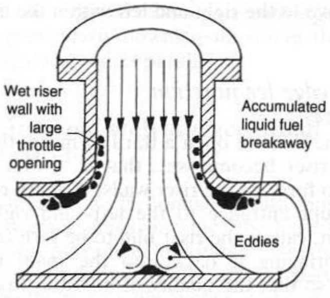

Fig. 5.15 Partly streamlined tee junction

tions, vortex filaments (eddies) will form caused by the swirling and turbulent movement of the mixture in no-man's land. Also, because of the larger tract section in this mid-position, a pressure drop exists which causes liquid particles to accumulate and breakaway continuously in this highly excited region.

Fully streamlined tee junction
(Fig. 5.16)
A fully streamlined tee junction is similar to the partly streamlined junction except that there is an inverted vee at the bottom of the riser, this being in the mid-region where the mixture flow divides in two and moves in opposite directions. This

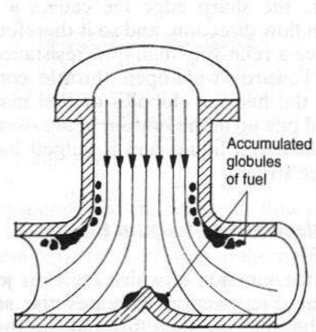

Fig. 5.16 Fully streamlined tee junction

shape ensures that the cross-sectional area at the tee junction remains constant or is even slightly reduced, this gentle division minimizes the flow path resistance. Nevertheless, there are still likely to be small amounts of accumulated liquid fuel downstream of the curved bends and on either side of the inverted vee.

5.3.5 Branch elbows

Curved elbow
(Fig. 5.17)
Charge flowing through a curved bend subjects the air and petrol particles to the effects of centrifugal force, this force being a minimum at the inner radius and a maximum at the outer radius. The radially outward direction of the centrifugal force continuously pushes the air charge towards the outer radius of the bend so that a pressure difference exists across the tract width, with the highest pressure on the outer radius bend and a relatively low pressure on the opposite inner radius region. At the same time, the air velocity in the outer radius flow path will be higher than for the inner bend flow tract

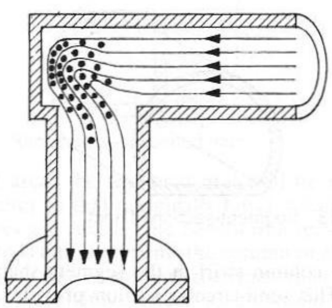

Fig. 5.17 Curved elbow

region. Thus, fuel particles will move from the outer to the inner flow path, this also causes the mixture movement to be excited and form a vortex filament region just downstream of the bend. Consequently, the low pressure and low air velocity near the inner radius curvature zone wall make it very difficult for the air to maintain its carrying capacity of the heavier fuel particles in this zone, this then causes the heavier fuel particles to be deposited on the inner bend curvature wall. The fuel therefore accumulates slightly downstream of the bend. The net result is to displace the fuel to one side of the elbow so that an unequal distribution of mixture will occur across the tract once the mixture moves beyond the bend. However, a curved bend does offer the least flow resistance, thus benefiting cylinder filling at high engine speed.

Sharp elbow
(Fig. 5.18)
In contrast to a curved bend, the sharp elbow provides an abrupt right-angle change in direction for the mixture flow. Consequently, due to the inertia of the air and fuel particles, the fresh charge column will continuously overshoot the bend so that it impacts against the blank end of the elbow. The sudden change in flow direction

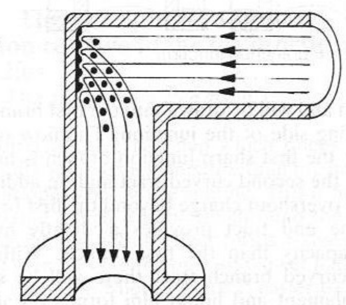

Fig. 5.18 Sharp elbow

excites the air into a state of turbulence in this region and, simultaneously, fuel particles will be dragged back into the main air stream by the high rate of flow. To some extent it can be said that the fuel droplets are pulverized by the turbulent air movement before the fuel is, in effect, bounced back into the main air stream, causing it to be thoroughly mixed with the incoming air. Mixture distribution through the tract is relatively good but this sharp bend does increase the charge flow resistance particularly at high engine speed.

Buffer end chamber elbow
(Fig. 5.19)
The short extension at each end of the main manifold tract just before the right-angle bend forms a buffer end chamber elbow. Provided that the valve ports are very close to the manifold bend the buffer chamber is able to absorb and damp out the pulsation in the inlet tract caused by the sudden opening and closing of the inlet valve. The actual volume of the buffer end chamber is important and must be tuned to respond to critical engine speeds where pulsating pressure waves may oppose and subsequently hinder the induced charge volume flow. Generally, the turbulent air movement created by trapped charge in the buffer zone improves the mixture distribution as it is projected back into the air stream.

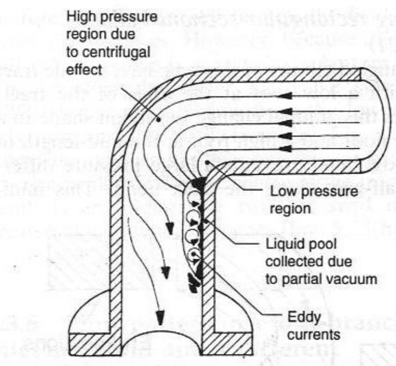

Fig. 5.19 Buffer elbow

45° angled straight elbow
(Fig. 5.20)
This elbow provides a right-angle change in flow direction by means of a 45° straight bend piece, the purpose of which is to produce a 90° directional flow change with two 45° bends so that the centrifugal force effect at each bend is low, thereby keeping the pressure difference across each

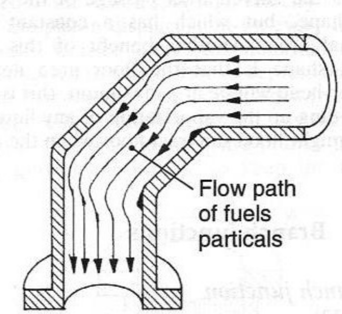

Fig. 5.20 45° angled straight-elbow

bend section to a minimum. As a result, the tendency for the liquid fuel particles to move towards the low-pressure inner walls of each bend is much reduced compared with a single curved right-angle elbow. The benefits obtained from this elbow shape therefore minimize the variation of mixture distribution across the elbow bends, and at the same time maximize the flow capacity of the tract.