Key words Or Question???	Subject: **combustion engineering** Topic: **Combustion of liquid fuels**

Spray formation and droplet behavior

Why diesel engines and gas turbines utilize liquid fuel sprays?

Oil fired furnaces and boiler, diesel engines, and gas turbines utilize liquid fuel sprays in order to increase the fuel surface area and thus increase the vaporization and combustion rate.

Give an example of the liquid fuel spray ?

breaking up a 3 mm sphere of liquid into 30μm drops results in 1 million drops . The droplet mass burning rate is approximately proportional to diameter squared, and the increase in burning rate is 10000 times if we assume that the large single droplet and 1 million small droplets burn under the same ambient conditions.

Spray region divided into:

1-The spray formation region .

2-The vaporization region .

3-The combustion region .

Types of spray

1- simple pressure nozzles

simple pressure nozzles either with 4-10 small holes or a pintle are used in predominantly in diesels.

2-Air or steam atomization

Air or steam atomization nozzles are used in burners and furnaces. The burner lance consists of two concentric tubes, a one-piece nozzle and a sealing nut. The media supplies are arranged so that the steam is supplied down the centre tube and the fuel oil through the outer tube

3-Swirl types nozzles

A-Tangential

Liquid enters under pressure and is forced through an offset orifice and into a swirl chamber. As the liquid leaves the orifice the droplets follow a trajectory influenced by the orifice shape and the swirl chamber design.

B-Axial

Liquid enters under pressure and is forced through a stationary turbine vane located inside the nozzle. As the liquid leaves the orifice the droplets follow a trajectory influenced by the orifice shape and vane design .The result is a consistent spray angle and uniform droplet distribution.

BREAKUP REGIMES

The disintegration of liquid jets is described by two main mechanisms.

primary breakup length

which is defined as the length of the intact liquid core
The first mechanism is the breakup of the intact liquid core into droplets
secondary breakup:
The second mechanism is the breakup of droplets into smaller ones,
Here the size of the droplets is a characteristic parameter.

Both breakup length and droplet size are dependent on the properties of the liquid and the surrounding gas.

The primary breakup is the most important mechanism in fuel injection system?

Because it determines the size of the droplets that separate from the liquid core, hence therefore also determines evaporation behavior and it marks the starting point for further breakup into smaller droplets (secondary breakup).