Design Formula for Coolant Nozzles

(**Tooling & Accessories Group**)

Premise: Velocity of coolant to equal velocity of wheel (flow/pressure at nozzle connection).

Formula: $Vc = Vs$

Formula: $Vc = Q / h \times p$

Or: $h = Q / Vc \times p$

Where:
Vc = Coolant Velocity
Vs = Grinding Wheel Surface Velocity
Q = $in.^3$/sec. = 231 $in.^3$/gal. (H_2O)
h = Height of Nozzle Exit Opening
p = Contact Perimeter Line of Wheel-to-Part Length

Example:
Vs = 6500 S.F.P.M.
Pump delivery of 20 GPM at nozzle connection
Grinding contact line of 1.0 inches (p = 1.0 inches)

Vs = 6500 Surface Feet Per Minute (S.F.P.M.) **x** 12 (in/ft.) **/**60 sec. = 1300 in/sec.

Q = 20 (Gallons per minute) **x** 231 (in^3/gal.)**/**60sec.= 77 in^3/sec.

IF: $Vc = Vs$

Then: 1300 in./sec. (Vs) = 77 in^3/sec.(Q) **/** h **x** 1 (p)

Therefore: 77 $in.^3$/sec.(Q) **/** 1300 in./sec. (Vs) **÷** 1in. (p) = 0.059 in. (h)

Due to the friction loss factors, wear tolerance and coolant flow loss at the exit of the nozzle, it is advisable to calculate a 10% loss factor. Therefore make h = 0.059 **x** 0.90 = 0.053 in.

A cross reference must now be made with the psi / velocity table to ensure pump psi available will give coolant velocity (SFPM) required to match wheel speed. To formulate the pressure needed:

$PSI = \left(\frac{SFPM/60}{12.2}\right)^2$ Example above would be $\left(\frac{6500/60}{12.2}\right)^2 = 79$ PSI

A change from water based coolant to straight oil fluid will affect nozzle performance. An increase in specific gravity and/or viscosity will decrease velocity pattern quality and impact strength. A conversion factor is available.