

Chapter 8

Conclusions



The following conclusions may be drawn from the discussion made in this research monograph:

- Insert devices are not good competitor with internally finned tubes or roughness for turbulent flow.
- However, insert devices are good for laminar flow of viscous liquids.
- Integral roughness is not good for laminar flow since the roughness is too small to enhance a laminar flow.
- Insert devices are used to upgrade the performance of an existing heat exchanger having a plain inner tube surface
- Major insert devices are twisted tapes, wire coil inserts, extended surface inserts, mesh or brush inserts and displaced inserts
- Many design correlations are available for inserts, but this is not enough.
- More research on tangential swirl injection is needed.
- More information on performance characteristics with various insert devices is needed.
- Research on fouling with insert devices is necessary.
- Significant progress has been made in the design and manufacture of roughened surfaces. However, more advanced research is necessary.
- A properly designed rough surface must have good efficiency index.
- More and more advanced manufacturing techniques are likely to give better rough surfaces for enhancement.
- Geometrical similarity makes the design of rough surfaces more convenient.
- Although predictive methods have already made significant inroads, better predictive models are required for rough surfaces.
- Heat transfer surface fouling is a matter of concern for rough surfaces.