

Tube-to-tubesheet joints

Joint method	Feature	Required control
Mechanical expansion	Controlled plastic deformation of the tube	Expansion length, wall reduction, groove geometry and torque
Seal welding	Reduces leakage risk at the tube/tubesheet interface	WPS/PQR, compatible materials, penetration, PT and distortion
Strength welding	Load transfer and sealing according to design	Joint detail, weld sequence and qualification testing
Expansion plus welding	Combines mechanical retention and sealing	Operation sequence, cleanliness, residual stress and final test

Source / basis: <https://niktrd.com/condenser-tube>