Minimum flow

• the lowest continuous flow the pump is permitted to operate
• without reference to a specific vibration limit or other criteria
• the ‘default’ pump manufacturer’s recommendation
Main purposes of minimum flow

• Permissible vibration
• Impeller cavitation erosion life
• Radial bearing loading, shaft bending
• Temperature rise

One or more of the above may be applicable.
Pump phenomena versus flow

- Temperature rise
- Minimum flow, acceptable bearing and seal life
- Onset of suction or discharge recirculation
- Best Efficiency Point flow
- Cavitation, high vibration
- Noisy operation, cavitation surge, high vibration
- Low flow limit for impeller cavitation erosion long life
- Suction impeller “Shock-less” entry

Thermal minimum flow
Intermittent minimum flow
Minimum Continuous Stable Flow
Minimum Continuous Stable Flow (MCSF) or \((Q_{\text{min}})\)

MCSF is the minimum allowable flow for which specified vibration limitations will not be exceeded.

Specified in API 610, and also used in other critical service applications.
Vibration characteristic

- Head versus rate of flow
- Vibration level versus rate of flow
- Preferred Operating Range
- Allowable Operating Range
- Best Efficiency Point
- Maximum allowable vibration limit
- Basic vibration limit
Minimum Intermittent Flow

It is the minimum flow for intermittent operation. The cumulative duration of operation at this reduced flow is usually specified.

Applicable to nuclear safety-related pump applications.
Thermal minimum flow

Also known as:
Minimum Continuous Thermal Flow (MCTF)

It is the minimum flow for which a maximum permissible pump temperature rise is anticipated.

MCTF prevents pump failure due to “flashing” of the pumped liquid.
Impeller long life

• commonly known as: 40,000 hour impeller life
• it is the pump operating range defined by a minimum level of NPSH Available

Relevant to:
large boiler feed water; water injection; carbonate service; high energy pipeline pumps; liquid metal pumps
Pump operation at shutoff

• Rapid heating
• Flashing / dry running potential
• High levels of vibration – destructive levels possible
• Higher energy levels - increasing danger
• ‘Small’ pumps – possible to run at shutoff continuously. Example: A fire sprinkler system’s jockey pump.
Final slide for:
Purpose of Minimum Flow