ICE CONVEYING AND DISTRIBUTION EQUIPMENT

Locate the ice storage bin as close to the major use of ice as possible and at a sufficient height that gravity conveying through simple chutes and hoses will deliver ice to these areas with a minimum of moving conveyor parts and effort. This will give the lowest installation and equipment costs.

If this cannot be done, site considerations such as availability of space, operational restriction and alternate demands for ice and economics will determine the exact location of the ice storage bin and the necessity of a conveying and distribution system. Monies and effort invested in a distribution system do not produce ice -- they only add to the convenience.

The objective of any conveying system whether by gravity, hand or machine, is to deliver quality usable ice to all use areas in sufficient quantity and in time to satisfy the cooling demands with repetitive and continuing reliability. In short, the system must work and satisfy your needs.

The two principal types of mechanical ice conveyor systems are (1) screw conveyors and (2) pneumatic conveyors. Both systems will elevate ice, move it horizontally, and turn corners. A screw conveyor system is usually lower in cost when the total conveying distance is less than 125 feet or 40 meters.

The initial cost of equipment and installation, the cost of operation and maintenance, the time required for installation, and the ease of system alteration will determine which ice conveyor will satisfy your needs.

All deliveries of ice from the bin and from the delivery system can be remotely controlled and volumetrically metered. Ice deliveries can be recorded on digital counters, within 2% accuracy at the storage bin, the remote stations, and the control centers. Rates of delivery can vary from 10 to 60 US tons (9 to 54 metric tons) per hour.

The remote control of the conveying and ice rake system can be as simple as an on-off switch.

SCREW CONVEYOR SYSTEMS

They are most efficient and economic when the line of flow or elevation is a straight line with all delivery points falling closely under the line of flow. Ice can be discharged intermediately to the final discharge point through a series of slide gates (manually or automatically operated) with ice dropping through metal chutes or flexible large diameter hoses.

The screw conveyor's main parts are a U-shaped metal trough with matching bolting flanges at each end and a spiral screw conveyor flight section welded to a pipe shaft.

The conveyors are provided with a motor, gear reduction drive, coupling and drive shafts, and all thrust, hanger and conventional bearings. All bolts, fittings, bushings and covers are provided. The conveyor couplings can be provided as standard drilled pipe requiring two bolts, and replacement of any conveyor section, shaft or bearing can be accomplished without disturbing the adjacent conveyor sections (if Redi-locks are installed).

The conveyor troughs and flight sections are normally provided with a hot dipped galvanized finish, however, conveyors can be made of stainless steel or supplied with a bare steel finish.

All screw conveyors can accumulate heat both during operation and when not delivering ice, which causes some melting of ice in the conveyor. Screw conveyors are normally supplied with factory applied insulation and metal covers or they can be insulated after installation.

For the delivery of ice to points away from the straight line of conveyor travel, secondary or additional complete screw conveyors can carry the ice. These conveyors can be placed crosswise to the primary conveyor. They can deliver in either direction (reversible) and receive ice at any point in their length to extend and convey right and left from the main conveyor.

The maximum practical angle of elevation for a conventional screw conveyor is 30° which is also the approximate angle of repose of flake ice. Screw conveyor sections normally come in lengths of 10 or 12 feet (3 or 4 meters) depending on the particular application.

Telescoping chutes or hoses can be provided at the conveyor discharge to accommodate variations in tidal elevation, placement, or size of the ice container (vessel, railroad car, or truck).

Caution: For the design of a screw conveyor in the bottom of an ice storage bin we suggest you contact ***North Star***. The above generalizations do not apply. We will provide additional drawings and information for such bin bottom installations.

Drag chains, bucket elevators, and belt conveyors have uniformly proven unsatisfactory when conveying particle ice.

PNEUMATIC CONVEYING SYSTEMS

They are most satisfactory and economic when the following conditions prevail: Conveying distances are over 125 feet or 40 meters; rate of delivery exceeds 15 US tons per hour (13.6 metric tons per hour); multiple delivery points must be served in divergent areas; many turns and changes in elevation are desired; and the ice is to be delivered at high velocity out of a hose.

Ice is conveyed at high velocity through thin walled tubing (aluminum stainless steel or plastic) by compressed air. The ice remains in the tubing a very short time. Tubing insulation is seldom needed or used.

The normal tubing cross sectional diameter is 4 to 8 inches (102 mm to 203 mm). The tubing requires minimum support, which makes installation easy and economical.

Multiple delivery points are served by automatic "Y" diverter valves which are generally supported by the tubing. The direction and flow and tubing can be moved or duplicated to the maximum delivery distance of the system and in multiple directions by moving the existing tubing or adding a "Y" diverter valve and adding new tubing.

Ice can be dropped out of the system at low velocity through a cyclone receiver. In certain applications ice is blown directly into the retort or processed without benefit of a cyclone receiver.

North Star ice has been successfully conveyed to an operating concrete batch plant over 1,200 feet (366 meters) distance from the ice plant at Libby Dam, Montana. Automatic pneumatic delivery systems of 400 to 800 feet (122 to 244 meters) distance in multiple directions from the ice plant are serving the chemical, concrete cooling, and fishing industries. The discharge rate of the ice storage bin and capacity of the delivery system are balanced to allow continuous or intermittent operation and delivery at 8 to 40 tons per hour per rake.

The major cost of a pneumatic conveying system is the equipment required to start the ice moving in the tube. The lightweight small cross sectional diameter tubing, simple tube bends, and lack of insulation allows quick and inexpensive installation and relation of the most complex multiple delivery system. The electrical operation of the entire system is controlled by the central ice rake electrical control panel. Electrical requirements at the use stations and delivery stations normally require only electrical control wiring at control voltages.

The large volumes of ambient air used to convey the ice in a pneumatic system condenses a small amount of moisture on the ice surface. Ice that is to be further stored and used at a later time or day should have the ambient conveying air cooled and dehumidified in a heat exchanger prior to the introduction of the ice flow. This is particularly important in maintaining easy handling ice in subsequent storage, and preserving the quality of the sub-cooled ice.

The selected heat exchanger equipment is highly dependent on final use and the geographic location of the ice and plant. Pneumatic ice conveying systems are designed to the customer's present and expected needs.

BUFFER ICE TANKS

It is impractical and damaging to a major ice storage system or delivery system to call for deliveries of ice of very short duration, small quantities and repeated several times a minute. These minimal demands on an automatic system short cycle the electrical controls and the built-in safety and protection devices in the system.

Buffer Tanks are live bottom storage bins of the following capacities: 1 US ton (.9 metric ton), 2 US tons (1.8 metric tons), and 3.3 US tons (3 metric tons).

Their function is to receive ice from the storage bin or conveyor system in large quantities and dispense small measured amounts of ice where the ice is repetitively required. The feed hopper of the buffer tank is automatically filled from the total delivery system. One or more buffer tanks can be filled with ice from a single conveyor system ***North Star*** ice plant.

Premeasured volumes of ice can be discharged and the amount of ice can be immediately increased or decreased by adjusting the discharge timing dial.