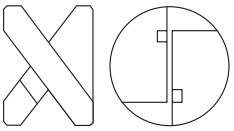
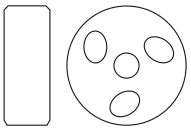
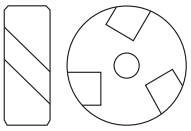
Effective Use of Full Cone Spray Nozzles

Clogging and Free Passage Diameter

Typical full cone spray nozzles comprise a whirler to form a round spray area with uniform distribution. The whirler part is the bottleneck of the liquid passage and where clogging can occur. There are several types of whirlers including X-shaped whirler, disc-shaped whirler, and spiral-shaped whirler. The diameter of a sphere that can pass through the whirler is defined as free passage diameter. Among them, the X-shaped whirler has the largest free passage diameter and allows for minimize clogging.
In our full cone nozzle series developed to have no whirler so as to eliminate clogging problems, our AJP series nozzles are the most clog-resistant due to its unique vaneless design and the largest free passage diameter.


X-shaped whirler


Disc whirler


Spiral-shaped whirler

Wear and Corrosion Resistance

When the liquid contains slurry, the inside of the nozzle exposed to the flow of liquid at high speed can wear out quickly. For these applications, the **JUP series** nozzle is ideal, as the orifice and whirler are made of ceramics. **JUXP, AJP-AL92, and TJJX-SiC series** nozzles are more effective as all parts are made of ceramics. For corrosive applications, nozzles made of special materials such as plastics and titanium alloy are available.

Reduction in Mass

For arrangements of many large size nozzles, mass savings of the nozzles affects the total production cost for the systems. The **TJJX series** nozzle with a newly developed X-shaped whirler has a 20% shorter overall length and 20% less mass than conventional nozzles. Furthermore, TJJX-SiC series nozzle (made of silicon nitride bonded silicon carbide) weighs less than a half of metal nozzle.

Rotation Reaction Force

In full cone spray nozzles with whirlers, rotation torque is generated as a reaction force by the vortex current produced by the whirler, which is determined by the following equation.

$$T \approx C \cdot Q \cdot D \cdot \sqrt{P}$$

T: Torque (N-m)
C: Constant
Q: Spray capacity (ℓ/min)
D: External dimension of whirler (mm)
P: Spray pressure (MPa)

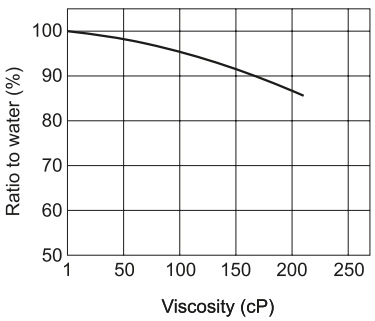
[Example]

Nozzle No.	Torque at pressure of 0.2 MPa
3/4FJJXP23	0.025 N-m
6TJJX4000	3,000 N-m

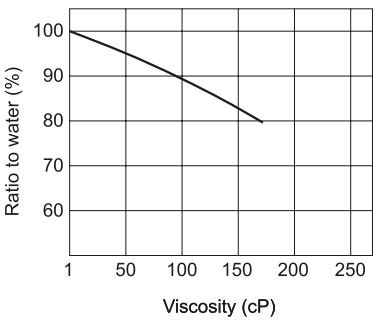
Viscosity

As the viscosity of the liquid increases, generally spray capacity and angle decreases, spray distribution deteriorates, and spray droplet size becomes larger.
(Spray capacity of hollow cone spray nozzles increases as the viscosity of liquid increases. See page 62 for details.)

[Relation between viscosity and spray capacity]



[Relation between viscosity and spray angle]



Nozzle tested: JJXP90
Spray pressure: 0.02–0.03 MPa