General Specifications for Soft Starter.

1.01 SOFT STARTER:

General:

This specification describes the requirements for a solid-state torque controlled starter (Controller) used to provide linear ramp starting and stopping of three-phase AC induction motors. The requirement is for a stand-alone unit that negates the need for further equipment in terms of protection, viewing and controlling.

A. Electrical ratings

a) 200 – 525 +/- 10% 200-690 +5%/- 10% Volts AC mains
b) 50-60 Hz +/- 10%
c) 100-240/380-500 +/- 10% Volts control voltage

B. The Controller shall provide as standard, the following **"starting"** modes:

a) Linear Torque control for Start
b) Quadratic Torque control for Start
c) Pump Control
d) Current Limit Start
e) Voltage ramp Start
f) Voltage ramp with current limit Start
g) Full Voltage DOL Start
h) Remote analogue control
i) Soft Start with Selectable Torque Boost
j) Slow Speed time controlled
k) Slow Speed external controlled
l) Dual Ramp Start
m) Bypass control

C. The Controller shall provide as standard, the following **"stopping"** modes:

a) Linear Torque control for Stop
b) Quadratic Torque control for Stop
c) Pump Control
d) Voltage ramp Stop
e) DOL/Coast to stop
f) Remote analogue control Stop
g) Dynamic DC-Brake and Soft brake (reverse brake)
h) Slow Speed time controlled
i) Slow Speed external controlled
j) DC-Brake at slow speed
k) Dual Ramp Stop

l) Accurate positional stop control
m) Bypass control

D. The Controller shall provide as standard, the following **"Additional"** features

a) Jogging forward and reverse
b) 4 parameter sets
c) Analog output
d) Built in Display

E. The Controller shall provide as standard, the following **"Operation"** features
a) Keyboard
b) Remote

F. The Controller shall provide as standard, the following **"Protection"** features:

a) Motor Thermal Overload
b) Soft Start thermal overload
c) PTC input
d) Motor Shaft Torque (Max) machine process protection.
e) Motor Shaft Torque (Min) machine process protection.
f) Phase imbalance
g) Phase reversal
h) Over voltage
i) Under voltage
j) Locked Rotor
k) Excessive Starts per hour for application
l) Phase loss input / output
m) Motor output loss

G. The Controller shall provide as standard, the following **"Viewing"** functions:

a) Three Phase Current
b) Three Phase Voltage
c) Current in L1, L2, L3
d) Voltage between L1-L2, L1-L3, L2-L3
e) Shaft Power in kW / HP (selectable)
f) Motor thermal capacity
g) Motor Energy consumption (kWh)
h) Power factor
i) Run time in hours
j) Torque in Lbs./ft or Nm (selectable)

H. The Controller shall provide as standard, the following **"Fault Indication"** functions:

a) Line failure
n) Phase imbalance
b) Over temperature – motor
c) Over temperature – Soft Starter
d) Shorted Thyristor
e) Open Thyristior
f) Locked Rotor
g) Motor output loss
h) Overload - Shaft Torque
i) Underload – Shaft Torque
j) Phase imbalance
k) Over voltage
l) Under voltage
m) Excessive Starts
n) Phase reversal
o) Event List of 15 latest fault indications/occurrence

1.02 CONSTRUCTION:

a) The Controller shall be of modular construction, consisting of a Power Control Board (PCB) and Power Structure.
b) The PCB shall be compatible the full range of power structures.
c) In the sizes from 17-1400 Amps all phases should be controlled during start/stop.
d) The power structure shall consist of six SCR's mounted on a heatsink for ratings up to and including 1400 Amps.
e) The Controller shall be DIN Rail mountable up to 250 A.
f) DIN Rail mountable units should be mountable without space at side.

1.03 CODES AND STANDARDS:

The controller shall be designed to meet the applicable requirements of:

a) EN 60204-1, EN 50081-1 (-2 from 170 A) EN 50082-2
b) IEC 947-4-2
c) UL 508
d) cUL

1.04 CONTROL MODULE DESIGN FEATURES:

A. MECHANICAL:

a) The PCB module shall consist of a power supply, logic control circuitry, silicon controlled rectifier (SCR) firing circuitry. I/O circuitry, a digital programming keypad, dual LED Displays and a serial communication port.

b) The PCB shall be designed for integral mounting on the power structure and shall be compatible with the full range of current ratings- 17 Amps to 1400 Amps.

c) The PCB shall be easily removed from the power structure, without the need to disassemble associated printed circuit board assembles.

d) Control terminals shall be easily accessible and located on the front bottom of the device. The terminals shall be UL rated for 300 Volts, 15 Amps maximum and accept a maximum of two wires, 0,2-4mm^2 (#30-#12 AWG).

e) Digital parameter adjustment shall be provided through a built-in keypad. Analog potentiometer adjustments are not acceptable.

f) Dual built-in alphanumeric, LED displays shall be provided for controller set-up, diagnostics, status and monitoring. The Control Keypad and Display shall have the option for remote mounting.

g) For safety reasons the controller should have 2 green lights for running and start/stop.

B. ELECTRICAL:

a) The PCB shall provide digital microprocessor control and supervision of all controller operation, including SCR pulse firing control.

b) The PCB power supply shall be self-tuning to accept control power input from 100 to 240 or 380 to 500 VAC, 50/60 Hz.

c) The SCR firing circuitry shall incorporate an RC snubber network to prevent false SCR firing.

d) The logic circuitry shall incorporate a latch circuit for three-wire control.

e) Reverse operation of the motor shall be standard in the jog mode without the use of a reversing contactor.

C. USER ADJUSTMENTS:

a) The two acceleration start ramp timers shall have individual adjustments from 1 to 60 seconds.

b) The two acceleration stop ramp timers shall have individual adjustments from 2 to 120 seconds.

c) The initial torque setting shall be adjustable from 0 to 250% of motor torque.

d) The end torque setting shall be adjustable from 50 to 250% of motor torque.

e) Current limit starting shall be adjustable from 150% to 500% of the motor's full load current.

f) Slow speed shall be adjustable up to 60 seconds or up to 100 external pulses.

D. PROTECTION AND DIAGNOSTICS:

a) Overload protection shall be as follows:

1) Meets applicable standards as a motor thermal protection device.
2) Shaft Power measurement without the use of external electro-mechanical sensors.
3) Electronic thermal memory shall be provided for enhanced motor protection.
4) Shaft Overload and Underload protection shall be available through the controller, even in a bypass configuration.
5) Protections should be available if bypass is made.

b) When fault conditions are detected, the controller shall inhibit starting or shut down SCR pulse firing.

E. PUMP CONTROL (standard feature):

a) The standard feature pump control shall be implemented to provide closed loop control of a motor to match the specific torque requirements of centrifugal pumps for both starting and stopping. This shall aid in eliminating the phenomena commonly referred to as "water hammer'. Methods utilizing Soft Start with Soft Stop shall not be

acceptable. The soft start and soft stop programming should be independent of each other.

b) Pump stop shall be initiated without the need for a dedicated Pump Stop input. A coast-to-rest stop shall still be possible with a stop input.

c) The Pump Stop times shall be user adjustable from 0 to 120 seconds.

F. POWER STRUCTURE DESIGN FEATURES:

Electrical:

a) Back-to-back SCR pairs shall be the only power-switching semiconductor means acceptable. Diode0SCR combinations shall not be acceptable.

b) There shall be separate power sections to operate from 200V to 525 V and 200V to 690V, 50/60 Hz.

c) Semi conductor fuses should not be required for warranty in sizes17-1400 Amps.

d) Softstarter should be built for continuous operation without need of by pass for any reason.

e) SCRs shall have the following minimum repetitive peak inverse voltage ratings:

1. 200 to 525V: 1600 V
2. 200 to 690V: 1800V

Transient Protection: 17 Amps to 1400 Amps

a) For controllers rated 17 Amps to 1400 Amps, transient protection with snubber circuit including RC-net shall be standard.

b) Capacitors against electrical noise should be integrated as standard.

G. ENERGY SAVER:

a) The Energy Saver feature shall operate to automatically cause the output voltage from the controller to be reduced when a motor is unloaded or lightly loaded.

b) Customer adjustments shall not be required.

c) The Energy Saver feature shall be defeatable.

d) Additional mounting space or wiring shall not be required.

H. ENVIRONMENTAL RATINGS:

a) Temperature Ratings

1) The Controller shall deliver its rated current in ambient temperature ranging from 0.°C to +50°C.
2) The controller should be able to operate up to 50 °C.
3) The ambient storage temperature shall range from 25°C to +70°C.

b) Humidity Range

1) The controller shall be operable in relative humidity of 5 to 95%, non-condensing.

c) Altitude Rating

1) The controller shall be suitable for operation up to altitudes of 1,000 meters without derating.