

מתקני קמ"ד אשדוד + חיפה

מערך גנרטורים בחרום

מפרט טכני לאספקה של מתנעים רכים 3.3KV

P3	06.06.2017	UPDATED	I. SHTADLAN	
P2	04.06.2017	UPDATED	I. SHTADLAN	
P1	20.09.2016	FOR APPROVAL	I. SHTADLAN	
Rev.	Date		BY	IPE
		Description	Approved	

TABLE OF CONTENT

1. INTRODUCTION	4
1.1 Scope of Specification	4
2. SCOPE OF SUPPLY	4
2.1 Supplier's Scope	4
2.2 Equipment scope of supply	5
2.3 Equipment and Services To Be Supplied	5
2.4 Exclusions	5
3. MANUFACTURING AREA OPERATIONAL OVERVIEW	6
4. EQUIPMENT CHARACTERISTICS	6
4.1 General	6
4.2 Starter Construction	6
4.3 Settings & Supervision	7
4.4 Starting & Stopping Characteristics	8
4.5 Motor & Starter Protection	8
4.6 Resetting After Fault	9
4.7 Auxiliary Contacts	9
4.8 Test Mode	10
4.9 By pass contactor	10
4.10 Capacitor contactor	10
4.11 CABINET	10
4.12 L.V. Control	11
4.13 Door Mounted Control Components	12
4.14 Communication	12

4.15 Analogue Output	13
4.16 Remote Supervision System	13
4.17 Motor Insulation Protection	13
4.18 Motor Protection Relay	14
4.19 APPLICABLE IEC & UL STANDARDS	16
5. LAYOUT	17
6. INSPECTION AND TESTS	18
6.1 Inspection During Manufacturing	18
6.2 Factory Acceptance Testing (FAT)	18
6.3 Pre-Commissioning Check	18
6.4 Commissioning And Start-Up	18
7. TRAINING	19
8. APPENDICES	19
8.1 APPENIX A - SOFT START DATA SHEET (To Be Filled In By Vendor)	19

1. INTRODUCTION

1.1 Scope of Specification

This specification defines the requirements for the design, manufacture, supply, inspection, FAT, delivery, installation, commissioning, documentation, for **4 UNITS 3.3kv soft starters**

The soft starters shall be supplied as package including all equipment as described in this specification.

The items will be installed in the Ashdod and Haifa plant.

2. SCOPE OF SUPPLY

2.1 Supplier's Scope

The Supplier's scope of supply and responsibility shall include, but not be limited to:

1. Detailed design of the 3.3kv soft starters and any ancillary equipment.
2. Meetings in Herzliya head office.
3. Engineering coordination, including also handling and expedition of drawings executed by Sub-vendors, if any.
4. Manufacture.
5. Complete pre-assembling in factory.
6. Factory Acceptance Test (FAT) (mechanical, instrumentation, automation, functionality), including FAT protocols.
7. Shipping to Ashdod and Haifa plants
8. Unloading and working of all components and equipment, also with special means (e.g. cranes) and skilled manpower (AS OPTION).
9. Supervision of Positioning and Installation (Remark: positioning and installation to be done by Others)
10. Commissioning and start-up assistance
11. Documentation.
12. Operators' training.
13. Supply of spare parts for Commissioning/start-up

2.2 Equipment scope of supply

1. 200A Soft starter
2. 200A By pass contactor
3. 200A Capacitor contactor
4. MPS-Motor Protection relay
5. Motor isolation protection (MIP)
6. Control system complete, including IPE standard process protection and control system

2.3 Equipment and Services To Be Supplied

Each soft starter shall be fabricated in fully assembled package (skid mounted)

2.4 Exclusions

The supply shall not include:

1. Civil works including finishes and sewer
2. Service general
3. Electrical control and communication cables

3. MANUFACTURING AREA OPERATIONAL OVERVIEW

The soft starters shall be installed indoor (in the medium voltage electrical room).

4. EQUIPMENT CHARACTERISTICS

4.1 General

- 4.1.1 The soft starter shall provide smooth, step-less acceleration and deceleration, reducing inrush current and mechanical shock, providing motor protection, remote control and supervision, according to the technical specification shown here below.
- 4.1.2 Mains voltage: 3300V +10% - 15%.
- 4.1.3 Nominal Current: 200A continuous.
- 4.1.4 Control voltage: 230V +10% - 15%.
- 4.1.5 Frequency: 50Hz \pm 2%.
- 4.1.6 When the starter is supplied from a stand-by diesel generator: The starter shall be capable of operating with a diesel generator supply, where voltage and frequency may be unstable (voltage drop up to 20% and frequency range of 45-55Hz). Starting & Stopping curves shall be designed for operating from a diesel generator supply.
The supplier shall provide a reference list of operation with a diesel generator supply.
- 4.1.7 Ambient temperature: 0°C - 40°C, Relative humidity: 95% non-condensed
- 4.1.8 Maximum number of starts: 2 per hour.
- 4.1.9 Altitude: below 1000m.
- 4.1.10 EMC Certificate – Starter shall have EMC certificate according to Article 10(2) of the EMC directive 89/336/EEC.
- 4.1.11 Minimum SCR PIV Rating shall be about 3 times system voltage.

4.2 Starter Construction

- 4.2.1 Starter shall be designed for heavy duty applications and ambient temperature of 50°C.
- 4.2.2 To ensure long term reliability and safety, each starter shall be tested for Partial Discharge (Corona Free), according to EN50178 & HD 625.1 S1:1996 Electronic Equipment for use in power installations.
- 4.2.3 Thyristor firing system shall be by fibre-optic, to provide complete isolation of the low voltage control from the Medium Voltage power circuitry.
- 4.2.4 The SCR firing system shall be provided with Fault Indication LEDs for easy trouble shooting.
- 4.2.5 Heat-sink over-temperature protection shall be provided for each of the 3 phases, with fibre-optic connections.

- 4.2.6 Each phase shall be protected from sides and front by reinforced insulation material. Double insulation sheets shall be used between phases.
- 4.2.7 Each phase shall have the capability to be disassembled on site for maintenance.
- 4.2.8 All printed circuit boards shall be varnish coated, to protect from harsh environmental conditions.
- 4.2.9 When required, preparation for connection power factor capacitors shall be made at starter input side, switched on by the Line Contactor, without the need for a special capacitor contactor.
- 4.2.10 Three phase voltage measurement shall be by an Electronic Potential Transformer (EPT), with fibre-optic connection, to provide complete isolation of the low voltage control from the Medium Voltage power circuitry.
- 4.2.11 All cable connections shall be to bus-bars, supported by isolators.
- 4.2.12 Selectable curves shall enable field setting of the starting characteristic - Voltage Ramp, Current Ramp or Torque Ramp, thus, optimizing soft start and soft stop processes, according to mains supply, motor and load requirements.
- 4.2.13 All control inputs shall be by opto-couplers, to isolate the micro controller board from the external and meet EMC requirements.

4.3 Settings & Supervision

- 4.3.1 The starter shall be programmed according to the driven load characteristic. Starting and stopping process shall be as specified here below.
- 4.3.2 Starter settings shall be made on a keypad and illuminated LCD. Illuminated LCD shall have 2 lines, 16 characters each for ease of use
- 4.3.3 Display language shall be English (additional languages, field selectable: German, French or Spanish).
- 4.3.4 The LCD shall display motor current, fault description and statistical data including: Total run time, Number of starts, Last start Current, Last start time duration, Description of last trip , last 9 trips data and Total number of trips.
- 4.3.5 LCD shall enable selection between viewing of minimum parameters - for basic applications and viewing full parameters - for demanding applications.
- 4.3.6 The following front panel LEDs shall enable quick status display: Control voltage On, Motor Starting, Motor Running, Motor Soft Stopping, Motor Stopped, operation at dual adjustment settings and Fault.
- 4.3.7 Keys on the keypad shall be clearly marked and setting software shall have easy-to-use Default Parameters.

4.3.8 Software lock, preventing parameters change shall be by an internal dip switch

4.4 Starting & Stopping Characteristics

The starter shall have the following starting and stopping settings:

- 4.4.1 Initial voltage: adjustable 10-80% Un.
- 4.4.2 Current Limit (C.L.): adjustable 100-440% x (Starter FLC / Motor FLA)
- 4.4.3 Ramp-up Time: adjustable 1-90 sec.
- 4.4.4 Ramp-down Time: adjustable 1-90 sec.
- 4.4.5 Pulse Start: Selectable pulse of either 80% Un, without current limit, for 0.1-1 sec. or 1-2 Sec at set C.L.
- 4.4.6 Torque Control, for linear acceleration and deceleration with selectable Torque Curves.
- 4.4.7 Current Ramp Control with Initial Current adjusts 100-400%, Ramp-up time 1-90 sec.
- 4.4.8 Pump Control, with selectable starting and stopping curves, to prevent Over Pressure and Water Hammer. Separate settings shall be available for starting and stopping.

4.5 Motor & Starter Protection

The starter shall have the following protection functions:

- 4.5.1 Excessive starts with adjustable Max. Number of Starts, Time Period and Waiting Time (time delay after exceeding maximum number of starts).
- 4.5.2 Long Start Time (Stall protection).
- 4.5.3 Electronic Shear-pin (Jam protection) - trips instantaneously (in less than 1 cycle) when current reaches 850% FLA. An adjustable time delay shall be available for lower currents.
- 4.5.4 Electronic Overload with selectable curves.
- 4.5.5 Under Current with time delay
- 4.5.6 Ground fault current with adjustable time delay
- 4.5.7 Current imbalance - trip time will be related to motor load
- 4.5.8 Phase Loss
- 4.5.9 Phase Reversal
- 4.5.10 Starter Over-temperature
- 4.5.11 Shorted SCR & Wrong Motor Connection
- 4.5.12 External Fault A – from a N.O. contact
- 4.5.13 External Fault B – from a N.O. contact

- 4.5.14 Bypass Contactor Open - trips the starter if bypass contactor does not close after End of Acceleration. When bypass is in a separate panel, Bypass Contactor Open protection can be disabled.
- 4.5.15 No start signal - trips the Line Contactor in case power is connected to soft starter and start signal was not given. No start signal protection can be disabled.
- 4.5.16 Motor currents shall be measured by soft starter's C/Ts on all three phases. Upstream protection shall operate before and after bypass contactor closes.
- 4.5.17 Protections disable functions: Protection functions, except for No-Volt Protection, can be disabled after Bypass Contactor closes. A special disable mode of Bypass Contactor Open function can be set when Bypass Contactor is remotely mounted.

4.6 Resetting After Fault

- 4.6.1 Upon fault, the starter shall trip and lock in a Fault Mode, also if mains voltage disappears (blown fuse or voltage outage).
- 4.6.2 For maximum safety, resetting shall be possible only after start signal is removed.
- 4.6.3 Resetting shall be possible either by local Reset Key or remotely by hard wire or communication.
- 4.6.4 Auto-Reset shall be possible for Under-Voltage, Phase Loss, Under Current and Open Bypass Contactor Faults.

4.7 Auxiliary Contacts

- 4.7.1 The soft starter shall incorporate a minimum of three auxiliary relays, each with 1 change-over contact rated 8A, 250V, 1800VA, with the following functions:
- 4.7.2 Immediate Relay - shall operate upon start signal, with adjustable On and Off delays. The contact shall return to original position upon Voltage Outage, Fault, and Stop signal and upon Soft stop signal – at the end of soft stopping process.
The Immediate Relay can be also programmed for over current shear-pin function.
- 4.7.3 End of Acceleration Relay - shall operate upon completion of starting process, with adjustable On-delay. The contact shall return to original position upon Voltage outage, Fault and upon Stop and Soft Stop signals.
- 4.7.4 Fault Relay – shall be programmed either as:
- 4.7.5 Fault – changes position upon Fault returns to original position upon Reset, after fault had been removed.

4.7.6 Fault-Fail-Safe - changes position upon control voltage connection returns upon fault can be used for "Control Voltage Disconnected" alarm).

4.8 Test Mode

Full functional test of all starter circuits shall be possible by using a standard low voltage motor. A special testing harness for the low voltage test shall be provided.

Special Warning signs, preventing connection of high voltage to the starter during low voltage test will be provided.

4.9 By pass contactor

By pass contactor shall be fixed mounted, rated according to motor current and voltage, having a minimum of 2 N.O & 2 N.C auxiliary contacts.

4.10 Capacitor contactor

Capacitor contactor shall be fixed contactor operated after motor acceleration finished. The contactor will be stopped while operating with generator.

4.11 CABINET

The cabinet shall be designed and constructed according to IEC standards as specified in paragraph 21, with 2.5 mm thick metal sheets & with soft starter keypad mounted behind a transparent window.

4.11.1 All exterior and interior metal parts shall be coated and painted under the following procedure:

4.11.2 All parts shall be separately painted before assembly.

4.11.3 Preparation - Alkaline wash / rinse / iron phosphates / rinse/non chrome sealer rinse / re-circulated de-ionized water rinse and distilled de-ionized water rinse.

4.11.4 Painting – Air atomized electrostatic spray, Hybrid Epoxy Polyester powder paint.

4.11.5 Semi-matt. Paint thickness shall be at least 0.07 mm.

4.11.6 Colour shall be RAL 7032.

4.11.7 Baking at 180 C (350 F) minimum.

4.11.8 Field "touch-up" spray can(s), matching the enclosure colour, shall be supplied.

4.11.9 Cabinet doors shall be provided with heavy duty hinges and Locks. MV doors shall be secured by four screws per door to prevent unauthorized opening.

- 4.11.10 Front part of bus-bar system shall be coated with coloured heat shrinkable tubes, for the necessary voltage level.
- 4.11.11 Ground Bus - A continuous bare copper ground bus, 5 X 50 mm, shall be provided along the entire width of the enclosure, at the bottom.
- 4.11.12 Cable access shall be from bottom with a minimum of 30 cm available space for cable connections. No components shall be mounted in this space. Top entry option shall be available upon request.
- 4.11.13 A door Switch with 1 N.O. + 1N.C. contacts shall be mounted on the M.V. door, operated when the door is opened and wired to the terminal blocks. When indicated – The Door switch shall be wired so as to trip open the Line Contactor when door is opened. The other contact shall be used to switch the MV Compartment light.
- 4.11.14 The MV Compartment shall be provided with a TCD 13 watt protected lamp, supplied from a dedicated C/B that shall light upon door opening.
- 4.11.15 Cabinet Heater - A 60W heater with humidity control, supplied from a dedicated miniature C.B.
- 4.11.16 Roof pressure relief cover – a metal sheet pressure relief cover with a minimum of 3/4 of roof area, fastened by metal bolts on its front side and plastic bolts on the rear and sides end.
- 4.11.17 Lifting hooks – Enclosure shall be equipped with top lifting hooks, capable to support 1.5 times cabinet weight.
- 4.11.18 Control wire ways – control wires in the MV Compartment shall be routed through metal wire ways. Plastic wire trays, flame retardant material, shall be used in the LV Compartment. Halogen free wire way shall be available upon request.
- 4.11.19 Optional Safety cover – A transparent poly carbonate cover shall be mounted in the MV Compartments to avoid any access to live parts upon opening the front door.
- 4.11.20 Cabinet floor – Sealed cabinet floor with glass epoxy covered openings provided for customer cable glands.

4.12 L.V. Control

The starter shall have a separate, completely segregated, front accessible L.V. compartment.

The L.V. Compartment shall include at least the following components:

- 4.12.1 Soft starter Control Module, with fiber optic wires.
- 4.12.2 Selector Switch - Local / Remote (for door mounted Start/Stop buttons or Remote by hard wires).

- 4.12.3 Selector switch - Soft Starter / DOL starting (enabling DOL starting in case of a fault in the soft starter).
- 4.12.4 Interposing relays shall be used for starters built-in output relays.
- 4.12.5 A Holding Relay shall be provided when external Start / Stop push buttons are used.
- 4.12.6 All control components mounted in the L.V. compartment shall be wired to terminal blocks, which shall be wired to Customer Terminal blocks.
- 4.12.7 Customer connection terminal blocks shall be located in separate, fully segregated section. Remote control cables shall be from the top or bottom of the structure. Control cable inputs and outputs shall be through removable entry plates on top or bottom of the structure.
- 4.12.8 Control copper wires shall be insulated, flexible stranded, flame retarding thermoplastic compound, 690V, Halogen free 90°C, neatly bundled.
- 4.12.9 Each wire shall be marked with cable marking sleeves, numbered according to the electrical diagram. Control wire terminations shall be screw-type, copper compression type, Non-insulated, locking type, fork tongue lugs shall be provided on the current transformers.
- 4.12.10 Whenever 2 wires are connected to the same terminal, they shall be crimped together.
- 4.12.11 RF filter shall be supplied for the control circuit.

4.13 Door Mounted Control Components

The following components shall be mounted on L.V. door:

- 4.13.1 Motor Protection Relay.
- 4.13.2 Motor Insulation protection
- 4.13.3 Digital power meter
- 4.13.4 Start / Stop Pushbuttons.
- 4.13.5 Emergency stop push button.
- 4.13.6 Indication light LED type: Line Contactor Closed, Line Contactor Open, Bypass Contactor Closed, Remote Operation and Fault. Indicating lamp test feature is available upon request.

4.14 Communication

The starter shall be equipped with Modbus communication protocol:

- 4.14.1 Modbus enabling Supervision.

4.14.2 Configuration software shall be provided for parameter setting and actual data reading

4.15 Analogue Output

Analogue output, proportional to motors current, 0–10VDC or 0/4–20mA as specified.

4.16 Remote Supervision System

Remote supervision system enables the user to control and monitor all parameters of the soft starter from a remote location.

The system incorporates the following features:

- 4.16.1 Parameters setup.
- 4.16.2 Remote start and stop.
- 4.16.3 Remote monitoring of actual parameters such as current, power, statistical data etc.
- 4.16.4 Remote fault analysis.
- 4.16.5 Communication with up to 28 local stations using one transmitter.
- 4.16.6 Communication to remote location using LAN, GSM (GPRS), satellite.
- 4.16.7 Security levels.
- 4.16.8 No need for special control servers.
- 4.16.9 Operate from normal windows based PC and handheld computer based on windows CE.
- 4.16.10 Customize comprehensive, friendly user active user interface.
- 4.16.11 Plug and play system – easy to install and commission.
- 4.16.12 Internal, On-line, massaging system. (ICQ style)

4.17 Motor Insulation Protection

Motor insulation protection monitors the insulation level of the motor.

The protection consists of a resistance box at medium voltage side and a factory pre-installed PCB in the main control module of the starter.

- 4.17.1 Monitoring is implemented using up to 48 VDC for maximum safety.
- 4.17.2 Microprocessor based controlling.
- 4.17.3 Monitoring while motor is de-energized.

4.17.4 Two distinct levels can be set for Alarm and Trip functions:

4.17.5 Alarm level, Range: 0.1(OFF) – 10 MΩ

4.17.6 Trip level, Range : 0.1 (OFF) – 10 MΩ

4.17.7 When insulation decreases below Alarm Level set point for more than 120 seconds, the LCD displays an alarm message and the insulation level can be read in MΩ on the display. The Fault LED flashes and the Insulation Alarm Relay are activated. Alarm signal will disappear automatically 60 seconds after insulation level returns to normal.

4.17.8 Trip does not reset automatically.

4.18 Motor Protection Relay

The starter shall incorporate a digital; microprocessor based Motor Protection System (MPS 3000 or equivalent – in that case, the equiv. MPS will have the ability for connecting with the existing communication protocol) as a full motor protection package. Upon fault that is not cleared by the soft starter, the MPS shall trip open the Line Contactor.

The MPS shall have the following protection and settings:

4.18.1 Under-Current Alarm with adjustable time delay

4.18.2 Maximum Start Time (Stall Protection)

4.18.3 Under Current Trip with adjustable time delay.

4.18.4 Load Increase Alarm.

4.18.5 Low set Over-current (overload) with adjustable time delay.

4.18.6 High set over-current (short circuit) with adjustable time delay.

4.18.7 Thermal Alarm (Modeling motor heating, with adjustable time to trip at 6xIn, Hot/Cold ratio, Cool Time Factor, Stall Time factor).

4.18.8 Thermal Trip with adjustable time delay.

4.18.9 Unbalance Current Alarm with adjustable time delay (negative – positive sequence)

4.18.10 Unbalance Trip with adjustable time delay

4.18.11 Ground Fault Alarm with adjustable time delay.

4.18.12 Ground Fault Trip with adjustable time delay.

4.18.13 Under Voltage with adjustable time delay.

4.18.14 Over Voltage Alarm with adjustable time delay.

- 4.18.15 Over Voltage Trip with adjustable time delay.
- 4.18.16 Under Power Trip with adjustable time delay.
- 4.18.17 Phase Loss.
- 4.18.18 Phase Sequence.
- 4.18.19 Motor Over Temp. – Input from 8 RTD (Pt100).
- 4.18.20 External Fault 1 (entry from a N.O. Contact).
- 4.18.21 External Fault 2 (entry from a N.O. Contact).
- 4.18.22 Internal fault.
- 4.18.23 Serial Communication fault.
- 4.18.24 Function shall be programmable, for each fault, as: Disable, Alarm Only, Trip Only, Alarm & Trip.
- 4.18.25 Authorized key: preventing unauthorized parameter changing.
- 4.18.26 Trip contact shall be 5A, 250VAC/DC.
- 4.18.27 Four analogue inputs, selectable 0/4-20mA.
- 4.18.28 Four analogue outputs, selectable 0/4-20mA, proportional to selectable actual values.
- 4.18.29 Settings and supervision shall be by a LCD, 2 line, 16 characters each.
- 4.18.30 Displays Measured Data: Phase voltage, Line voltage, Line current, Ground current, Frequency, Real power, Active power, Reactive power, Power factor, Each RTD sensor temperature, Analogue inputs 1-4 value.
- 4.18.31 Displays Calculated Data: Motor current (% of motor FLC), Equivalent current (calculated according to unbalance K factor), Unbalance current, Thermal capacity, Time to trip by overload, Time to start (after trip).
- 4.18.32 Displays Discrete Input Status: status of each digital input (open or closed)
- 4.18.33 Displays Statistical Data: Total run time, Total number of starts, Total number of trips, Last start period, last start maximum current, Total energy, minimum voltage, maximum voltage, minimum current, maximum current
- 4.18.34 Displays Fault Data: Last trip, Last alarm, Trip 3 Line current values, trip ground current, Trip phase voltage, last 10 trips with time stamp, external fault with time stamp, RTD value before last trip, over-current level 2 (short circuit).

- 4.18.35 Maintenance Options: Run test, Simulation test.
- 4.18.36 Reset function shall be programmable for each fault as Auto Reset, Local Reset and Remote Reset.
- 4.18.37 The MPS shall be equipped with communication RS 485, with Modbus Protocol.
- 4.18.38 Configuration software shall be provided for parameter setting and actual data reading

4.19 APPLICABLE IEC & UL STANDARDS

1. IEC 62271-200 High Voltage switchgear and control gear.
2. IEC 60061-1 High Voltage test techniques, General definitions and test requirements.
3. IEC 60694 and Common specifications for high voltage switchgear control gear standard.
4. IEC 71-1 Insulation co- ordination.
5. IEC 71-2 Insulation co- ordination.
6. EN 50178:1998 Electronic equipment for use in power installation.
7. IEC 664 and Insulated coordination within low- voltage systems including clearances and creepage distances for equipment.
8. EN 60265-1 Load break switch.
9. EN 60420 Load break switch.
10. IEC 129 Double section rotary disconnectors.
11. IEC 129 Earthing switch.
12. IEC 60470, UL 347 Vacuum contactors.
13. IEC 282-1 Vacuum contactors + fuses.
14. IEC 60282-1 Medium voltage fuse
15. IEC 420 Medium voltage fuses
16. DIN 43624 Fuse base for indoor mounting
17. DIN 46234 Cable lugs
18. DIN 0472+IEC 754 Medium voltage cables
19. EN 61000-6-2 Electromagnetic compatibility (EMC) - Immunity
20. EN 61000-6-4 Electromagnetic compatibility (EMC) - Emission
21. EEC/72/23

5. LAYOUT

Vendor shall specify any layout requirement and weight for the installation, operation and maintenance of the soft starters.

6. INSPECTION and TESTS

6.1 Inspection During Manufacturing

Materials and work in progress will be subject to inspection by YWGE/MN to ensure that the manufacture is in compliance with the agreed design and the required codes, standards and regulations. Waiver of any phase of inspection must be obtained in writing from the Contractor.

6.2 Factory Acceptance Testing (FAT)

The complete system shall be fully built at the Supplier's factory. The equipment will be connected to adequate control system and a factory acceptance test (FAT) carried out.

The Supplier shall provide a complete FAT procedure and protocol two months before FAT execution. Supplier is responsible of testing execution and test results' record on FAT protocol.

This test must demonstrate that the equipment and control system are in compliance with this specification and relevant standard, codes etc.

Equipment will not be released for shipment until a satisfactory inspection, factory acceptance test (FAT) and document hand over has been achieved.

All the drawings needed for FAT execution shall be available in "as built before FAT" revision

The FAT shall include mechanical (dimensional, material check, etc.), electrical (wiring test, etc.), instrumentation, performance tests and documentation check.

FAT shall include, as a minimum, the following tests:

1. Construction drawings and documentation check
2. Mechanical (dimensional, material, finishing check, etc.)
3. Electrical (wiring test, etc.)
4. Instrumentation and Automation
5. Documentation check

6.3 Pre-Commissioning Check

At the end of the installation the Supplier shall carry out pre-commissioning checks on site, to ensure that all of the equipment has been installed correctly to the required levels of workmanship.

6.4 Commissioning And Start-Up

Supplier shall quote the assistance to commissioning and start-up activities for the soft starters.

The Supplier shall provide personnel and supervision for mechanical installation. Installation activities included in the Vendor's scope will be:

- Supply of information for basement design
- Supply of information for equipment positioning and installation
- Supervision of mechanical installation operations

The Supplier shall specify any special requirements that may arise during the installation period.

7. TRAINING

Vendor's personnel shall provide basic training to Client's operating and maintenance staff during commissioning and start up activities. This training shall ensure that the Client's staff are fully conversant with the documentation provided by the Supplier and are capable of operating and maintaining the equipment without danger to themselves or the equipment without the Supplier's supervision.

Vendor shall be available, in case of need, for specific operators training and quote in the bid training activities (on reimbursable basis).

8. APPENDICES

8.1 APPENIX A - SOFT START DATA SHEET (To Be Filled In By Vendor)

NO.	ITEM	REQUIRED	REMARKS
4.1	<u>Cabinet</u> Degree of Protection Cooling Colour		
4.2	<u>Service Condition</u> Altitude Humidity Temperatures		
4.3	<u>Power Unit</u> Soft Starter Power Unit Network Supply Voltage (AC) + 10%-15% Current ratings System frequency SCR P.I.V ratings Standard Routine Test Line C.B By pass C.B		

NO.	ITEM	REQUIRED	REMARKS
4.4	<u>Control Unit</u> Soft Starter Control Unit MV Voltage measurement Control Voltage Supply Input & output voltage Display Languages available Keypad Aux. Contacts		
4.5	<u>Start Stop Parameters</u> Starter FLC Motor FLA Pump Control Curves Pulse Start Level and Duration Initial Voltage Initial Current Current Limit Acceleration Time Deceleration Time Dual Adjustments Tacho and Linear Acceleration		
4.6	<u>Motor Protection Relay</u> Relay manufacturer and type Too many starts Maximum number of starts during a time period Starts inhibit Long start time (Stall protection) Over current (Shear-pin) Electronic overload Over current 1 Over current 2 Under current Under voltage Over voltage Phase loss Phase sequence Unbalance Current Ground Fault Communication		
4.7	<u>Starter protection</u> Wrong connection or shorted SCR Heat-sink over temp External fault 1 External fault 2 Power ON & NO start By-pass open Motor temperature		

NO.	ITEM	REQUIRED	REMARKS
4.8	<u>Standard cabinet scope of supply</u> Line breaker By Pass breaker By Pass contactor Capacitor contactor Protection Relays PLC and programming Marine Certification		