Rick Dumont – Rosemont Engineering, Inc.
December - 2008

This paper is provided to delineate the differences between controllers for use in fire pump service. The major consideration in the choosing of a controller style is the inrush current of the motor. Motor inrush current is defined by determining the 100% full load amperage and multiplying by six (6). The result is often referred to as the motor "locked rotor current". Starting current of various controllers are expressed (in this paper) as a percentage of motor full load amperage.

Full Voltage **-** The simplest and least expensive style of controller is the full voltage, or "Across-the Line" type. This controller is used when the power source can handle the inrush current of the motor upon starting the fire pump. A standard 3-phase induction motor is required for this controller.
Starting current: 600%.

Reduced Voltage **-** When the high inrush current of a fire pump motor may jeopardize the power source, a reduced voltage controller is required. Thru the years, several methods of reduced voltage starting have evolved.

Part Winding **-** Used with special two-winding motors. One winding is used to start, the other is connected after a time delay to run at full speed/torque.
Starting current: 390%

Wye Delta /Open Transition **-** Used with wye-delta motors. The motor is connected via the wye connection first. After the "transition" time, the motor is connected via the delta connection.
Starting current: 200%

Wye Delta/ Closed Transition **-** An additional contactor and high wattage resistor network is provided to connect to the motor during the transition time to absorb any line disturbances possibly generated by the motor which could jeopardize the power source. Typically provided when used with emergency generator power.

Primary Resistor **–** Used with standard 3-phase induction motors, this is the oldest method of reduced voltage starting. Resistors are initially in series with the motor windings to reduce inrush current to about 50% levels. After a transition time, a contactor shorts out the resistors to provide full voltage to the motor. Drawback is when the transition timer fails; resistors are always in the circuit creating an overheating condition.
Starting current: 300%

Autotransformer **-** Used with standard 3-phase induction motors. A transformer is in the motor circuit during the start phase. After the transition time, a contactor shorts out the transformer to provide full voltage to the motor. This method is any early design of reduced voltage starting and requires a larger enclosure to house the transformer.
Starting current: 252%

Solid State Soft-Starter **-** Used with standard 3-phase induction motors. The soft-starter ramps the motor up to speed. A bypass contactor shorts out the soft-starter once the motor reaches full speed. Upon a call to stop, the soft-starter takes over and ramps the motor down under a controller deceleration. This soft-start/soft-stop method of control substantially reduces the effects of water hammer in a piping system.
Starting current: 240% to 390%

Variable Frequency **-** Used with standard 3-phase induction motors (rated for VFD use). The variable frequency drive ramps the motor up to speed and maintains a desired pressure set point by monitoring a pressure transducer providing feedback of actual system pressure. Pressure will be maintained at wherever the transducer is piped to.
Starting current: 10% full load amps

Rosemont Engineering, Inc.
225 Stedman St., - Unit 5
Lowell, MA 01851
Phone: 978-453-9191 Fax: 978-453-1919
RDumont@rosemonteng.com