LIQUID SPRAY AND SPRAY NOZZLES Liquid spray

LIQUID SPRAY AS A PROCESS

The process of spraying a liquid can be described as composed of two phases, namely:

1. Breaking up the liquid into separated drops.
2. Directing the liquid drops onto a surface or an object, to achieve the desired result.

The above two phases are normally performed, by the types of nozzles being used in industrial processes, at the same time by means of different techniques which shall be illustrated in the following.

The continuous progress in the manufacturing techniques in recent years has requested the nozzle manufacturer to make available to the industry an always more complete range of spray nozzle types to perform the different processes in a more efficient way.

It is the interest of the engineer using spray nozzles in manufacturing processes to become familiar with the different types of nozzles which are available today and with their individual characteristics, in order to be able to choose the nozzle which performs with the highest possible efficiency on a given application.

Spraying a liquid through a spray nozzle can serve different purposes, among which the most important are the following:

1. Cooling, by means of heat transfer between the product itself and the liquid running on its surface.
2. Washing, where the water directed onto the product takes away dirt or undesired substances from the product surface.
3. Humidifying, with sprays carrying very little liquid quantities to the product surface.Into a chamber or into a room.
4. Metering the desired liquid quantity in a unit of time into the product being handled.
5. Applying a product on a surface, as in the case of spray painting or surface pre-treatment before painting.
6. Increasing the liquid surface to speed up heat transfer processes or chemical reactions and many others in numerous applications throughout modern industry.

It is self-evident that the best results for every application are only obtained when the right choices in terms of nozzle type, flow value, spray angle, drop dimensions and nozzle material are made.

The purpose of the following pages is to give the reader the basic knowledge which is needed to properly select a spray nozzle for a given application.

Spray nozzles

a spray nozzle is a device which makes use of the pressure energy of a liquid to increase its speed through an orifice and break it into drops.

Its performances can be identified and described precisely, so that the design engineer can specify exactly the spray nozzle required for a given process.

The relevant characteristics which identify the performances of a nozzle are the following:

1. The liquid flow delivered as a function of the nozzle feed pressure.
2. The opening angle of the produced spray.
3. The nozzle efficiency, as the ratio between the energy of the spray and the energy used by the nozzle.
4. The evenness of the flow distribution over the target.
5. The droplet size distribution of the spray.
6. The jet impact of the spray.

The above characteristics will be discussed in the following pages, in connection with the different nozzle types.
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TECHNIQUES FOR SPRAY PRODUCTION

Many different techniques can be used to produce a spray, and most of them are used today for nozzles to be applied in industrial processes. Based on the different techniques, the following nozzle types can be used in industrial applications to generate a liquid spray.

1. Pressure nozzles
   This is the simplest type of nozzles, where an orifice is opened into a chamber where the liquid to be sprayed is fed under pressure. A spray is produced through the orifice with spray pattern, flow rate and spray angle depending upon the orifice edge profile and the design of the inside pressure chamber.
   Typical pressure nozzles are the flat jet nozzles series QA, J, GX and GY.

2. Turbulence nozzles
   In these nozzles the liquid moving towards the chamber preceding the orifice is given a rotational speed component, so as to open up in a conical shape as soon as it leaves the orifice edge because of centrifugal force. Based on the nozzle design and the technique used to generate the rotational speed, the drops produced can be confined to the cone outer surface (hollow cone spray) or be evenly distributed to fill the entire volume of the cone (full cone spray).

3. Impact nozzles
   Here the desired spray shape is obtained producing an impact of the liquid jet onto a properly designed surface. The liquid jet is subsequently changed into a fluid lamina and then broken into drops with the desired spray pattern after leaving the nozzle edge.

4. Air assisted atomizers
   Fine and very fine sprays can be obtained by means of air assisted atomizers, working upon various different principles. More detailed information about air assisted atomizing can be found in our Catalogue "Air assisted atomizers" (ordering code CTG AZ18).