Die entrance velocity profiles were determined, using the Single-Cooled-Stainless-Tube technique and a novel temperature sensor, for a high-density polyethylene (HDPE) melt. The velocity profiles of the HDPE melt were measured below and above the critical point where the extrudate distortion, melt fracture, occurred. It was found that the phenomenon of melt fracture was associated with the development of the velocity profiles and changes in axial flow-rate distribution at the die entrance. It was observed that before the onset of melt fracture, as the flow rate was increased, the velocity across the flow increased in proportion to the increased in the flow rate. After the onset of melt fracture, the changes in melt velocity observed was no longer proportional to the increased in the flow rate. The distortion of the extrudate arose due to a disturbance of the flows resulting from a drag force in the die region.