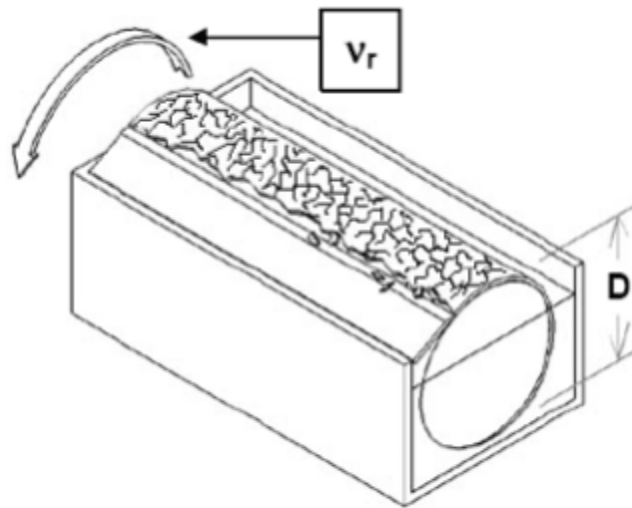


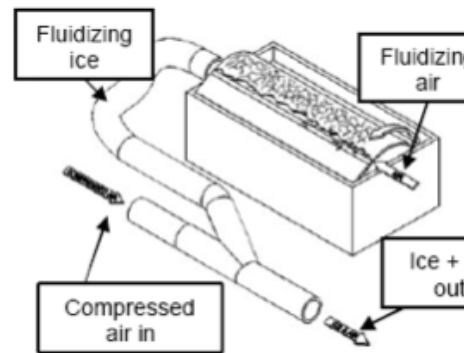
Coulson Ice Blast uses ice particles that are accelerated by a stream of high velocity air to do impact cleaning work. Ice particles are not free flowing and will pack and agglomerate when static. For Ice Blast to work reliably, ice particles must be created and consumed continuously in a dynamic state.



**Figure A: Immersed Cold Drum for  
Ice Making**

Equipment-wise, it requires refrigeration and ice making. These are the two most reliable industrial components today as our entire food supply infrastructure depends on them. They can operate reliably under harsh climatic and environmental conditions, even in third-world countries. The cost of ice making is low as even local fish stores can afford it. In combination, they have the attributes of a robust industrial process that is reliable and cost-effective. In comparison, production of ice crystals by cryogenic fluids is neither cost effective nor reliable in comparison. The most reliable ice making process is known as “immersed cold drum”. (Figure A). As refrigerant cools a rotating drum surface, a thin sheet of ice is immediately formed. Under appropriate conditions of drum diameter, temperature and rotational speed, the ice sheet can be formed with sufficient internal stress that when its frontal edge impacts a doctor blade, the sheet fractures into small ice fragments similar to the shattering effect of a broken stressed (safety or Pyrex) glass.

Above, the doctor blade is mounted on a tube with a longitudinal slot over the entire length of the blade. One end of this tube is connected to a venturi-type nozzle that draws by vacuum the ice fragments from the tube. The other end of the tube is connected to a compressed air source that supplies sufficient air to balance the vacuum created by the venturi. In this manner, ice fragments are instantly fluidized and moved to the nozzle by the induced flow. (Figure B).



**Figure B: Ice Blast Process**

In this process design, there is no mechanical intervention within the ice particle production area. This allows ice particles to flow with no interference. This process takes advantage of the natural fragmentation of a stressed ice sheet to create particles and not rely on any mechanical means to size them.

An Ice Blast machine is therefore a collection of refrigeration, an icemaker and a blast nozzle. These are proven commercially available components. To operate an Ice Blast machine, only standard utilities such as water, air and electricity are required. As ice particles disintegrate on impact, they create a blast mist that helps to suppress dust from the operation and to cool the environment for the workers. This is particularly helpful in the summer. Evaporation will normally reduce the net liquid waste to about 10-40 LPH.