A number of optical methods were developed and applied for diagnostics of high-pressure diesel flows at stationary and transient conditions. The high-pressure equipment corresponds to that of a common rail pump and included a special optical throttle providing optical access through sapphire windows into the flow discharge area. Inlet pressures up to 400 bar can be realized this way at stationary flow conditions and up to 1200 bar at transient ones, both at variable outlet pressures. Cavitation areas and flow turbulence are visualized using transmitted light and digital image recording (recording time 100 ns, spatial resolution up to 0.7 µm/pix). An interferometrical technique was used for measurements of density distributions at same flow conditions (accuracy about λ/20). Pressure and temperature distributions of the diesel flows are extracted from corresponding density distributions. Velocity profiles of the flows are measured using laser induced fluorescence signals from the propagating diesel flow (uncertainty being about 3% inside the velocity range of 100 to 500 m/s). The set of hydraulic geometries for measurements cover a range of parameters (sizes, shapes, surface quality) being typical for modern common-rail injectors in engines. The presented results demonstrate the influence of external flow parameters (inlet and outlet pressures and temperatures, shape of the hydraulic geometry and channel surface roughness) on the microscopic flow structure, i.e. cavitation onset downstream, pressure and temperature distributions and velocity profiles. Due to the high optical resolution of the applied optical measurements the study of thin boundary layers is possible.