

# HALCOR TUBE HEAT TRANSFER LABORATORY



- Performance measurement and R&D on plain and inner-grooved tubes
- Test data derived from the laboratory enable HALCOR to offer specialized technical support to manufacturers of heat-exchangers with the aim of optimizing their heat-exchanger design and achieving higher efficiency

HALCOR established the Tube Heat Transfer Laboratory dedicated in performance measurement and R&D of plain and inner-grooved tubes for heat-exchangers.

The Tube Heat Transfer Laboratory is located within HALCOR's Inofita plant, where TALOS® Inner-Groove Tubes (IGT) and TALOS® ACR tubes are manufactured according to international standards and customer specifications. IGT seamless copper tubes feature internal grooves whose geometry significantly enhances the amount of heat transferred through the internal medium. Typical applications of IGT copper tubes include fin-and-tube condenser and evaporator coils for air-conditioning, refrigeration, chiller, as well as heat-pump applications.

HALCOR's production technology for TALOS® IGT copper tubes enables the manufacture of advanced inner-groove designs for a complete range of sizes, from 16mm outside diameter down to the new generation microgroove™ tubes with an outside diameter of 5mm or less, being one of the few manufacturers worldwide to have this capability.

The equipment of the Tube Heat Transfer Laboratory was specially designed to enable measurements of the heat transfer performance of ACR tubes under fully controlled test conditions. Critical features, such as the heat transfer coefficient and the pressure drop, are measured using a sophisticated system for condensation and evaporation of HFC and HFO refrigerants. The flow and thermal parameters are programmed to simulate specific operating conditions, such as,

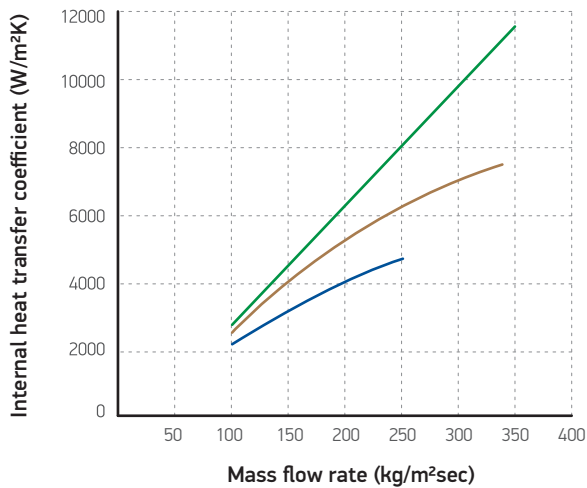
refrigerant flow rate, saturation temperature, vapor quality, thermal capacity, etc. and thus allow HALCOR's engineers to study the influence of the inner-groove design of the different IGT types.

The Tube Heat Transfer Laboratory gives HALCOR the capability to incorporate the test results in a complete framework of technical support to manufacturers of heat-exchangers, with the purpose of optimizing their heat-exchanger design for any of the following:

- Improved efficiency
- Higher capacity
- Reduction of raw material
- Compact heat-exchanger size
- Reduction of refrigerant charge

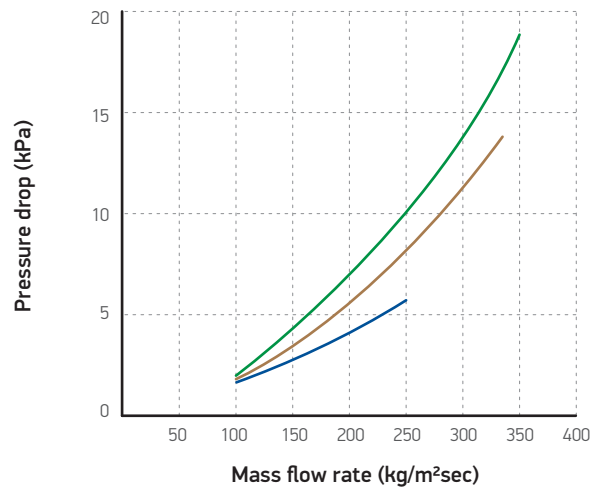
The Tube Heat Transfer Laboratory offers a superior advantage to HALCOR's clients by giving them the opportunity to establish a mutually beneficial co-operation within an integrated support and product development framework.

### Tube Heat Transfer Performance: EVAPORATION



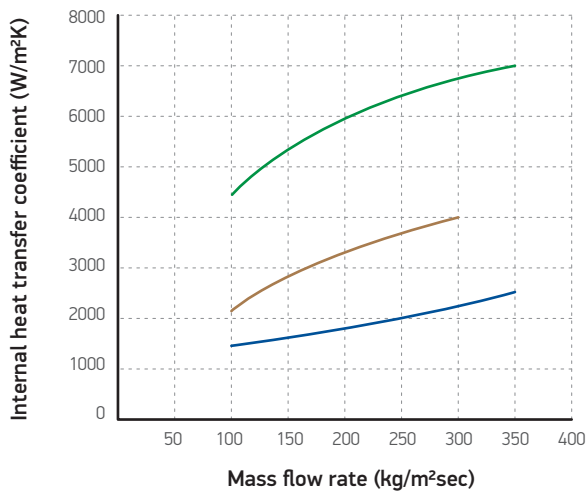
**Performance mode:** Evaporation  
**Refrigerant:** R404A - no oil  
**Test conditions:** Dew point: 0°C, Inlet vapor quality: x=20%, Outlet superheat: 5K, Tube length: 2m  
**PLAIN TUBE**  
**HALCOR IGT ENHANCED TYPE**  
**HALCOR IGT STANDARD TYPE**

### Tube Heat Transfer Performance: EVAPORATION



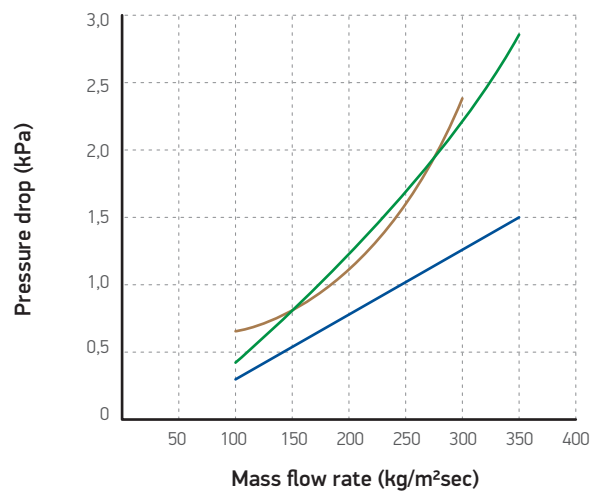
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### Tube Heat Transfer Performance: CONDENSATION

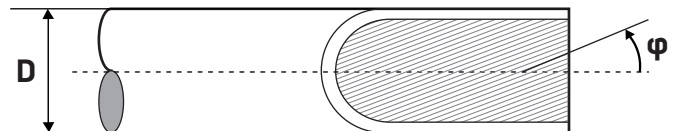
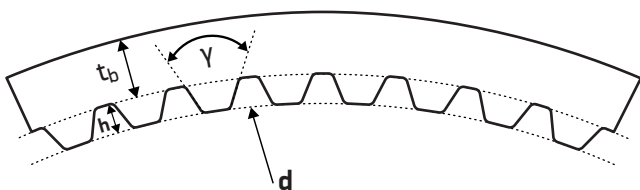


**Performance mode:** Condensation  
**Refrigerant:** R404A - no oil  
**Test conditions:** Dew point: 35°C, Inlet superheat: 5K, Outlet subcooling: 2K, Tube length: 2m  
**PLAIN TUBE**  
**HALCOR IGT ENHANCED TYPE**  
**HALCOR IGT STANDARD TYPE**

### Tube Heat Transfer Performance: CONDENSATION



**Performance mode:** Condensation  
**Refrigerant:** R404A - no oil  
**Test conditions:** Dew point: 35°C, Inlet superheat: 5K, Outlet subcooling: 2K, Tube length: 2m  
**PLAIN TUBE**  
**HALCOR IGT ENHANCED TYPE**  
**HALCOR IGT STANDARD TYPE**



**D:** Outside Diameter    **d:** Inside Diameter    **t<sub>b</sub>:** Bottom Wall Thickness    **h:** Groove Depth    **φ:** Lead Angle    **γ:** Top Angle