YORK BY JOHNSON CONTROLS	YORK HEAT EXCHANGER TUBE DESIGN	
TECHNICAL DATA	Supersedes: 160.00-TD1 (805)	Form 160.00-TD1 (910)

YORK brand centrifugal and screw chillers utilize the latest, state-of-the-art tube enhancements, heat exchanger designs and materials to achieve the lowest energy levels attainable. Enhancements in water-side and refrigerant-side design minimize energy consumption, water pressure drop, and tube fouling.

All YORK heat exchanger tubes have been designed to provide the most reliable long term operation possible. Tubes are “locked” into place at the end of each tube through mechanical (roller) expansion, and held firmly at intermediate tube supports within the heat exchanger through tight tolerances on the outside diameter (O.D.) of each tube. Reliability is maximized as all YORK tubes have plain lands (without internal and external enhancements) at the tube sheets and at all intermediate tube supports.

TABLE 1 – TUBE DIMENSIONS

Tube Gage	Actual Tube Thickness	
	Enhanced Section	Plain Section
23	0.025”	0.041 – 0.047”
22	0.028”	0.044 – 0.050”
20	0.035”	0.051 – 0.057”

Note: Dimensions for plain section are for Tube MTI (Marketing Tube Index) numbers 271/272/273; standard evaporator tubes for YK & YR chillers

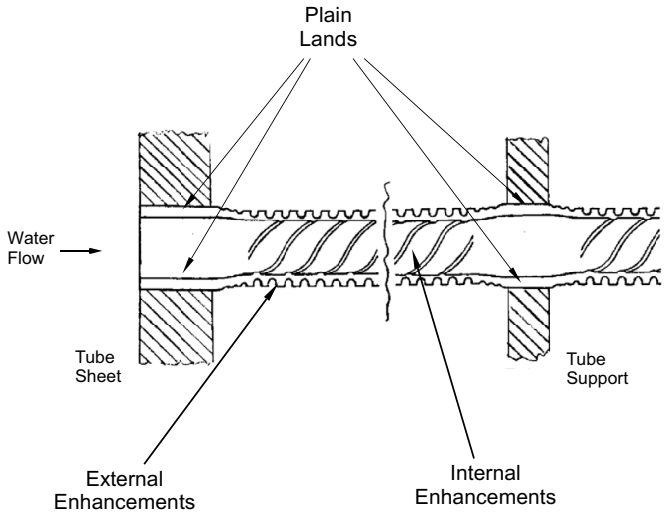

FIG. 1 – SKIP FIN DESIGN

The design of the plain lands provides nearly double the thickness of material at these critical support portions of the tube. A cross-sectional view of the skip-fin technology showing the plain lands at the tube sheets and tube supports can be found in Figure 1. Dimensions of the skip-fin technology at the plain sections can be found in Table 1 for a standard YK or YR evaporator tube. Dimensions vary based on MTI (Marketing Tube Index) number but what is shown here is indicative of all skip-fin tubes; the thickness at the plain lands is nearly double that of the enhanced portion of the tube.

All YORK heat exchanger designs have been evaluated for proper tube support design and application. Violent boiling of

the refrigerant within the evaporator and high refrigerant gas velocity within the condenser could result in excessive tube vibration if the heat exchangers are not designed properly. However, YORK's robust design, which uses at least 0.375" thick steel, greatly reduces the vibration of the internal tubes. Expanding the tubes at the internal supports is another preventive measure against wear due to excessive vibration. For facilities with high leaving chilled water temperatures or a temperature delta greater than 30°F (-1° C) across the evaporator, it is recommended to internally expand each tube.

The industry terminology; gage or wall thickness refers to the minimum wall thickness of the tube. The gage is measured at the enhanced portion of the tube. The wall thickness is measured from the root of the outer enhanced surface to the root of the internally enhanced surface. The tube gage number with reference to wall thickness may be found in Table 1. You will notice that the tube thickness at the plain sections is nearly double the thickness at the enhanced section.

The minimum wall thickness is a function of the maximum temperature and pressure to which the tube will be subjected. The tube external pressure depends upon the refrigerant selected and chiller duty conditions, and so must be adequate for the design working pressure (DWP) of the heat exchanger. The 0.025" (0.64 mm) nominal wall thickness copper tubes in ¾" (19 mm) and 1" (25 mm) nominal diameter are qualified for external pressures of at least 300 psig (2069 kPa), and at tube wall temperatures up to 150°F (65.5°C). This allows the use of 0.025" (0.64 mm) nominal wall thick¬ness tube for most R-134a applications. The 0.025" (0.64 mm) nominal wall thickness copper tube can readily be used for process water or glycol brine solutions with 300 psig (2069 kPa) internal pressure rating.

If plain tube lands are not provided, a minimum wall thickness of 0.035" should be specified to handle the tube support function.

Recommended Specification Text: Provide evaporator and condenser tubes with minimum tube wall thickness of 0.035" at the plain lands contacting the intermediate tube supports and end sheets.

Thicker wall tubes are sometimes specified with the intended purpose of extending the life of the heat exchanger. As discussed above, one area of concern is the portion of the tube that is in contact with the intermediate tube supports. A skipped fin 0.025" wall tube provides more thickness at the tube supports than a non-skipped 0.035" tube. For these applications, the customer must specify skipped fin tubes to assure that extended life.

Heat exchanger tubes may be supplied with many different internal and external configurations; as well as many differ¬ent tube material options which may be required when lower quality water sources (like treated sewage effluent (TSE) or seawater, for example) are used. For more information on tube recommendations for these types of applications, refer to Form 160.00-AD5; Chiller Materials Application Guide for Various Water Conditions.

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Johnson Controls