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| --- |
| Altivar Process general specifications for tender 2.1 |
| Altivar Process  ATV630, ATV650, ATV660 , ATV680 |
| Eric LEMAIRE – Drives |

### First page to resume actions and comments

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| 1 | July 21 | E.LEMAIRE | Add firmware and application functions |
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| 1.2 | May 18 | E.LEMAIRE | Final ratings for standard products  Final ratings for drives systems  Add “three levels technology” for harmonics mitigation  Add availability of filters |
| 2.0 | Sept 17, 2014 | E.LEMAIRE | Review with project team in accordance with firmware & hardware wave 2and range extension with drive systems.  Refer to : specification ATV6x0 release 2.0 in details .xls  complete chapter 3.3 about “Services” |
| 2.1 | Oct 17 , 2014 | E.LEMAIRE | updates into chapter 3.1 : UL61800-5-1 and CSA22.2 N274  updates into chapter 3.1.5: cos Phi >0,99 and lambda factor =1 |
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How to read the document?

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| --- | --- |
| **Color** | **Comments** |
| Black | Original from product specification DES 04 rev 03 from 2013.10.24 |
| Blue | Use the « blue » style for texts and variables that may be personalised by the specifier |
| Red | Use the « red » style for texts and variables that may be adapted by Schneider local team |

Terminology and Acronyms

|  |  |
| --- | --- |
| Drive systems | Drives systems = drives from 110 KW up to 800 KW |
| IP21,IP23, IP54 ,IP55, UL type 1 , UL type 12 | Protection degree variant |
| Mounting type | Mounting variant for standard drives: wall mounting, floor standing, cabinet. |
| Low harmonics drive | Drive with embedded harmonic mitigation 400V IP55 |
| QR code | Quick Response code |
| CG | Corner grounded. Neutral connection type used in North America |
| IT | Insulated network |
| TT/TN | Neutral connected to earth networks |
| Genset | Rescue generator |
|  |  |
|  |  |

Specifications for Tender about:

* standard products ATV630
* wall mounting products ATV650
* compact drive system products ATV660
* low harmonic drive system products ATV680

Please note that the first four pages of this document, page1 to page 4, are part of the document body.

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# 1. General

This part of the specification describes the general requirements for the Variable Speed Drives, here in referred to as AC Drives, for use with standard IEC or [NEMA A] [NEMA B] [NEMA D] [NEMA E], [Wound Rotor] design AC motors and synchronous motors with permanent magnets***.*** The nominal values, the standard documents and the drive’s minimum performance are defined in this part. The AC Drive does not include motor in this specification.

The Variable Speed Drives (here in this document named by “AC drive “ ) are particularly dedicated for applications managing air, gas and fluid. Most of applications as water treatment plant, pumping, multi-pumping, water management but also fans and compressors applications.

To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters without motor rotation.

# 2. Requirements for the Manufacturer

## 2.1 Certifications

The AC drive Manufacturer shall have a valid ISO 9001 (2010 version) certification and an applicable quality assurance system.

The AC drive Manufacturer shall have the Environment Certification ISO 14001 for EcoDesign.

The AC drive Manufacturer shall furnish the Product Environmental Profile (P.E.P.) on demand.

The AC drive Manufacturer shall be compliant with the European directive ROHS-2 (Restriction Of Hazardous Substances (European Directive CE 2002/95) that prohibits the use of materials such as lead, chromium 6...

The AC drive Manufacturer shall be compliant with the European directive REACH (EU Regulation 1907/2006)

The AC drive Manufacturer shall design the device with more than 70% of recyclability rate.

The AC drive Manufacturer shall design the device according to the IEC 62635 guidelines to reduce the carbon footprint.

# 3. Basic requirements for the AC Drives

## 3.1 General requirements

The AC Drive shall comply with National and International standards and the recommendations for electrical industrial control:

- ANSI/NFPA 70: National Electrical Code

- EN61800-5: Electronic equipment for use in power installation

- CSA C22.2 N274: Industrial Control Equipment

- IEC 68 Part 2-3: Basis Environmental Testing Procedures Part 2: Tests – Test Ca: Damp Heat

- IEC 146.1: Semiconductor Converters – General Requirements and Line Commutated Converters Part 1-1: - Specifications of Basic Requirements

- IEC 664: Insulation Co-ordination for Equipment within Low-Voltage Systems

- IEC 447: Man-Machine Interface Actuating Principles

- IEC 439 Part 1: Low Voltage Switch gear and Control gear Components

- IEC 364: Electrical Installation of Buildings

- IEC 204/NFPA 79: Electrical Equipment of Industrial Machines/Industrial Machinery

- IEC 106: Guide for Specifying Environmental Conditions for Equipment Performance Rating

- IEC 529: Degrees of protection provided by enclosure

- IEC 1000: Electromagnetic Compatibility

- IEC 1800: Adjustable speed Electrical power drive systems

- IEC 721: Classification of Environmental Conditions

- IEC 255-8: Overload Relays

- IEC 801-2,-3,-4,-5: Immunity Tests

- NEMA ICS Part 4: Overload Relays

- NEMA ICS7: Industrial Control and Systems Variable Speed Drives

- UL 508C: UL Standard for Safety Power Conversion Equipment

- IEC/EN 61508-1/2 SIL3 Machine Safety directive.

* The AC Drive shall be able to start and control the speed of a standard squirrel cage induction AC motor and synchronous motor.
* The AC Drives shall be CE marked, conforming to European Low Voltage (73/23/CEE and 93/68/CEE) and EMC (89/336/CEE) Directives
* The AC Drives have to be built to comply with the IEC standards.
* The AC Drives shall be UL marked according to UL61800-5-1
* The AC Drives shall be CSA marked according to CSA 22.2 N274.
* The AC Drives shall be RCM (previously C-tick) certified for the Australian market.
* The AC Drives shall be NOM certified for Mexican market.
* The AC Drives shall be EAC (previously GOST) certified for the East-European market.
* The AC Drive shall be a digitally controlled drive, using, at least, the Pulse Width Modulation (PWM) with flux vector control open loop, with speed control mode, and a safety function .It shall have IGBT’s in the inverter section of the throughout the power range, and it shall have the following minimum specifications.

3.1.1 General specification for standard AC drives IP21

|  |  |
| --- | --- |
| Rated Input Voltage and Power range | Three phases power supply :  200V -15% 240V +10%, three-phase up to 75 KW  380V -15% 480V +10%, three-phase up to 160 KW  500 to 690V -15% / +10%, three-phase up to 90 KW  Single phase power supply:  200V -15% 240V +10%, single-phase up to 30 HP  380V -15% 480V +10%, single-phase up to 50 HP |
| Rated Input Frequency | 50 Hz -5% to 60 Hz + 5%  For use with generators, the AC Drive shall operate from 40 to 72 Hz. |
| Protection degree | Wall mounting : IP21 , UL type 1 up to 90 KW  Wall mounting : IP21 , UL type 1 from 110 KW with option  Floor standing : IP21 ,up to 315 KW |
| Cooling system | Heatsink and air forced |
| Harmonics according to IEC/EN 61000-3-12 | Harmonics <48% THDi |
| Mechanical dimensions ( W x H x D in mm ) | Mechanical frames for wall mounting drives range from 0,75 to 160 KW in 380/480 Vac.  Frame 1 : 143 x 314 x 202 up to 5,5 KW  Frame 2 : 168 x 395 x 233 up to 11 KW  Frame 3 : 211 x 549 x 232 up to 22 KW  Frame 4 : 226 x 673 x 271 up to 45 KW  Frame 5 : 290 x 922 x 323 up to 90 KW  Frame 6 : 300 x 1155 x 375 up to 160 KW  Mechanical frames for floor standing drives range from 110 to 315 KW in 380/480 Vac.  Frame 1p : 400 x 2150 x 600 up to 160 KW  Frame 2p : 600 x 2150 x 600 up to 315 KW |

3.1.2 General specification for standard AC drives low harmonics

|  |  |
| --- | --- |
| Rated Input Voltage and Power range | 380V -15% 480V +10%, three-phase from 30 up to 90 KW |
| Rated Input Frequency | 50 Hz -5% to 60 Hz + 5%  For use with generators, the AC Drive shall operate from 40 to 72 Hz. |
| Protection degree | IP21 , UL type 1 from 30 to 90 KW |
| Cooling system | Heatsink and air forced |
| Harmonics according to IEEE519 | Harmonics <5% THDi |
| Mechanical dimensions ( W x H x D in mm) | Frame 5 : 290 x 922 x 323 up to 90 KW |

3.1.3 General specification for standard AC drives IP55

|  |  |
| --- | --- |
| Rated Input Voltage and Power range | Three phases power supply :  380V -15% 480V +10%, three-phase up to 315 KW |
| Rated Input Frequency | 50 Hz -5% to 60 Hz + 5%  For use with generators, the AC Drive shall operate from 40 to 72 Hz. |
| Protection degree | Wall mounting : IP55  Floor standing : IP54 |
| Cooling system | Heatsink |
| Harmonics according to IEC/EN 61000-3-12 | Harmonics <48% THDi |
| Mechanical dimensions ( W x H x D in mm) | Mechanical frames for wall mounting drives range from 0,75 to 90 KW in 380/480 Vac.  Frame 1 : 250 x 678 x 296 for standard drives up to 22 KW  Frame 2 : 290 x 910 x 340 for standard drives up to 45 KW  Frame 3 : 345 x 1250 x 375 for standard drives up to 90 KW  Mechanical frames for floor standing drives range from 110 to 315 KW in 380/480 Vac.  Frame FS1 : 400 x 2350 x 600 up to 160 KW  Frame FS2 : 600 x 2350 x 600 up to 315 KW |

3.1.4 General specification for standard AC drive systems:

|  |  |
| --- | --- |
| Rated Input Voltage and Power range | Three-phase supply up to 800 KW:  380...415 V +10% -15%  440V +10% -15%  480V +10% -15% ,  Three-phase supply up to 1,1MW:  500V +/-15% 50Hz  525V +10 /-15% 50Hz  600V +10 /-15% 60Hz  Three-phase supply up to 1,5MW:  690V +10% -15% 50 Hz and 60Hz |
| Rated Input Frequency | 50/60 Hz +/- 5 % |
| Protection degree | IP23 ,IP42 and NEMA/UL type 1  IP54 separate air-flow and NEMA/UL type 12 |
| Cooling system | Air cooled with forced ventilation |
| Harmonics according to IEC/EN 61000-3-12 | Harmonics <48% THDi |
| Mechanical dimensions ( W x H x D in mm ) | Mechanical frames for drive systems from 110KW to 800KW 400 V  Frame 1p : 400 x 2150 x 600/669 up to 160 KW  Frame 2p : 600 x 2150 x 600/669 up to 315 KW  Frame 3p : 800 x 2150 x 600/669 up to 500 KW  Frame 4p : 1200 x 2150 x 600/669 up to 630 KW  Frame 5p : 1400 x 2150 x 600/669 up to 800 KW  600/669 : without /with handle |

3.1.5 General specification for standard AC drives systems low harmonics:

|  |  |
| --- | --- |
| Rated Input Voltage and Power range | Three-phase supply up to 800 KW:  380...415 V +10% -15%  440V +10% -15%  480V +10% -15% ,  Three-phase supply up to 1,1MW:  500V +/-15% 50Hz  525V +10 /-15% 50Hz  600V +10 /-15% 60Hz  Three-phase supply up to 1,5MW:  690V +10% -15% 50 Hz and 60Hz |
| Rated Input Frequency | 50/60 Hz +/- 5 % |
| Protection degree | IP23 ,IP42 and NEMA/UL type 1  IP54 separate air-flow and NEMA/UL type 12 |
| Cooling system | Air cooled with forced ventilation |
| Harmonics according to IEEE519 | Harmonics <5% THDi ( at nominal load on sinusoidal main voltage )  Cos phi > 0,99 ( at full load range ) |
| Mechanical dimensions ( W x D x H in mm ) | Mechanical frames for drive systems low harmonics from 110KW to 800KW 400 V  Frame 1a : 600 x 2150 x 600/669 up to 160 KW  Frame 2a : 1000 x 2150 x 600/669 up to 315 KW  Frame 3a : 1600 x 2150 x 600/669 up to 500 KW  Frame 4a : 2000 x 2150 x 600/669 up to 630 KW  Frame 5a : 2600 x 2150 x 600/669 up to 800 KW  600/669 : without /with handle |
|  |  |

Operating conditions:

|  |  |  |
| --- | --- | --- |
| Harmonics mitigation at 100 % of the load according to IEC/EN 61000-3-12 | Below 48% of THDi for Standard drives and standard drive systems | |
| Harmonics mitigation at 80 % of the load . | Below 48% of THDi for Standard drives and standard drive systems | |
| Harmonics mitigation at 80 % of the load up to 100% according to IEEE519 | Below 5 % of THDi for low harmonic drives or low harmonic drive systems  Based on three levels technology | |
| Displacement Factor | 0.97 or better at nominal load  >0,99 lambda factor for low harmonics drives and drive systems. | |
| Efficiency | | ≥ 98 % at nominal load for standard drives, ≥ 97.5 % at nominal load for drive systems, ≥ 96 % at nominal load for low harmonic drives ≥ 95.5 % at nominal load for low harmonic drive systems |
| Output Voltage | 0 - UN, three-phase | |
| Acceleration/Deceleration Time | Adjustable duration, linear ramp, S shape ramp, with U or customised profile. | |
| Overload capability | * 110% of nominal current at normal duty for 1min/10min * 150% of nominal current at heavy duty for 1min/10min | |
| Load profile management | Dual load profiles management   * Normal duty at 1.1 In * Heavy duty at 1.5 In | |
| Operating ambient Temperature for standard drives | 3K5-3K6, from -15°C up to 60°C   * -15°C up to +50° C without derating * up to 60°C with derating on power stage | |
| Operating ambient Temperature for drive systems | 3K3,from 0 ... +40°C (-10...+40°C with option enclosure heating), up to 50°C with derating | |
| Storage ambient Temperature | 1K4 ,- 40°C up to +70 °C | |
| Maximum operating altitude ( 400 V range ) | Up to 4800 meters   * 1000 m without derating * 1000…4800 m with derating of the current * Limited to 2000 m for the “Corner Grounded” distribution network * Limited to 3000 m for the “IT” distribution network | |
| Mechanical protection according to static load | 3M1 | |
| Mechanical protection according to dynamic load | 3M3 | |
| Mechanical protection according to falling load | 3M2 | |
| Relative Humidity according to  IEC 60068-2-3 | 3K5-3K6  95 %, without condensation and dripping water | |
| Corrosion Level of the Cooling Air according to IEC 60721-3-3 | 3C3 | |
| Corrosion Level of the Chemical Gases according to IEC 60721-3-3 | 3C3 | |
| Biological level protection according to IEC 60721-3-3 | 3B1 | |
| Dust level protection according to IEC 60721-3-3 | 3S3 | |
| Vibration level according to IEC 60721-3-3 | 3M3 | |
| Shock level according to IEC 60721-3-3 | 3M3 | |
| Seismic level according to IBC ,ICC, ES AC156 | Level 1,5 for standard drives | |
| Electrostatic discharge according IEC/EN 61000-4-2 | Level 3 | |
| Radiated electromagnetic field according IEC/EN 61000-4-3 | Level 3 | |
| Fast transient burst according IEC/EN 61000-4-4 | Level 4 | |
| Surge immunity according to IEC/EN 61000-4-5 | Level 3 | |
| Conducted radio-frequency according to IEC/EN 61000-4-5 | Level 3 | |
| Ambient Pollution degree for standard drives  according to IEC/EN 61800-5-1  according to UL 508C | Degree 2, up to 15 KW (20 HP)  Degree 3, above 15 KW (20HP) | |
| Ambient Pollution degree for drive systems  according to IEC/EN 61800-5-1 | Degree 2 for IP23 and IP42  Degree 3 for IP54 | |
| EMC according to IEC/EN 61800-3 for standard drives | Up to 300 meters motor cable length   * Level C1 50 meters with accessory * Level C2 50 meters * Level C2 150 meters with accessory * Level C3 150 meters * Level C3 300 meters with accessory | |
| EMC according to IEC/EN 61800-3 for Drive Systems | Up to 450 meters motor cable length   * Level C3 150 meters * Level C4 450 meters with accessory | |
| Main Protections | Over current, short circuit between output phases, short circuit between output phases and ground, input phase loss, output phase loss, motor overload, overvoltage, under voltage, over speed, IGBT over temperature, heat sink over temperature | |
| Possible independent supply of control module | +24 Vdc | |
| Short circuit rating | Up to 100 kA Isc ( short circuit current )  50 kA on standard product and drive systems | |

* The AC Drive shall be able to give a 100 % output current continuously in the above specified conditions. In order to ensure that the drive can provide the required output current in the specified ambient conditions, the Manufacturer shall inform the required derating, if the ambient temperature given in the project specification is higher than 50 °C (40°C for Drive Systems) or if the installation altitude is more than 1000 m above the sea level. The derating factor shall be specified so that neither the lifetime of the AC drive nor the unit’s performance, overload capability included, nor the reliability of the AC Drive shall suffer.

## 3.2 AC Drive performance

3.2.1 Motor control type

- The AC Drive shall be able to offer different motors command laws in accordance with the applications needs and energy savings.

- VTS variable torque standard for asynchronous motor

- OTM optimized torque mode for asynchronous motor

- CTS constant torque standard for asynchronous motor

- UF5 custom load profile five points for asynchronous motor

- SYNU permanent magnet motor load for synchronous motor

- The AC Drive shall provide a speed range in the motor quadrant 1:100 in sensor less vector control

- The AC Drive shall provide an over current capability better than 110% of the rated motor current during 60s in normal duty mode each 10 minutes.

- The AC Drive shall provide an over current capability better than 150% of the rated motor current during 60s in heavy duty mode each 10 minutes.

- The AC Drive shall provide a speed accuracy ± 10% of the nominal slip of the motor in sensor less vector control

- The AC Drive shall provide a torque control accuracy ± 15% in sensor less vector control for AC motors

3.2.2 Voltage reflection superimposition suppression with motors compliant to IEC60034-25

* Unshielded motor cable length up to 300 meters no precaution is needed
* Unshielded motor cable length up to 500 meters a dV/dt filter is requested
* Unshielded motor cable length up to 1000 meters a Sinus filter is requested

3.2.3 Voltage reflection superimposition suppression with motors not compliant to IEC60034-25

* Unshielded motor cable length up to 50 meters a dV/dt filter is requested
* Unshielded motor cable length up to 1000 meters a Sinus filter is requested
* Using shielded cable reduce by two values above.

3.2.4 Bearings protection

The AC Drive shall be able to eliminate the current into the motor bearings

The AC Drive could run into a common mode to reduce current stress into motor cables

3.2.5 Filters and Chokes

- The AC Drive manufacturer shall provide DC chokes ,

- The AC Drive manufacturer shall provide AC chokes

- The AC Drive manufacturer shall provide filters based on passive or active technology to fit installation and machines EMC requirements.

## 3.3 Quality insurance and warranty

* Every AC Drive has to be tested functionally. The inverter part of the AC Drive or each inverter module at least has to be tested by running it with a motor at full nominal load. A test report of the tests made shall be delivered by the Frequency Converter Manufacturer on engineer’s request.

3.3.1 Warranty for standard drives

* 18 months parts warranty shall be provided on materials and workmanship from the delivery date.
* 24 months parts warranty shall be provided on materials and workmanship from the manufacturing date.
* 24 months parts warranty shall be provided on materials and workmanship from the delivery date for registered units.
* 30 months parts warranty shall be provided on materials and workmanship if commissioning is done by AC Drives manufacturer or delegated manufacturer’s partners.

3.3.2 Warranty for drive systems

* 12 months parts warranty shall be provided on materials and workmanship from the commissioning date.
* 18 months parts warranty shall be provided on materials and workmanship from the delivery date.
* 24 months parts warranty shall be provided on materials and workmanship if commissioning is done by AC Drives manufacturer or delegated manufacturer’s partners.

3.3.3 Warranty extension

* One or three years warranty extension shall be provided based as optional.

3.3.4 Services

* The AC Drive shall be compliant with the remote diagnostic capabilities provided by the manufacturer.
* The AC Drive shall provide a programmable accurate diagnostic sequence to reduce down time for maintenance. Diagnosis and accurate downsize the maintenance duration.
* The AC Drive shall provide embedded self-diagnostics dedicated for end-users
* The AC Drive shall provide embedded self-diagnostics dedicated for experts level.
* The AC Drive shall provide four configurable thresholds for end-users diagnostics.
* The AC Drive shall provide a dynamic QR code to enhance the diagnostics.
* The AC Drive shall provide a dynamic QR code for fast access to the customer care center.
* The AC Drive shall provide a dynamic QR code to reach the device documentation.
* The drive manufacturer shall provide a customer center for service all day worldwide.

3.3.5 Spare parts

* The AC Drive manufacturer shall provide spare for repairing with a worldwide support.
* The AC Drive manufacturer shall provide fast supply chain within 48 hours maximum with a worldwide support.

3.3.6 Commissioning

* After the commissioning of the AC Drive by the manufacturer, the engineering shall fill-up the “health record” of the device.

3.3.7 Double sourcing

* The AC Drive manufacturer shall provide double sourcing suppliers for each critical component.

3.3.8 Life cycle policy

* The AC Drive manufacturer shall provide a detailed program at each stage of the product life cycle.

3.3.9 Repair networking

* The AC Drive manufacturer shall provide a worldwide certified repair networking..

3.3.10 Cloud traceability

* The AC Drive manufacturer shall provide complete product traceability based on cloud applications.

## 3.4 Protections

* The AC Drive shall be UL 508C listed for use on distribution systems. The AC Drive has a coordinated short circuit rating designed to UL 508C and NEMA ICS 7.1 and listed on the nameplate. The AC Drive shall not create a hazard in the event of a short circuit at any point within the AC Drive when it is connected to a power source as specified on the nameplate and protected as specified in the instruction bulletin
* Upon power-up the AC Drive shall automatically test for valid operation of memory, option module, loss of analogue reference input, loss of communication, DC to DC power supply, control power and the pre-charge circuit.
* The Power Converter shall be protected against short circuits, between output phases and ground and the logic and analogue outputs.
* The AC drive shall have a minimum AC under voltage power loss ride-through of 200 msec.
* The AC drive shall have a selectable ride through function that will allow the logic to maintain control for a minimum of one second without faulting.
* The deceleration mode of the AC drive shall be programmable for normal and error conditions. The stop modes shall include freewheel stop, fast stop.
* Upon loss of the analogue process follower reference signal, the AC Drive shall error and/or operates at a user-defined speed set by a software programmed speed settings or last speed.
* The AC Drive shall integrate a protection against IGBT modules over-temperature that is different to the heat sink over-heat.
* The AC drive shall have solid state thermal protection that is UL Listed and meets UL 508C as a Class 20 overload protection and meets IEC 947.
* The AC drive shall have a motor thermal memory retention.
* The AC Drive should be able to protect the motor when PTC probes are connected.
* The AC Drive should be able to manage different types of probes such as PT100, PT1000, KTY.
* The AC drive should be able to limit the motor surge ( I dv/dt ) at twice the DC bus voltage
* The AC drive shall display all faults in plain text and help screens shall be available to guide the user in the troubleshooting. Codes are not acceptable.
* The AC drive shall display errors with QR codes to guide the user in the troubleshooting.
* The AC drive shall display a signal by LED near the connection point of the device when a hazardous voltage is present.

## 3.5 Safety

* The AC drive shall be integrated directly in the safety chain complying with IEC/EN 61508-1/2 SIL3.
* The AC drive shall be compliant with EN13849 Performance Level PL level ”e” .
* The AC drive shall be compliant with safety of machinery EN 954-1
* The AC drive shall integrate the “STO” (Safe Torque Off) double channels safety function which prohibits unintended equipment operation. The motor no longer produces torque.
* The AC drive shall be certified as conforming to these standards by a third part certification body such as TÜV NORD SYSTEMS GMBH & CO. KG.
* The AC drive manufacturer shall provide the certified schematics and the list of devices in order to comply with IEC/EN 60204-1 stopping category 0 and 1.
* The AC drive shall integrate the safety contacts in compliance with EN-81 13.2.2.3

## 3.6 Environmental compliance

* The materials used in the AC Drive shall be recyclable, non-toxic and flame retardant.
* The AC Drive manufacturer shall provide the carbon foot print of the devices.
* The AC Drive manufacturer shall demonstrate the Eco Design Concept of the device.
* The AC Drive shall be compliant with the waste and recycling concept (EOL).
* The AC Drive shall be compliant with the “Green” Premium label (REACH, RoHS-2, EOL, and PEP).

# 4. Enclosure and mounting

## 4.1 Standard drives IP21 or IP55

4.1.1 Mounting type for standard products

* wall mounting for standard products IP21 / UL type 1 up to 90 KW.
* wall mounting for standard products IP55 / UL type 12 up to 90 KW.
* push through mounting for standard products up to 90 KW
* floor mounting for standard products IP21 / UL type 1 from 110 to 315 KW
* side by side mounting without top cover
* vertical position ± 10°

4.1.2 Power ranges per frames( W x H x D ) IP21 with conduit box for standard products

Mechanical frames for wall mounting drives range from 0,75 to 160 KW in 380/480 Vac.

Frame 1 : 143 x 314 x 202 up to 5,5 KW

Frame 2 : 168 x 395 x 233 up to 11 KW

Frame 3 : 211 x 549 x 232 up to 22 KW

Frame 4 : 226 x 673 x 271 up to 45 KW

Frame 5 : 290 x 922 x 323 up to 90 KW

Frame 6 : 300 x 1155 x 375 up to 160 KW

Mechanical frames for floor standing drives range from 110 to 315 KW in 380/480 Vac.

Frame 1p : 400 x 2150 x 600 up to 160 KW

Frame 2p : 600 x 2150 x 600 up to 315 KW

4.1.3 Power ranges per frames( W x H x D ) IP55 for standard products

Mechanical frames for wall mounting drives range from 0,75 to 90 KW in 380/480 Vac IP55.

Frame 1 : 250 x 678 x 296 for standard drives up to 22 KW

Frame 2 : 290 x 910 x 340 for standard drives up to 45 KW

Frame 3 : 345 x 1250 x 375 for standard drives up to 90 KW

Mechanical frames for floor standing drives range from 110 to 315 KW in 380/480 Vac IP54.

Frame 1p : 400 x 2350 x 600 up to 160 KW

Frame 2p : 600 x 2350 x 600 up to 315 KW

## 4.2 Drive Systems

4.2.1Mounting type for drive systems

* Floor standing with a width starting at 400 mm.
* Floor standing with a common depth of 600/ 669 ( including door handle ) mm

4.2.2Power ranges per frames( W x H x D ) IP23 for drive systems

Mechanical frames for drive systems from 110KW to 800KW 400 V

Frame 1p : 400 x 2150 x 600/669 up to 160 KW

Frame 2p : 600 x 2150 x 600/669 up to 315 KW

Frame 3p : 800 x 2150 x 600/669 up to 500 KW

Frame 4p : 1200 x 2150 x 600/669 up to 630 KW

Frame 5p : 1400 x 2150 x 600/669 up to 800 KW

4.2.3Power ranges per frames( W x H x D ) IP54 for drive systems

Frame 1p : 400 x 2350 x 600/669 up to 160 KW

Frame 2p : 600 x 2350 x 600/669 up to 315 KW

Frame 3p : 800 x 2350 x 600/669 up to 500 KW

Frame 4p : 1200 x 2350 x 600/669 up to 630 KW

Frame 5p : 1400 x 2350 x 600/669 up to 800 KW

4.2.4 Enclosure design specs for drive systems

* Enclosure system Spacial SF in RAL 7035
* protection degree IP23 and IP54
* cables entry from bottom
* Graphic display terminal of the AC Drive shall be accessible for programming and controls with the main door closed.
* Maximum current in Normal duty (ND): 110 % for 60 s per 10 minutes
* Maximum current in Heavy duty (HD):150 % for 60 s per 10 minutes
* Opeating temperature : -10...+50 °C (below 0 °C with option enclosure heating, above +40 °C with derating)
* Forced cooling with separate air flows.

4.2.5 Content of the enclosure for drive systems

* frequency inverter including mains switch
* line reactor (< 48 % THDi)
* dv/dt filter
* mains and motor terminals
* Graphic display terminal IP65 on front face of enclosure
* Terminal mounting kit IP65.
* Pluggable control terminal.

4.2.6 Content of the enclosure for “pre-defined” drive systems ( engineering to order ETO ) .

The AC drives supplier shall be able to customize the drives systems by:

* Increased protection degree
* Enclosure plinth
* Connection enclosure cable from top
* Connection enclosure cable from bottom
* Enclosure lighting
* Enclosure heating
* Key switch
* Ethernet port on front door
* Logic and analog I/O card
* Relay output card
* Communication cards
* SIL 3 stop category
* SIL 3 stop category 1
* Voltage / current display
* Indication lamps on front door
* PTC relay
* PT100 relay
* dv/dt filter choke for long motor cables
* Motor heating
* Circuit breaker
* Under voltage coil for circuit breaker
* Motor for circuit breaker
* Mains ON/OFF via remote control

4.2.7 Content of the enclosure for “customized” drive systems (engineering to order ETO)

The AC drives supplier shall be able to customize the drives systems by :

* Different mains voltages(e.g. 440 V, 480 V)
* Multipulse supply (12-pulses)
* Design without main switch
* Increased short-circuit strength (100 kA)
* Air intake from back
* Differing enclosure colors
* Customized documentation
* Customized labelling
* Stronger or sea-proofed packaging

4.2.8 International standards compliance for drive systems

* Total harmonics distortion shall comply with IEC 61800-3-1
* RFI filter for second "industrial environment" C3 integrated
* Basic standard The devices are designed, built and tested on the basis of EN 61800-2, EN 61800-3, EN 61800-5-1 and EN 60204-1.
* EMC immunity According to EN 61800-3, second environment IEC 1000-4-2;IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6.
* EMC emission In accordance with product standard EN 61800-3, second environment, category C3
* Insulation Galvanic insulation of the control circuit in accordance with EN 61800-5-1 PELV (Protected Extra Low Voltage

# 5. User interface

5.1 General

The user interface shall be identical throughout the power range to avoid confusion.

5.2 Inputs and outputs

5.2.1 At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

* Analogue Inputs:
  + - * 3 x Programmable current input 0(4) - 20mA or 0 – 10V
      * 2 of analogue inputs may be used either with PTC, PT100, PT1000 or KTY84.
* Analogue Output:
  + - * 2 x Programmables analogues outputs 0 (4) - 20mA or 0–10V
* Logic inputs:
  + - * 6 x Programmable logic Inputs isolated from the mains
      * In accordance with IEC 61131-2
      * All logic inputs may be used either in sink or source
      * Two logic inputs may be used as pulse inputs up to 30 kHz.
* Safety input:
  + - * Two inputs are dedicated to the STO Safe Torque Off safety function
      * In accordance with IEC/EN 61508-1 SIL3.
* Relay Outputs:
  + - * 3x Programmable Digital outputs with a changeover dry contact
      * In accordance with IEC 61131-2.
* Reaction time: :
  + - * 2ms ± 0.5ms (except for the relays)
* All the control terminals shall be clearly marked.

5.2.2 It shall be possible to extend the number of inputs / outputs of the AC Drive up to :

* 12 logic inputs
* 5 analogue inputs
* 2 analogue outputs
* 1 logic outputs (open collector)
* 6 relays

5.2.3 At least, it shall be possible to assign the following functions to the analogue I/Os:

|  |  |
| --- | --- |
| Analogue input | Analogue outputs |
| Speed reference  Summing reference  Subtracting reference  Multiplying reference  PID feedback  Manual PID reference  PID speed reference  Forced local | Motor current  Motor frequency  Motor torque ((signed or unsigned)  Motor power  Motor voltage  Output frequency (signed or unsigned)  PID error  PID feedback  PID output  PID reference  Ramp output  signed ramp  Drive thermal state  Motor thermal state |

5.2.4 At least, it shall be possible to assign the following functions to the digital I/Os:

|  |  |
| --- | --- |
| **Logic input** | **Relay or logic outputs (open collector)** |
| Run  Forward  Reverse  Preset speeds  Reference switching  Ramp switching  Error reset  Error inhibition  PID regulation mode (auto)  PID speed regulation mode (manual)  PID integral reset  Preset PID reference  Sleep/wake-up  Activate sleep mode by flow detection  Analogue torque limitation activation  Torque reference sign  Command switching  Parameter sets selection  Fast stop  DC injection  Freewheel stop  + speed  - speed  External error  Pre Fluxing  Forced local  Current limitation activation  Output contactor feedback  Reference memorisation  Auto-tuning  Forced operation  Under load detection  Overload detection  Limiting low speed operating time  Switching frequency, noise reduction | Ready  Drive running  Frequency reference attained  Current attained  High speed attained  Drive error  Frequency threshold attained  Motor thermal state attained  Drive thermal state attained  Torque or current limitation attained  Output contactor command  Input contactor command  Current present  Power removed  Alarm Groups  Alarm (load slipping, 4-20mA loss, external error, probes, PID error, PID feedback, IGBT temperature, under voltage, drive temperature  Active configuration  Active parameter set  Active channel  DC bus charged  DC bus charging |

5.3 Communications

5.3.1 The AC drive shall provide as standard one embedded Modbus port and one embedded Ethernet Modbus TCP port.

5.3.2 The AC drive shall have the capability to host additional communication card. The following protocols shall be the minimum available:

* CanOpen daisy Chain, 2 ports, RJ45.
* CanOpen SUB-D, 1 port, SUB-D9.
* CanOpen Open terminals, 1 port, terminal 5points.
* Profibus DP V2, 1 port, SUB-D9.
* Profinet , 1 port , RJ45.
* DeviceNet , 1 port , , terminal 5points.
* Ethernet IP / modbus TCP, RJ45. Dual port.

5.3.3 The AC drive shall provide integration connectivity in automation and assets management tool

* DHCP protocol for Fast Device Replacement
* FDT/DTM compliance
* Ethernet dual port

5.3.4 The AC drive shall be compliant with command profile networking services:

* Drivecom profile (CANopen CiA 402)
* Drive profile (Profibus)
* I/O profile where the command is as simple as the wired logic
* ODVA profile

5.3.5 The speed command and reference may come from different control sources:

* I/O terminals
* Communication network
* Web server
* Remote graphic display terminal

5.3.6 Command module

* The control section of AC drive shall be supplied separately if necessary with 24Vdc, to keep the network communication always available even if the power supply is OFF.
* The AC drive behaviour shall remain programmable even during communication error.

5.3.7 The AC drive shall integrate an embedded web server

* The AC drive shall provide a Plug & play configuration
* The AC drive shall being commission without additional software
* The AC drive shall provide a Web server with native template to monitor the AC drive
* The AC drive shall provide a Web server with native template to diagnose the AC drive
* The AC drive shall provide a Web server with native template for energy savings dashboard
* The AC drive shall provide a Web server customizable without programmation tools.
* The AC drive shall provide a Web server designed with Responsive Web Design (RWD) mechanism.

5.3.8 The AC drive shall provide advanced Ethernet services

* The AC drive shall provide dialogue and networking management SNMP
* The AC drive shall provide a Clock synchronization via networking SNTP
* The AC drive shall be compliant with IP address management IPv6
* The AC drive shall provide a Modbus TCP server
* The AC drive shall provide an Ethernet IP address discriminator
* The AC drive shall be compliant with the Cyber security Management ISA Secure /Achilles level 2.

5.3.9 The AC drive shall provide maintenance functions

* The AC drive shall provide the Power Elapsed Time in order to manage the working profile.
* The AC drive shall provide the Life Cycle monitoring in order to inform about the warranty period.
* The AC drive shall provide different levels of diagnostics for customers and services departments.

5.4 Graphic display terminal

5.4.1 The AC drive shall provide a detachable graphic display terminal

* Keypad designed for harsh conditions IP65
* Keypad with a graphic display.
* Remote mounting shall be possible at a distance of 10m.
* The display should have a programmable back-light display.
* The display should have a coloured red back-light when an event occurs.
* The programming shall be able to operate in a multi-point connection.
* The displayed messages shall be plain text in 23 languages, including English, German, French, Italian, Spanish, Russian, Turkish and Chinese.
* Coded messages are not acceptable.

5.4.2 Man machine interface

* The AC drive shall provide a wheel button IP65 without mechanical inside to carry out the navigation in the menu and the parameter settings.
* The AC drive shall provide Led on front cover for status signalling.
* A “Simply Start “menu for fast and easy commissioning should be provided and parameter setting shall be easily accessible and user friendly with actual text messages and actual setting range.
* The AC drive shall provide a password protection to avoid unauthorized tampering with the set parameters.

5.4.3.1 Configuration Data transfer

* The programming terminal shall offer the possibility of memorizing and downloading configurations of the AC drives to save time during the commissioning, to save time for the fast device replacement (FDR) and to avoid mistakes.
* The programming terminal shall offer the possibility of loading and customizing additional languages.
* The AC drive shall provide Ethernet connectivity for FDR .
* The AC drive shall provide HMI features for FDR .

5.4.3.2 Firmware Data transfer

* The AC drive shall provide an Ethernet terminal connectivity to upgrade the firmware of the AC drives

5.4.4 The programming terminal shall offer a mini-usb port for mass storage or PC device connection.

5.4.5 The programming terminal shall offer the possibility to display QR code for diagnostic, maintenance and application tracking.

5.4.6 The mechanical mounting on the cabinet of the programming terminal should be done with a 22,5 mm hole.

5.4.7 The programming terminal shall be able to display the commercial reference of the AC drive , references of options , the software version , the serial number, MAC address, IP address.

5.4.8 The user shall be able to customize the man –machine interface:

* Creation of a user menu
* Customization of 15 parameters: name, scaling, unit
* Four programmable function keys shall be available for short cuts linked to application.

5.4.9 The programming terminal shall be able to display a chart relative to energy efficiency and energy management.

- Report in KW

- Daily, weekly, monthly report

- Trend base on variation /time

- All measurement precision must be below 5 % of deviation.

5.4.10 The programming terminal shall be able to display the “efficient” set point for pump based on pump characteristics.

5.4.11 The programming terminal shall be able to display the “pump monitoring” data.

5.4.12 The programming terminal shall be able to display the “efficiency board”.

* CO2 savings
* Savings viewer
* Return of Investment

5.4.13 The programming terminal shall be able to display any kind of internal settings used by the AC drive.

5.4.14 The AC Drive shall have self-diagnostic capabilities to display errors or warnings as they occur and be able to store at least 15 last errors into the error memory including.

5.4.15 The error memory shall be accessible by PC maintenance tools or web server with flash record for data logging expertise

5.5 Application programming

* The AC Drive shall have built-in macros configuration available in the Simply Start Menu, to allow selection of the range of pre-programmed control configurations.
* The AC Drive shall have a wizard to assist the configuration
* The AC Drive shall be able to store at least ten customer modified macro-configuration, to suit the specific application. It shall be possible to reset the parameter settings back to the original macro settings through the keypad.

5.5.1 Functions dedicated to pump applications

5.5.1.1 Pump Control & Monitoring Functions

* The AC Drive should be compliant with centrifugal pump characteristics and configurations.

* The AC Drive should provide a pump monitoring function in order to define data relevant for pump (acceleration, low speed, high speed...)
* The AC Drive should provide a Application Units function in order to define units used in applications

5.5.1.2 Pump Protection Functions

* The AC Drive should provide an Anti-Jam function in order to remove automatically clogging substances from the pump impellers.
* The AC Drive should provide a Pipe Cleaning function in order to start pump regularly to avoid sedimentation in pump impeller
* The AC Drive should provide a Cavitation Pump Protection
* The AC Drive should provide a Inlet protection in order to avoid system dry running system.
* The AC Drive should provide a Pump Cyclic Start Protection in order to protect of the pump against too many restarts in a dedicated time period.

5.5.2 Multi-pump functions

* The AC Drive should provide a Multi Pump Control
* The AC Drive should provide a Master/Slave function with floating master.

5.5.3 Application control functions

* The AC Drive should provide a Stop and Go function in order to reduce consumption of AC drive in case of pump doesn't work
* The AC Drive should provide a pulse input in order to connect a flow meter.
* The AC Drive should provide a Process control (PID) function in order to maintain a process at a given pressure or flow reference in the water network.
* The AC Drive should provide a Flow limitation function in order to allow limiting the consumption of water especially in countries with local regulations.
* The AC Drive should provide a Friction loss compensation function in order to compensate pressure losses over pipes due to friction.
* The AC Drive should provide a Pipe Fill function in order to manage a smooth control during pipe filling also prevents hammer effect.
* The AC Drive should provide a Sleep wake-up function in order to manage periods of the application where water demand is low and where it is not needed to keep main pumps running.
* The AC Drive should provide a Jockey pump control function in order to start a jockey pump, during sleep period, to maintain emergency service pressure or answer a low water demand.
* The AC Drive should provide a Sensor management in order to define how will be used drive inputs to manage Pressure sensor or flow sensor

5.5.4 Application protection functions

* The AC Drive should provide a High flow protection function in order to preserve the pipe or detect running outside normal working area
* The AC Drive should provide an Outlet pressure protection function in order to fix minimum and maximum pressure.

5.5.5 Pump monitoring

* The AC Drive should provide a Storage of the pump characteristics
* The AC Drive should provide a best efficiency points (BEP) function in order to run in optimum conditions and detect deviation from this point.

5.5.6 Advanced functions

* The AC Drive should provide a Scheduler based on Real Time Clock.

5.6 PC Tools for configuration and monitoring

5.6.1 Principles and services

* The AC Drive Supplier shall have PC based software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.
* The PC-tools might be connected to the drive by wired or wireless connection.

5.7 Status signals

* The AC Drives must provide LED (electroluminescent diode) display to figure out the status of the AC drive at any time. With or without keypad terminal.
* The AC Drives must provide LED display for communication, command order, power supply and safety status.

# 6. AC drive specifications

The AC Drives must provide the following functions:

6.1 Drive protection function

6.1.1 The AC Drive should provide an IGBT protection

* The AC Drive should provide a IGBT check up sequence
* The AC Drive should provide a IGBT over-heat protection

6.1.2 The AC Drive should provide a Drive Current protection

* The AC Drive should provide a Phase short circuit protection
* The AC Drive should provide a Ground protection
* The AC Drive should provide a Over-current protection

6.1.3 The AC Drive should provide a Drive Voltage error protection

* The AC Drive should provide a Mains over-voltage protection
* The AC Drive should provide a Mains under-voltage protection
* The AC Drive should provide a DC Bus over-voltage protection
* The AC Drive should provide a DC Bus pre-charge protection

6.1.4 The AC Drive should provide a Drive Thermal protection

* The AC Drive should provide a Drive over-heat protection
* The AC Drive should provide a FAN management
* The AC Drive should provide a Switching Frequency

6.1.5 The AC Drive should provide Drive internal error detection

* The AC Drive should provide a Internal error protection
* The AC Drive should provide a Storage error protection

6.2 The AC Drive should provide a Motor & Application protection function

6.2.1 The AC Drive should provide a Motor protection function

* The AC Drive should provide a Motor output phase detection
* The AC Drive should provide a Motor surge voltage
* The AC Drive should provide a Motor over load detection
* The AC Drive should provide a Motor stall protection

6.2.2 The AC Drive should provide a Application protection function

* The AC Drive should provide a Catch on fly function
* The AC Drive should provide a Mains input phase lost protection
* The AC Drive should provide a Current limitation
* The AC Drive should provide a Power limitation
* The AC Drive should provide a Reverse inhibition
* The AC Drive should provide a Under-load protection
* The AC Drive should provide a Over-load protection
* The AC Drive should provide a External error
* The AC Drive should provide a AI lost management
* The AC Drive should provide a thermal Sensor management
* The AC Drive should provide a ABS protection
* The AC Drive should provide a PI State checking
* The AC Drive should provide a Customer application event

6.3 Motor Control Function Description

6.3.1 The AC Drive should provide a SRS139.1 Motor Control laws for induction machine and permanent magnet machine.

6.3.2 The AC Drive should provide SRS139.2 Motor Parameters compliant with:

* Asynchronous motor
* Permanent synchronous motor
* Motor parameter tune function
* PM motor angle setting function

6.3.3 SRS139.3 Motor Control performance

* The AC Drive should provide an Auto-tuning modes without motor rotation

6.3.4 The AC Drive should provide a SRS139.4 Motor control function  compliant with:

* Uncontrolled Down Stream Contactor function
* Sinus Filter

6.4.2.1 The AC Drive should provide a Command and reference channels compliant with:

* Mixed mode
* Command switching function
* Reference switching function
* Forced local function
* 2 /3 wires function

6.4.2.2 The AC Drive should provide a Speed set-point function compliant with:

* Maximum output frequency function
* Low and High speed scaling and limitation function
* Speed summing references function
* Preset-speed references function
* Up-Down speed references
* Jump frequency

6.4.2.3 The AC Drive should provide a Stop function compliant with:

* Freewheel stop
* Stop function
* Stop by DC injection at motor stop detection
* Stop by DC injection by Logic Input
* Stop on prolonged speed
* Error stop
* Controlled Stop on power loss

6.4.2.4 The AC Drive should provide a Ramp generator function compliant with:

* Ramp type
* Ramp Deceleration adaptation
* Ramp switching

6.4.2.6 The AC Drive should provide Generic protection.

- The AC Drive should provide Thermal sensors protection function compliant with PTC probes.

* The AC Drive should provide Thermal sensors protection function compliant with PT100 probes. Two wires as basic and three wires with I/O extension option card.
* The AC Drive should provide Thermal sensors protection function compliant with PT1000 probes. Two wires as basic and three wires with I/O extension option card.
* The AC Drive should provide Thermal sensors protection function compliant with KTY84 probes.
* The AC Drive should be compliant with Customer Application Event in order to manage programmable alarms and alarms groups.
* The AC Drive should provide function to reduce the voltage surges in case of long motor cables.
* The AC Drive should provide a Reversal Inhibition function in order to avoid reversing the direction of the pump.
* The AC Drive should provide an embedded dv/dt filter for ratings above 160 KW.
* The AC Drive should provide a mechanism to reduce the leakage current and protect motor.

6.5 The AC Drive should provide Commissioning features

* The AC Drive should be compliant with the management of an Output contactor management.

6.6 Monitoring data

6.6.1 The AC Drive should provide SRS141.1 Motor monitoring data

* Motor current
* Motor frequency
* Output power
* Motor thermal state
* Reference frequency

6.6.2 The AC Drive should provide a SRS141.2 Drive monitoring data

* Drive thermal state
* Mains Voltage
* DC Bus Voltage
* Status function

6.7 The AC Drive should provide an Energy management

* The AC Drive should provide a Data logging function in order to keep files ready for maintenance or user.
* The AC Drive should provide information related to the instantaneous consumption of the machine
* The AC Drive should provide information related to the evolution of machine consumption during the time.
* The AC Drive should provide information related to Energy management through different channels such as : Web Server ,Keypad, Facet for Scada architecture ,communication networks.
* SRS142.1 The AC Drive should provide a Real Time Clock management with embedded battery.
* powermeasurementpo The AC Drive should provide output power estimation below 5 % of accuracy.

6.8 The AC Drive should provide a Communication function

6.8.1 The AC Drive should provide a SRS143.1 Embedded Field-buses

6.8.1.1 The AC Drive should provide a MIR137 Modbus

* The AC Drive should provide Modbus field-bus
* The AC Drive should provide Communication scanner
* The AC Drive should provide Modbus error management

6.8.1.2 The AC Drive should provide a MIR138 Ethernet TCP connection

* The AC Drive should provide a Cyber Security management
* The AC Drive should provide a Ethernet scanner
* The AC Drive should provide a Ethernet error management
* MIR139

6.8.2 The AC Drive should provide SRS143.3 Local & Network identification

* The AC Drive should provide a IP address accessible by web server
* The AC Drive should provide a Drive address accessible by web server

6.8.3 The AC Drive should provide a SRS143.3 WIFI connectivity without Ethernet network.

* The AC drive should provide an automatic detection of all Schneider Products, even Legacy using transparent Discovery mechanism
* The AC Drive should provide a simply start display of embedded Schneider Devices web server.

6.9 The AC Drive should provide a Files & Configuration management

* The AC Drive should provide a Upload and download of drives configurations

6.9.1 The AC Drive should provide a SRS144.1 Configuration management

* The AC Drive should provide a Configuration management
* The AC Drive should provide a Configuration error
* The AC Drive should provide a Drive configuration
* The AC Drive should provide a Configuration transfer

6.9.2 The AC Drive should provide a SRS144.2 Parameter management

* The AC Drive should provide a Parameter attributes
* The AC Drive should provide a Parameter visibility
* The AC Drive should provide a Parameter switching

6.9.3 The AC Drive should provide a SRS144.3 Password

* The AC Drive should provide a Parameter protection
* The AC Drive should provide a Password

6.9.4 The AC Drive should provide a SRS144.4 Customization

* The AC Drive should provide a Parameter customization
* The AC Drive should provide a Customer unit for machine speed
* SRS144.5 The AC Drive should provide a Memorization management

6.9.5 Firmware update

* The AC Drive should provide a digital process for firmware loading or updating.

# 7. Environmental effects

7.1 Harmonic Distortion

Note to specifier : Guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", which suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers. Collectively, all facility loads and the building electrical distribution network determines the harmonic levels at the user & electric utility interface. The Electrical Power Research Institute (EPRI) recognizes the ‘Point of Common Coupling’ or PCC as the interface between user and electric utility (energy meter) in the electrical distribution network. The AC Drives manufacturer can provide calculations through computer modeling, specific to the installation, showing total harmonic voltage distortion. Contractor to provide one line diagram drawings to supplier including transformer impedance. The AC Drive manufacturer needs this information.

7.1.1 Harmonic distortion analysis shall be performed and priced as a separate line item by the AC Drive manufacturer based upon documentation supplied by the contractor. The documentation shall consist of one-line diagrams, distribution transformer information (kVA, %Z, and X/R ratio) and emergency standby generator performance specifications. The harmonic distortion analysis report shall be part of the approval drawing process, submitted to the engineer for approval.

7.1.2 If the calculations determine that harmonic distortion values are higher than the voltage and current values specified, the drive manufacturer shall provide solutions to comply with:

- IEC 61800-3-12

- IEEE 519-1992 guidelines

7.1.3 The AC drive manufacturer should provide a software tool to determine the harmonic mitigation level of the device.

7.1.4 The AC drive manufacturer should provide a software tool to determine the harmonic mitigation level at the connection point of power network supply.

7.2 The AC drive manufacturer should be compliant with regional EMC Regulations and Compatibility from UL/CSA / RCM / EAC.

7.2.1 The supplied AC Drive shall have built-in EMC filters and carry the CE marking indicating that they comply with the essential requirements of the relevant EU directives. The AC Drives shall meet the requirements set in EN 61800-3 for Industrial Low-Voltage Networks.

7.2.2 A detailed description and other directions to ensure the EMC Compatibility during the installation of the AC DRIVE and associated field cables and connections, shall be given by the Supplier to comply with the EMC Directives. The Contractor shall follow the directions during installation, in order to achieve attenuation of the RFI.

7.2.3 The supplied AC Drives shall carry the RCM mark indicating that they comply with the essential requirements of the relevant Australian directives

7.2.4 The supplied AC Drives shall carry the UL mark indicating that they comply with the essential requirements of the relevant American directives.

7.2.5 The supplied AC Drives shall carry the CSA mark indicating that they comply with the essential requirements of the relevant Canadian directives.

7.2.6 The supplied AC Drives shall carry the EAC mark indicating that they comply with the essential requirements of the relevant Customs Union Technical Regulation ( Russia, Byelorussia, Kazakhstan )

# 8. Documents

8.1 Documents to be delivered with the quotation

The following documents have to be delivered with the quotation:

Drawings: Dimension drawings, control connection diagrams and CAD drawings 2D and 3 D models for standard unit, E-plan drawings.

If order specific engineering is required, the engineered drawings have to be sent for approval before the delivery.

8.2 Documents to be delivered with the delivery

The following documents have to be delivered with the delivery:

Manuals: Getting started manual included into the packaging.

Programming and installation manual shall be downloadable on web site. CD Rom is delivered with Drive Systems

Drawing: Dimension drawings, control connection diagram shall be downloadable on web site.

Quality assurance: Test reports shall be downloadable on web site

On request: Certifications to standardization shall be downloadable on web site

Environmental aspect: The AC Drive Manufacturer shall also present documents to prove that impact on environment has been taken into account during all the life cycle of the product (manufacturing, distribution, use, end of life), the software used to measure impact shall be E.I.M.E.or equivalent. This documentation shall be downloadable on web site