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Knitlines, Bondlines & Weldlines ... what are they?

By Larry Workman

You are assembling a plastic irrigation system and you notice what appears to be a crack in one of the new fittings you've just received. Then, you notice that all of the other fittings in the supply bin have 'cracks' in them. Now, you wonder if all of these fittings are defective.

The first thing you should consider before the panic sets in is what is known as the 'knitline' in the injection molding business. It is also called the 'weldline,' or 'bondline.' This marking is on many fittings, sometimes more faint than others. It is the result of the natural flow of the semi-fluid plastic through a mold during the manufacturing process. So just how does this injection molding process work, and what causes these knitlines?

Injection-molded fittings are produced by large machines that feed raw plastic stock, in powder or pellet form, into a giant feed screw. This large feed screw, which resembles an old-fashioned meat grinder, rotates within a barrel and compresses the plastic by heat generated mainly by friction. At the outlet of the barrel, the molten plastic is pushed or injected into a metal mold. Since all fittings are cylindrical in shape, the filling of the mold with molten plastic is what causes the knitline.

The hot melted plastic flows into the mold cavity, and is diverted around a core, or piece of metal that forms the internal passage of the fitting. A line is created as the separated molten plastic flows around the core and bonds or 'knits' together. The line is the result of the 'cooled skin effect' on the leading edge of the flow. This is similar to what would happen with molten lava as the exterior is dark and semi-solid while the interior is still hot and molten.

The knitline is formed by the encounter of the leading edges of molten plastic flowing around a core, and is located on the opposite side of the fitting from the gate or sprue. The gate is where the plastic is introduced into a mold and can usually be identified by a bump or dimple on the surface of the fitting. The knitline tends to be more obvious on the darker fittings, like the gray Schedule 80, than on fittings made of white material.

Knitlines are not cracks, even though they may be very prominent. They are susceptible to being the most vulnerable area in the wall of a fitting, so proper design of injection-molded fittings will place this feature in an area that has low stresses applied by the system pressures. Under extreme pressures, it may crack along the knitline. This occurrence is seldom and only under high pressures. By placing the knitline in an area that is not experiencing high stress from system pressures, the effects of the weak point are minimized. The crotch of elbows and tees is exposed to the highest stress, therefore careful manufacturers will not allow knitlines to occur in this area.

The next time you are suspicious of having cracked PVC fittings, first look for the sprue. If you see a crack in the side of the fitting opposite the sprue and it's not in the crotch area, it is more than likely a knitline. Remember the knitline, bondline, or weldline is on the opposite side of the fitting from the sprue or gate mark.

October 2002

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Comment Box

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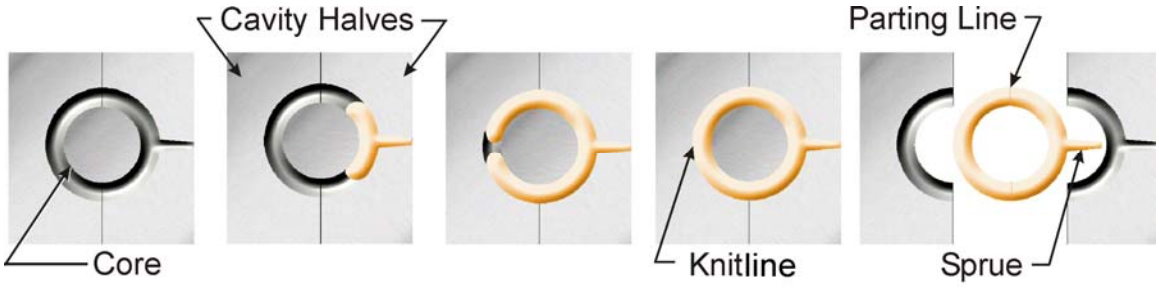
Injection molded fittings are produced by large machines that feed raw plastic stock, in powder or pellet form, into a giant feed screw. This large feed screw, which resembles an old fashion meat grinder, rotates within a barrel and compresses the plastic by heat generated mainly by friction. At the outlet of the barrel, the molten plastic is pushed or injected into a metal mold. Since all fittings are cylindrical in shape, the filling of the mold with molten plastic is what causes the Knitline.

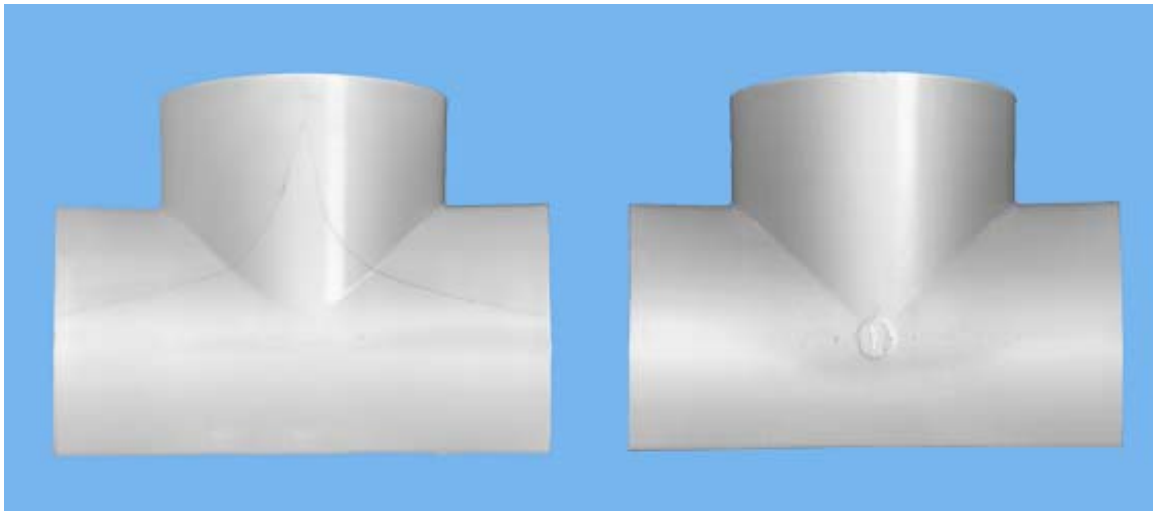


The hot melted plastic flows into the mold cavity, and is diverted around a core, or piece of metal that forms the internal passage of the fitting. A line is created as the separated molten plastic flows around the core and "bonds" or "knits" together. The line is the result of the "cooled skin effect" on the leading edge of the flow. This is similar to what would happen with molten lava as the exterior is dark and semi solid while the interior is still hot and molten.

The Knitline is formed by the encounter of the leading edges of molten plastic flowing around a core, and is located on the opposite side of the fitting from the gate or sprue. The gate is where the plastic is introduced into a mold and can usually be identified by a bump or dimple on the surface of the fitting. The Knitline tends to be more obvious on the darker fittings, like the gray Schedule 80, than on fittings made of white material.

The Knitline is not a crack even though it may be very prominent. The Knitline is susceptible to being the most vulnerable area in the wall of a fitting, so proper design of injection-molded fittings will place this feature in an area that has low stresses applied by the system pressures. Under extreme pressures, it may crack along the Knitline. This occurrence is seldom and only under high pressures. By placing the Knitline in an area that is not experiencing high stress from system pressures, the effects of the weak point are minimized. The crotch of Elbows and Tees is exposed to the highest stress; therefore careful manufacturers will not allow the Knitline to occur in this area.

The next time you are suspicious of having cracked PVC fitting first, look for the sprue. If you see a crack in the side of the fitting opposite the sprue and it's not in the crotch area, it is more than likely a Knitline! Remember the Knitline, Bondline, or Weldline is on the opposite side of the fitting from the sprue or gate mark.



Knitline & Gate mark

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