.

If a drawing through process is used, the pipe leg comprising a number of individual pipes must be axially pre-stressed by a rope or chain, so that the individual pipes cannot be separated by the friction between the pipe surface and the soil as they are drawn into the pipe duct. The force of the axial pre-tensioning depends on the pipe diameter, the maximum pipe leg length and finally on the process by which the ground duct has been created. The maximum axial pressure loading acceptable on the pipe leg is calculated essentially from the kinking loadbearing capacity of the individual pipes in the pipe leg and from their resistance to bulging, which for their part are essentially dependent on the diameter and on the wall thickness of the individual pipes.

Practical studies have shown here that, for instance, in the case of a pipe with an external diameter of 110 mm and a wall thickness of 3.2 mm, the pipe joint must be pre-tensioned with a maximum stress of 2 tonnes.

In considering a standard PVC cable protection conduit with dimensions of 110 x 3.2 mm, the maximum acceptable short-term compressive load on the material may be given as 90 N/mm². This pipe has a cross-sectional area of 1073 mm² with its external diameter of 110 mm and a wall thickness of 3.2 mm. From this a maximum compressive loading in the axial direction can be calculated at 96,580 N or 9.6 tonnes. The maximum permissible compressive loadbearing capacity thus lies at 4.8 times the value of the maximum axial pre-tension force to be anticipated.

In this way it is possible to reduce the areas subject to axial pressure loading by a half, without overloading of the material occurring at the point subject to pressure.

In this way, the bearing area can be reduced by approximately 50% thanks to the cam shape of the push fit end in the embodiment of the pipe connection in accordance with the invention. Pressure testing of a pipe connection of this type has shown that the connection does not fail in the event of overpressures occurring, even with a reduction of the pressure bearing surfaces by 50%, i.e. the two pipes do not slide over one another, but the pipe leg either bends or the pipe bulges axially. Consequently, the area loading in the socket generated by the axial pressure loading causes no problems either, as a result of the cam-shaped form of the pressure surfaces proposed in accordance with the invention.

An essential circumstance for the pipe connection in accordance with the invention is that the pipe sections connected together must be fixed centrally by their axes so that the end faces of the pipes transferring the pressure are optimally mated and no disturbing butt end occurs on the exterior of the pipe leg, which might hinder the insertion of the pipe leg in the earth duct. This centring of the ends of the pipe subject to pressure is ensured by the necked-in pipe end, the external diameter of which corresponds with the internal diameter of the follow-on pipe. As a consequence of the necked-in pipe end, which acts as an inserted socket joint, there is a restriction in the cross-section, which demands a continuous transition from the restriction to the normal internal pipe diameter, so that subsequent pipes or cables can be drawn into the pipe system once laid without further problem. This continuous transition is created at the inserted push fit end by a chamfer, whilst this continuous transition is created at the stop zone by the process of forming the necking. It should be noted in this respect that the width of the formed stop zone may not be too great, since the continuous transition of the necking in the pipe diameter is partially lost by the formation of the stop zone. This is particularly significant when the stop zone is created by individual stop cams.

Two requirements thus oppose one another in technical achievability: on the one hand, the cam width should be as wide as possible, to make the bearing surface of the butting pipe end as great as possible, on the other hand, the cam width may not exceed a certain dimension, in order not to influence too unfavourably the continuous transition on the internal surface of the pipe.

In this respect, tests have shown that the cam width should correspond to some five times the nominal wall thickness of the pipe and the spacing between the individual cams should approximate almost to the cam width.

Example embodiments of the pipe connection in accordance with the invention are shown in the drawing; in which

Figure 1 shows a cross-section through the pipe end serving as the male section, with cams disposed over the tapered transitional section;

Figure 2 shows a cross-section in accordance with figure 1 with cams formed in the tapered transitional section.

Figure 3 shows a cross-section in accordance with figure 1 with a pressure ring formed around the circumference before the tapered transitional section.

Figure 4 shows a cross-section in accordance with figure 3 with axial supporting webs for the pressure ring.

Figure 5 shows a cross-section through the pipe end serving as the male section with a pressure ring created on the tapered transitional section.

Figure 1 illustrates the pipe end serving as the male end with the end of the pipe section 11 and the necked-in section 12. The tapered transitional section 121 is shown at the end

of the necked-in section 12, whilst the tapered transition section 111 is formed in the region of the transition from the necked-in section 12 to the pipe section 11.

The stop zone comprises, in the illustration shown, of the stop cams 2 which run around the entire area of the tapered transition 111. The cams 2 are pressed out of the tapered transition section by mechanical force, with the zone of the greatest pressure lying at the beginning of the necked-in push fit end 12. This region of greatest pressure is simultaneously the mating surface 21 for the butt end of the follow-on pipe not illustrated in the drawing.

The embodiment of the cams 2 illustrated results in the most favourable load transfer of the cross-section surface of the follow-on pipe mating with cams 2 and not illustrated in the drawing. In this case, a direct, straight transition to the follow-on pipe corresponding to the full wall thickness results from the area 21 of the cams 2 subject to pressure loading. With this embodiment there are, thus, no deleterious kinking, bulging or bending loads.

The same features have been given the same designation in the embodiment illustrated in figure 2. By contrast with the embodiment illustrated in figure 1, here the cams do not run around the full area of the tapered transition, but are disposed within this area. The form given to the cams 2 in the illustration shown here is more favourable, but the load application from the pressure surface 21 through the cam 2 to the follow-on pipe 11 can be seen to be less favourable, since the forces have to be diverted through the cam form into the tapered transitional section. There are, however, fields of application for the pipe connection in accordance with the invention in which the pressure-bearing capacity is not a primary consideration and in which the essential requirement is for centring of the two connected pipes against one another.

The cam arrangements shown in figure 2 are adequate under such conditions.

What has been said in respect of the cam form in accordance with figure 2 is also applicable to the embodiment in accordance with figure 3. The stop zone with stop surface is not located in the tapered transition section 3 in this embodiment, but is located in the form of a circumferential pressure ring 4 before the transition section 3. The stop surface is here referenced with the numeral 41.

In accordance with the embodiment shown in figure 4, the stop zone 4 of figure 3 is supported against pipe 11 by additional supporting webs 42, covering the tapered transitional section 3.

In figure 5, forming of cams or stop zones from or before the tapered transitional section 3 is dispensed with. In this case the stop zone 4 is formed from a ring tapered in the opposing direction to the tapered transitional section 3. This ring is secured, e.g. by cementing, welding, etc., externally on the tapered transitional section.

The pipe connection in accordance with the invention can be manufactured on the extrusion line as an internal socket joint on pipes made from thermoplastic materials. The centrifugal casting process may also be used for the manufacture of pipes of this type in addition to extrusion.

This process is of particular interest for the manufacture of short pipe sections, for example for relining processes.

In the case of pipes manufactured by the extrusion process, the neck-in can be produced by appropriate socket tools within the extrusion line or outside it. The cams for the stop surfaces can then be created in the socketing process. The blow moulding technique is a further possibility for the

manufacture of the pipe connection in accordance with the invention. In this case, a circumferential rim in accordance with figure 3 or figure 4 is, for instance, subsequently blow moulded into the necked-in pipe end. These embodiment forms can also be produced by the centrifugal casting process.

Claims



1. Pipe connection made from plastic or metal, whereby the push fit end of one pipe, serving as the male section, is reduced in its outer diameter, thus forming a tapered transitional section, to the clear width of the follow-on pipe, serving as the female section, characterized in that the tapered transitional section (3) of the pipe end (1) serving as the male end features at least one stop zone (2, 4) with stop faces (21, 41) disposed perpendicular to the pipe axis for the end face of the follow-on pipe serving as the female end.
2. Pipe connection in accordance with claim 1, characterized in that the stop zone comprises stop cams (2) distributed evenly around the circumference in the transitional section (3).
3. Pipe connection in accordance with claim 1, characterized in that the stop zone is fashioned in the form of an annular-shaped stop ring (4) running round the circumference of the tapered transitional section (3).
4. Pipe connection in accordance with claim 1, characterized in that the stop ring (4) is additionally supported by axial support webs (42) running along the transitional section (3).
5. Pipe connection in accordance with claim 1, characterized in that the stop zone is formed by a support ring tapered in the opposite direction to the tapered transitional section (3) and which is seated in a manner resistant to pressure on the tapered transitional section.