

EU RO Mutual Recognition Technical Requirements

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| ELECTRICAL ACTUATOR FOR VALVES | Version | 0.2 |
| | Adoption Date | 1 April 2016 |
| | Application Date | 1 October 2016 |
| | Tier | 3 |
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1. PRODUCT DESCRIPTION

1.1 General description of the product

Electrical valve actuator is an electromechanical device used for on-off and control valves.

1.2 Application limitations

- For the purpose of this technical requirement, the part-turn, multi-turn and linear actuators shall be considered;
- This technical requirement is not applicable for solenoid actuators, electro-hydraulic actuators and electric actuators ,which are integral in the design of valves;
- This technical requirement applies to the electric valves actuator`s hardware only. Firmware, application software is subject to EU RO requirements as well compliance with UR E22.

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1.3 Intended use

To drive the valves through their fully open to the fully closed position, to drive the valves occasionally, frequently or continuously to any position between fully open and fully closed at the following systems:

- a) Remotely controlled ballast and bilge systems;
- b) Remotely controlled heel and trim systems;
- c) Remotely controlled cargo systems.

Other systems, at the EU ROs request, associated with provision of the basic functionality and safety of the ships.

1.4 System context

Refer to the item 1.3 above.

2. DESIGN EVALUATION

2.a Engineering evaluation requirements

2.a.i. Technical Requirements

The electric valve actuators design depends on the sea service condition, duty and action as detailed below:

- a) Part turn actuator shall be designed to transmit torque to the valve for less than one revolution. It does not have to be capable of withstanding thrust;
- b) Multi- turn actuator shall be designed to transmit torque to the valve or gearbox for at least one revolution. It may be capable of withstanding thrust. Linear actuator is designed to transmit thrust to the valve for a defined linear stroke;
- c) On loss of external power, the actuator should remain in the position achieved before loss of power or to be able to operate the valve to a predefined safe position;
- d) As a general rule, actuators shall be furnished with a manual override to open or close the valve in the event of loss of electric power, due-to safety reasons and for operational purposes (if required);

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- e) The manual override shall have priority over remote control. Fail safe direction shall be clearly and permanently indicated at the actuator housing. Unless otherwise specified, the manual operating element shall be rotated clockwise to close the valve;
- f) Electric valve actuator shall be provided with indicators for the fully open and fully closed positions;
- g) Electrical valve actuators shall be capable of being tested during normal operation;
- h) Setting components of electric valve actuators shall be protected against spontaneous changes of setting. Such protection shall not preclude the possibility of adjustment;
- i) The electrical valve actuators shall be equipped with a torque overload measurement/ limiting device, travel limiting device and overheating device;
- j) The electrical actuators shall include the means of de-energizing the motor in case of reaching set open and close position;
- k) When required, part-turn and liner electrical actuators shall be supplied with two integral mechanical end stops, typically one for each end position;
- l) Reliable operation of electrical valve actuators shall be ensured under the following ambient temperature conditions:
 - **0 °C to +55 °C in enclosed spaces, -25 °C to + 45 °C on open deck.**
 - **No damage to electrical and electronic parts shall be caused by temperatures up to +70 °C.**
- m) Reliable operation of electrical valve actuators shall be ensured at relative air humidity up to 100%;
- n) - Reliable operation of electrical valve actuators shall be ensured at vibrations having a frequency of 2 to 100 Hz, namely, with shift amplitude of ± 1 mm where the vibration frequency is between 2 and 13,2 Hz, and with an acceleration of $\pm 0,7$ g where the vibration frequency is between 13,2 and 100 Hz, for severe vibration conditions such as, e.g. on diesel engines, air compressors, etc. the following requirements should be applied: with shift amplitude of ± 1.6 mm where the vibration frequency is between 2.0 to 25Hz, and with an acceleration of $\pm 4,0$ g where the vibration frequency is between 25.0 and 100Hz. More severe conditions may exist for example on exhaust manifolds of diesel engines

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especially for medium and high speed engines. Values may be required to be in these case 40Hz to 2000Hz - acceleration $\pm 10.0g$ at 600 °C, duration 90min.

- o) Reliable operation electrical valve actuators shall be ensured at long-term heel up to 22,5° and at motions of 22,5° with a period of (8 ± 1) s: **See Table 2.1:**

Table 2.1 - Angles of Inclination

| Static inclination | Dynamic inclination |
|----------------------|----------------------|
| 22.5° ⁽¹⁾ | 22.5° ⁽¹⁾ |

Note 1: In ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk, emergency power supplies are to remain operable with the ship flooded to a final athwartships inclination up to a maximum of 30°. In this case the test level has to be named on the certificate.

- p) The protective enclosure of electrical valve actuators shall be chosen in accordance with IEC 60529 and has to be at least IP 65. For open deck installation the requirements of UR E 10 refer salt mist test should be applied and the IP66 or higher is required;
- q) Electrical valve actuators shall operate reliably in case of deviation of the power parameters from nominal values: **See Table 2.2.**

Table 2.2 Voltage and frequency Fluctuation

(a) Voltage and frequency fluctuations for a.c. distribution systems ^(Note 1)

| type of fluctuation | Fluctuation ^(Note 4) | |
|---------------------|---------------------------------|-----------------------------|
| | Permanent | Transient |
| Voltage | +10% , -10% | $\pm 20\%$ (1.5 s duration) |
| Frequency | $\pm 5\%$ | $\pm 10\%$ (5 s duration) |

(b) Voltage fluctuations for d.c. distribution systems ^(Note 2)

| Type of fluctuation | Fluctuation ^(Note 4) |
|--------------------------------------|---------------------------------|
| Voltage fluctuation (Permanent) | $\pm 10\%$ |
| Voltage cyclic fluctuation deviation | 5% |
| Voltage ripple | 10% |

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(c) Voltage fluctuations for battery systems

| Systems | Fluctuation ^(Note 4) |
|---|---------------------------------|
| Components connected to the battery during charging ^(Note 3) | +30%, -25% |
| Components not connected to the battery during charging | +20%, -25% |
| All components | ±25% (2 s duration) |

Note 1: A.C. distribution systems mean a.c. generator circuits and a.c. power circuits produced by inverters.

Note 2: D.C. distribution systems mean d.c. generator circuits and d.c. power circuits produced by converters.

Note 3: Different voltage fluctuations as determined by charging and discharging characteristics, including voltage ripples from the charging devices, may be considered.

Note 4: The numerical values given in the table, excluding those values for time, mean percentages of rated values.

- r) Electrical valve actuators supplied from accumulator batteries shall operate reliably with the following voltage variations from the nominal value:
- **from +30 to –25 per cent for the equipment, which is not disconnected from the battery during battery charging;**
 - **from + 20 to –25 per cent for the equipment, which is disconnected from the battery during battery charging.**
- s) Provision shall be made to ensure the electromagnetic compatibility of the electrical valve actuators is in order to comply with requirements of IACS UR E10:
See Table 2.3.

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Table 2.3 - Testing condition and method IACS UR E10 rev.5

| NO. | TEST | PROCEDURE ACC. TO ¹ : | TEST PARAMETERS | OTHER INFORMATION |
|--|-------------------------------|--|--|---|
| * indicates the testing procedure which is normally to be applied. However, equivalent testing procedure may be accepted by the RO provided that the requirements stated in the other columns are fulfilled. | | | | |
| 1. | Visual inspection | - | - | conformance to drawings, design data. |
| 2. | Performance test | Manufacturer performance test programme based upon specification and relevant Rule requirements. | - standard atmosphere conditions - temperature: 25°C ± 10°C - relative humidity: 60% ± 30% - air pressure: 96 KPa ± 10KPa | - confirmation that operation is in accordance with the requirements specified for particular system or equipment; - checking of self-monitoring features; - checking of specified protection against an access to the memory; - checking against effect of unerroneous use of control elements in the case of computer systems. |
| 3. | External power supply failure | - | - 3 interruptions during 5 minutes; - switching-off time 30 s each case | - The time of 5 minutes may be exceeded if the equipment under test needs a longer time for start up, e.g. booting sequence - For equipment which requires booting, one additional power supply interruption during booting to be performed Verification of: |

¹ Note: indicates the testing procedure which is normally to be applied. However, equivalent testing procedure may be accepted by the individual Society provided that the Unified Requirements stated in the other columns are fulfilled.

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|------------------------------|--|----------------------------------|--|-------------------|-------------------------------|---------------------------------|---|----|----|---|----|----|---|-----|----|---|-----|----|--|---------------------------|--------------------------|---|-----|-----|---|-----|-----|------------------------------|-------|--------------------------|----|----------------|-----|---|
| 4. | Power supply variations a) electric b) pneumatic and hydraulic | - | AC SUPPLY <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 15%;">Combination</th> <th style="width: 35%;">Voltage variation permanent %</th> <th style="width: 50%;">Frequency variation permanent %</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">+6</td> <td style="text-align: center;">+5</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">+6</td> <td style="text-align: center;">-5</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">-10</td> <td style="text-align: center;">-5</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">-10</td> <td style="text-align: center;">+5</td> </tr> <tr> <td></td> <td style="text-align: center;">voltage transient 1,5 s %</td> <td style="text-align: center;">frequency transient 5s %</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">+20</td> <td style="text-align: center;">+10</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">-20</td> <td style="text-align: center;">-10</td> </tr> </tbody> </table> DC SUPPLY <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tbody> <tr> <td style="width: 70%;">Voltage tolerance Continuous</td> <td style="text-align: center;">± 10%</td> </tr> <tr> <td>Voltage cyclic variation</td> <td style="text-align: center;">5%</td> </tr> <tr> <td>Voltage ripple</td> <td style="text-align: center;">10%</td> </tr> </tbody> </table> <p style="margin-top: 10px;"> Electric battery supply: – +30% to –25% for equipment connected to charging battery or as determined by the charging/discharging characteristics, including ripple voltage from the charging device; – +20% to –25% for equipment not connected to the battery during charging. Pressure: ±20% Duration: 15 minutes </p> | Combination | Voltage variation permanent % | Frequency variation permanent % | 1 | +6 | +5 | 2 | +6 | -5 | 3 | -10 | -5 | 4 | -10 | +5 | | voltage transient 1,5 s % | frequency transient 5s % | 5 | +20 | +10 | 6 | -20 | -10 | Voltage tolerance Continuous | ± 10% | Voltage cyclic variation | 5% | Voltage ripple | 10% | – equipment behavior upon loss and restoration of supply; – possible corruption of programme or data held in programmable electronic systems, where applicable |
| Combination | Voltage variation permanent % | Frequency variation permanent % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | +6 | +5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | +6 | -5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | -10 | -5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | -10 | +5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | voltage transient 1,5 s % | frequency transient 5s % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | +20 | +10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | -20 | -10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage tolerance Continuous | ± 10% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage cyclic variation | 5% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage ripple | 10% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| 5. | Dry heat | IEC Publication 60068-2-2 | Temperature: 55° ± 2°C Duration: 16 hours or Temperature: 70°C ± 2°C Duration: 2 hours (see note 1) | <ul style="list-style-type: none"> – equipment operating during conditioning and testing; – functional test during the last hour at the test temperature; – For equipment specified for increased temperature the dry heat test is to be conducted at the agreed test temperature and duration. |
| 6. | Damp heat | IEC Publication 60068-2-30 test Db | Temperature: 55°C Humidity: 95% Duration: 2 cycles 2 x (12 + 12 hours) | <ul style="list-style-type: none"> – measurement of insulation resistance before test; – The test shall start with 25°C±3°C and at least 95% humidity ☐ equipment operating during the complete first cycle and switched off during second cycle except for functional test; ☐ functional test during the first 2 hours of the first cycle at the test temperature and during the last 2 hours of the second cycle at the test temperature; ☐ recovery at standard atmosphere conditions; ☐ insulation resistance measurements and performance test. |

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| 7. | Vibration | IEC Publication 60068-2-6 Test Fc | <p>2²₀ Hz to 13.2 Hz – amplitude ±1mm 13.2 Hz to 100 Hz – acceleration±0.7g For severe vibration conditions such as, e.g. on diesel engines, air compressors, etc.:</p> <p>2.0 Hz to 25 Hz – amplitude ±1.6 mm 25.0 Hz to 100 Hz – acceleration±4.0g</p> <p>Note: More severe conditions may exist for example on exhaust manifolds or fuel oil injection systems of diesel engines. For equipment specified for increased vibration levels the vibration test is to be conducted at the agreed vibration level, frequency range and duration Values may be required to be in these cases 40 Hz to 2000 Hz – acceleration ± 10.0g at 600°C, duration 90 min.</p> | <ul style="list-style-type: none"> – duration in case of no resonance condition 90 minutes at 30 Hz; – duration at each resonance frequency at which Q≥ 2 is recorded – 90 minutes; – during the vibration test, functional tests are to be carried out; – tests to be carried out in three mutually perpendicular planes; ☒ where sweep test is to be carried out instead of the discrete frequency test and a number of resonant frequencies is detected close to each other duration of the test is to be 120 min. Sweep over a restricted frequency range between 0.8 and 1.2 times the critical frequencies can be used where appropriate. Note: Critical frequency is a frequency at which the equipment being tested may exhibit: <ul style="list-style-type: none"> - malfunction and/or performance deterioration; - mechanical resonances and/or other response effects occur, e.g. chatter |

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| 8. | Inclination | Publication IEC 60092-504 | <p>Static 22.5°</p> <p>Dynamic 22.5°</p> | <p>a) inclined to the vertical at an angle of at least 22.5°</p> <p>b) inclined to at least 22.5° on the other side of the vertical and in the same plane as in (a),</p> <p>c) inclined to the vertical at an angle of at least 22.5° in plane at right angles to that used in (a),</p> <p>d) inclined to at least 22.5° on the other side of the vertical and in the same plane as in (c).</p> <p>Note: The period of testing in each position should be sufficient to fully evaluate the behaviour of the equipment.</p> <p>Using the directions defined in a) to d) above, the equipment is to be rolled to an angle of 22.5° each side of the vertical with a period of 10 seconds. The test in each direction is to be carried out for not less than 15 minutes</p> <p>On ships for the carriage of liquefied gases and chemicals, the emergency power supply is to remain operational with the ship flooded up to a maximum final athwart ship inclination of 30°.</p> <p>Note: These inclination tests are normally not required for</p> |

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|-----------------------------|-----------------------|----------------------------------|---|---------------------------------|---------------------|----------------------------|--|-------------|------------|---------|--------------------|----|---|---------|-----|-----|----|--|
| | | | | equipment with no moving parts. | | | | | | | | | | | | | | |
| 9. | Insulation resistance | | <table border="1"> <thead> <tr> <th rowspan="2">Rated supply voltage Un (V)</th> <th rowspan="2">Test voltage Un (V)</th> <th colspan="2">Min. insulation resistance</th> </tr> <tr> <th>before test</th> <th>after test</th> </tr> </thead> <tbody> <tr> <td>Un ≤ 65</td> <td>2 x Un min. 24V</td> <td>10</td> <td>1</td> </tr> <tr> <td>Un > 65</td> <td>500</td> <td>100</td> <td>10</td> </tr> </tbody> </table> | Rated supply voltage Un (V) | Test voltage Un (V) | Min. insulation resistance | | before test | after test | Un ≤ 65 | 2 x Un min. 24V | 10 | 1 | Un > 65 | 500 | 100 | 10 | <ul style="list-style-type: none"> – For high voltage equipment, reference is made to IACS UR E11. – insulation resistance test is to be carried out before and after: damp heat test, cold test, salt mist test, and high voltage test; – between all phases and earth; and where appropriate, between the phases. <p>Note: Certain components e.g. for EMC protection may be required to be disconnected for this test.</p> |
| Rated supply voltage Un (V) | Test voltage Un (V) | Min. insulation resistance | | | | | | | | | | | | | | | | |
| | | before test | after test | | | | | | | | | | | | | | | |
| Un ≤ 65 | 2 x Un min. 24V | 10 | 1 | | | | | | | | | | | | | | | |
| Un > 65 | 500 | 100 | 10 | | | | | | | | | | | | | | | |

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| 10. | High voltage | | <table border="1"> <tr> <td>Rated voltage Un (V)</td> <td>Test voltage (A.C. voltage 50 or 60 Hz) (V)</td> </tr> <tr> <td>Up to 65</td> <td>2 x Un + 500</td> </tr> <tr> <td>66 to 250</td> <td>1500</td> </tr> <tr> <td>251 to 500</td> <td>2000</td> </tr> <tr> <td>501 to 690</td> <td>2500</td> </tr> </table> | Rated voltage Un (V) | Test voltage (A.C. voltage 50 or 60 Hz) (V) | Up to 65 | 2 x Un + 500 | 66 to 250 | 1500 | 251 to 500 | 2000 | 501 to 690 | 2500 | <ul style="list-style-type: none"> - For high voltage equipment, reference is made to IACS UR E11. - separate circuits are to be tested against each other and all circuits connected with each other tested against earth; - printed circuits with electronic components may be removed during the test; - period of application of the test voltage: 1 minute |
| Rated voltage Un (V) | Test voltage (A.C. voltage 50 or 60 Hz) (V) | | | | | | | | | | | | | |
| Up to 65 | 2 x Un + 500 | | | | | | | | | | | | | |
| 66 to 250 | 1500 | | | | | | | | | | | | | |
| 251 to 500 | 2000 | | | | | | | | | | | | | |
| 501 to 690 | 2500 | | | | | | | | | | | | | |
| 11. | Cold | IEC Publication 60068-2-1 | Temperature: +5°C ± 3°C Duration: 2 hours or Temperature: -25°C ± 3°C Duration: 2 hours (see note 2) | <ul style="list-style-type: none"> - initial measurement of insulation resistance; - equipment not operating during conditioning and testing except for functional test; - functional test during the last hour at the test temperature; - insulation resistance measurement and the functional test after recovery | | | | | | | | | | |

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| 12. | Salt mist | IEC Publication 60068-2-52 Test Kb | Four spraying periods with a storage of 7 days after each. | <ul style="list-style-type: none"> - initial measurement of insulation resistance and initial functional test; - equipment not operating during conditioning; - functional test on the 7th day of each storage period; - insulation resistance measurement and performance test 4 to 6h after recovery. (see Note 3) On completion of exposure, the equipment shall be examined to verify that deterioration or corrosion (if any) is superficial in nature. |
| 13. | Electrostatic discharge | IEC 61000-4-2 | Contact discharge: 6kV Air discharge: 8kV Interval between single discharges: 1 sec. No. of pulses: 10 per polarity According to level 3 severity standard. | <ul style="list-style-type: none"> - to simulate electrostatic discharge as may occur when persons touch the appliance; - the test is to be confined to the points and surfaces that can normally be reached by the operator; - Performance Criterion B (See Note 4). |
| 14. | Electromagnetic field | IEC 61000-4-3 | Frequency range: 80 MHz to 2 GHz Modulation**: 80% AM at 1000Hz Field strength: 10V/m Frequency sweep rate: $\leq 1.5 \times 10^{-3}$ decades/s (or 1%/3 sec) According to level 3 severity standard | <ul style="list-style-type: none"> - to simulate electromagnetic fields radiated by different transmitters; - the test is to be confined to the appliances exposed to direct radiation by transmitters at their place of installation. |

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| | | | | <ul style="list-style-type: none"> - Performance criterion A (See Note 5) ** If for tests of equipment an input signal with a modulation frequency of 1000 Hz is necessary a modulation frequency of 400 Hz may be chosen. |
| 15. | Conducted low frequency | | <p>AC: Frequency range :rated frequency to 200th harmonic; Test voltage (rms) : 10% of supply to 15th harmonic reducing to 1% at 100th harmonic and maintain this level to the 200th harmonic, min 3 V r.m.s, max 2 W</p> <p>DC: Frequency range : 50 Hz - 10 kHz; Test voltage (rms) :10% of supply max. 2 W</p> | <ul style="list-style-type: none"> - to stimulate distortions in the power supply system generated for instance, by electronic consumers and coupled in as harmonics; - performance criterion A (see Note 5). - See figure – “test set-up” |
| 16. | Conducted radio frequency | IEC 61000-4-6 | <p>AC, DC, I/O ports and signal/control lines: Frequency range : 150 kHz-80 MHz Amplitude : 3 V rms (See Note 6) Modulation ***: 80% AM at 1000 Hz Frequency sweep range: ≤ 1.5 x 10⁻³ decades/s (or 1%/3sec.) According to level 2 severity standard</p> | <ul style="list-style-type: none"> - Equipment design and the choice of materials is to stimulate electromagnetic fields coupled as high frequency into the test specimen via the connecting lines. - performance criterion A (see Note 5). *** If for tests of equipment an input signal with a modulation frequency of 1000 Hz is necessary a modulation frequency of 400 Hz may be chosen. |

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|------------------|------------------------------------|----------------------------------|---|---|--|---------------------|--|----------|-----|-----|---------------------|--------|-----|-----|---------------------|---------|-----|--|---------------------|--|
| 17. | Burst/fast transients | IEC 61000-4-4 | <p>Single pulse rise time: 5ns (between 10% and 90% value) Single pulse width: 50 ns (50% value) Amplitude (peak): 2kV line on power supply port/earth; 1kV on I/O data control and communication ports (coupling clamp) Pulse period: 300 ms; Burst duration: 15 ms; Duration/polarity: 5 min According to level 3 severity standard</p> | <ul style="list-style-type: none"> - arcs generated when actuating electrical contacts; - interface effect occurring on the power supply, as well as at the external wiring of the test specimen; - performance criterion B (see Note 4). | | | | | | | | | | | | | | | | |
| 18. | Surge/voltage | IEC 61000-4-5 | <p>Open-circuit voltage: Pulse rise time: 1.2 μs (front time) Pulse width: 50 μs (time to half value) Amplitude (peak) : 1kV line/earth; 0.5kV line/line Short-circuit current: Pulse rise time: 8 μs (front time) Pulse width: 20 μs (time to half value) Repetition rate: \geq 1 pulse/min No of pulses: 5 per polarity Application: continuous According to level 2 severity standard</p> | <ul style="list-style-type: none"> - interference generated for instance, by switching "ON" or "OFF" high power inductive consumers; - test procedure in accordance with figure 10 of the standard for equipment where power and signal lines are identical; - performance criterion B (see Note 4). | | | | | | | | | | | | | | | | |
| 19. | Radiated emission (less than 1GHz) | CISPR 16-1, 16-2 | <p>For equipment installed in the bridge and deck zone.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Frequency range:</th> <th colspan="2">Quasi peak Limits :</th> </tr> </thead> <tbody> <tr> <td>0.15-0.3</td> <td>MHz</td> <td>80-</td> <td>dBμV/ 52 m</td> </tr> <tr> <td>0.3-30</td> <td>MHz</td> <td>52-</td> <td>dBμV/ 34 m</td> </tr> <tr> <td>30-2000</td> <td>MHz</td> <td></td> <td>dBμV/ 54 m</td> </tr> </tbody> </table> | Frequency range: | | Quasi peak Limits : | | 0.15-0.3 | MHz | 80- | dB μ V/ 52 m | 0.3-30 | MHz | 52- | dB μ V/ 34 m | 30-2000 | MHz | | dB μ V/ 54 m | <ul style="list-style-type: none"> - procedure in accordance with the standard but distance 3 m between equipment and antenna |
| Frequency range: | | Quasi peak Limits : | | | | | | | | | | | | | | | | | | |
| 0.15-0.3 | MHz | 80- | dB μ V/ 52 m | | | | | | | | | | | | | | | | | |
| 0.3-30 | MHz | 52- | dB μ V/ 34 m | | | | | | | | | | | | | | | | | |
| 30-2000 | MHz | | dB μ V/ 54 m | | | | | | | | | | | | | | | | | |

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|------------------|------|----------------------------------|---|-------------------|--|--|--|---------|-----|----|------------------|------------------|--|---------------------|--|---------|-----|-------|------------------|--------|-----|-------|------------------|----------|-----|----|------------------|-------------|--|--|--|---------|-----|----|------------------|--|
| | | | <table border="1"> <tr> <td colspan="2">except for:</td> <td></td> <td></td> </tr> <tr> <td>156-165</td> <td>MHz</td> <td>24</td> <td>dBμV/ m</td> </tr> </table> <p>For equipment installed in the general power distribution zone.</p> <table border="1"> <tr> <td colspan="2">Frequency range:</td> <td colspan="2">Quasi peak Limits :</td> </tr> <tr> <td>0.15-30</td> <td>MHz</td> <td>80-50</td> <td>dBμV/ m</td> </tr> <tr> <td>30-100</td> <td>MHz</td> <td>60-54</td> <td>dBμV/ m</td> </tr> <tr> <td>100-2000</td> <td>MHz</td> <td>54</td> <td>dBμV/ m</td> </tr> <tr> <td colspan="2">except for:</td> <td></td> <td></td> </tr> <tr> <td>156-165</td> <td>MHz</td> <td>24</td> <td>dBμV/ m</td> </tr> </table> | except for: | | | | 156-165 | MHz | 24 | dB μ V/ m | Frequency range: | | Quasi peak Limits : | | 0.15-30 | MHz | 80-50 | dB μ V/ m | 30-100 | MHz | 60-54 | dB μ V/ m | 100-2000 | MHz | 54 | dB μ V/ m | except for: | | | | 156-165 | MHz | 24 | dB μ V/ m | |
| except for: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 156-165 | MHz | 24 | dB μ V/ m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency range: | | Quasi peak Limits : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.15-30 | MHz | 80-50 | dB μ V/ m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30-100 | MHz | 60-54 | dB μ V/ m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100-2000 | MHz | 54 | dB μ V/ m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| except for: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 156-165 | MHz | 24 | dB μ V/ m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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|------------------|---------------------|---------------------------------------|--|---|---------------------|------------|--------------------|-------------|--------------------|---------------|-----------------|------------------|---------------------|------------|---------------------|-------------|-----------------|------------|-----------------|--|
| 20. | Conducted emission | CISPR 16-1, 16-2 | <p>For equipment installed in the bridge and deck zone.</p> <table border="1"> <tr> <td>Frequency range:</td> <td>Quasi peak Limits :</td> </tr> <tr> <td>10-150 kHz</td> <td>96-50 dBμV/m</td> </tr> <tr> <td>150-350 kHz</td> <td>60-50 dBμV/m</td> </tr> <tr> <td>350kHz-30 MHz</td> <td>50 dBμV/m</td> </tr> </table> <p>For equipment installed in the general power distribution zone</p> <table border="1"> <tr> <td>Frequency range:</td> <td>Quasi peak Limits :</td> </tr> <tr> <td>10-150 kHz</td> <td>120-69 dBμV/m</td> </tr> <tr> <td>150-500 kHz</td> <td>79 dBμV/m</td> </tr> <tr> <td>0,5-30 MHz</td> <td>73 dBμV/m</td> </tr> </table> | Frequency range: | Quasi peak Limits : | 10-150 kHz | 96-50 dB μ V/m | 150-350 kHz | 60-50 dB μ V/m | 350kHz-30 MHz | 50 dB μ V/m | Frequency range: | Quasi peak Limits : | 10-150 kHz | 120-69 dB μ V/m | 150-500 kHz | 79 dB μ V/m | 0,5-30 MHz | 73 dB μ V/m | |
| Frequency range: | Quasi peak Limits : | | | | | | | | | | | | | | | | | | | |
| 10-150 kHz | 96-50 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| 150-350 kHz | 60-50 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| 350kHz-30 MHz | 50 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| Frequency range: | Quasi peak Limits : | | | | | | | | | | | | | | | | | | | |
| 10-150 kHz | 120-69 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| 150-500 kHz | 79 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| 0,5-30 MHz | 73 dB μ V/m | | | | | | | | | | | | | | | | | | | |
| 21. | Flame retardant | IEC 60092-101 Or IEC 60695-11-5 | <p>Flame application: 5 times 15 s each. Interval between each application: 15s or 1 time 30s.</p> <p>Test criteria based upon application.</p> <p>The test is performed with the EUT or housing of the EUT applying needle-flame test method.</p> | <ul style="list-style-type: none"> - the burnt out or damaged part of the specimen by not more than 60 mm long. - no flame, no incandescence or - in the event of a flame or incandescence being present, it shall extinguish itself within 30 s of the removal of the needle flame without full combustion of the test specimen. - any dripping material shall extinguish itself in such a way as not to ignite a wrapping | | | | | | | | | | | | | | | | |

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| | | | | tissue. The drip height is 200 mm ± 5 mm |

Table 2.3 Notes:

1. Equipment to be mounted in consoles, housing etc. together with other equipment are to be tested with 70°C.
2. For equipment installed in non-weather protected locations or cold locations test is to be carried out at -25°C.
3. Salt mist test is to be carried out for equipment installed in weather exposed areas.
4. Performance Criterion B: (For transient phenomena): The EUT shall continue to operate as intended after the tests. No degradation of performance or loss of function is allowed as defined in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however allowed but no change of actual operating state or stored data is allowed.
5. Performance Criterion A: (For continuous phenomena) : The Equipment Under Test shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed as defined in relevant equipment standard and the technical specification published by the manufacturer.
6. For equipment installed on the bridge and deck zone, the test levels shall be increased to 10V rms for spot frequencies in accordance with IEC 60945 at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz.

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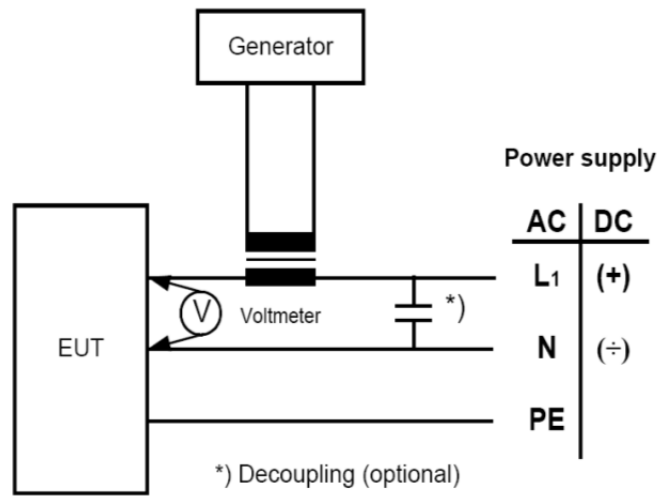


Figure - Test Set-up – Conducted Low Frequency Test

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2.a.ii. Technical documents to be submitted:

IMPORTANT: The English Language shall be used for all submitted documents.

- a) Explanatory note with description of the electrical valve actuator;
- b) Specification with indication of the devices and appliances used and the technical characteristics thereof;
- c) General view drawings, dimensional drawings;
- d) Circuit diagram of the electrical and electronic devices incorporated in to actuator with input and output signals, etc.;
- e) QM - certificate according to ISO 9001;
- f) In case when explosion-proof electric valve actuators are used, Certificates issued by competent authorities in accordance with requirements of EN/IEC 60079 series should be provided;
- g) The technical documentation must make it possible to assess the product's compliance with the agreed technical requirements, as described in the items 2.1, 2.3;
- h) Test program and standards.

2.b Type testing requirements

The requirements of UR E 10 shall be applied depending on electric valves actuators design, power supply used, installation area intended. Also, specimen(s) shall be tested in order to define functionality as indicated in manufacturer`s technical documentation and to satisfy the requirements of present standard. **See Table 2.3 and Table 2.4.**

Test specimens shall be taken from the production line or from stocks†. Tests shall be carried out in the presence of the EU RO Surveyor. In cases where the tests are conducted at Nationally Accredited Laboratories, the presence of the EU RO surveyor may be omitted†.

† For further clarification of witnessing of tests and sampling the test specimen(s), refer to paragraphs 6, 7 and 8 of the EU RO "Design Evaluation Scheme" procedure (Appendix V of EU RO Framework Document for the Mutual Recognition of Type Approval found on <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition>)

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Table 2.4

| Nos | Test | Normative document | Test parameters and conditions | Test purpose, performance criteria |
|-----|-----------------------------|--|--|---|
| | Additional Tests | | The additional tests of the automation equipment specimens shall be carried out in cases when it is necessary to document suitability of special characteristics of the articles indicated in the technical documentation. | |
| 1 | Protective enclosure | IEC 60529 | The test is applicable for enclosures of the articles with operating voltage up to 1000V. | The equipment is considered to have passed the test, if it satisfies the Performance Criterion A and the requirements of IEC 60529. |
| 2 | Impact | -Acceleration – 5g, -Duration : 10 – 15 ms, :No of impacts: 20, Frequency of impacts: 40 – 80 impacts/min. | The test shall be carried out under working condition, in three mutually perpendicular planes. Sinusoidal shape of the impact momentum is recommended | The equipment is considered to have passed the test, if during and after the test it complies with the requirements specified in the technical documentation. |
| 3 | Exposure to solar radiation | -Temperature in the chamber: + 55°C. | Subjected to the test are appliances with the use of plastics which are intended for operation on the open deck in areas where they are continuously exposed to solar radiation | The equipment is considered to have passed the test, if: |
| | | - Radiation intensity: 1125W/m ² . | | - No deformation, cracking, stratification, buckling , ungluing of plastic pieces and other materials has taken place; |

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|---|--|---|--|---|
| 4 | | (Including flux density of the ultra-violet portion of spectrum with a wave length of 280 – 400 nm shall be not less than 42 W/m ²) | | - No degradation of readability of inscriptions and signs on the instrument scales has not been detected; |
|---|--|---|--|---|

3. PRODUCTION REQUIREMENTS

Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval).

4. MARKING REQUIREMENTS

Manufacturers of the approved equipment are, in principle, to mark the product before shipment for identification of approved equipment as per referenced standard. In addition, and as a minimum, the following items to be marked at the suitable place:

- a) Manufacturer's name or equivalent,
- b) Type No. or symbol,
- c) Serial No. and date of manufacture,
- d) Rated torque
- e) Ambient temperature
- f) Rated voltage
- g) Rated frequency
- h) Rated power/current
- i) IP class
- j) Explosion-proof marking (if applicable).

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5. TYPE APPROVAL CERTIFICATE CONTENT

The EU RO MR Type Approval Certificate shall contain the minimum information as defined in the EU RO Framework Document for the Mutual Recognition of Type Approval - see Appendix I EU RO MR Type Approval Certificate Information.

The following information is specifically applicable to products relevant to this technical requirement and shall be included on the relevant EU RO MR Type Approval Certificate:

- a) model type;
- b) duty and cyclic duration factor;
- c) voltage, current type and frequency;
- d) nominal motor power (kW);
- e) nominal motor current (A);
- f) actuator rated torque (Nm)
- g) motor insulation class;
- h) enclosure protection (IP designation);
- i) hazardous protection (when applicable);
- j) ambient temperature range;
- k) gear case lubrication type.

6. APPROVAL DATE AND REVISION NUMBER

| Date | Revision | Comment |
|-----------------|----------|--|
| 31 January 2014 | 0.0 | Accepted by Advisory Board |
| 31 January 2015 | 0.1 | CRF018 – Revision to par. 2.a.ii - Technical documents to be submitted in English; CRF020 – Revision to par. 5 - 'Type Approval Certificate Content'. |
| 1 April 2016 | 0.2 | CRF025 – Updated to new MR TR document format incl. par. 8; CRF026/026a – Witness testing & control of test specimen; CRF028 – addition of 6 month application clause. |

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7. BACKGROUND INFORMATION / REFERENCES

- a) International Electro-technical Commission (IEC) standards mentioned above;
- b) Unified requirements (UR) E10 of the International Association of Classification Societies (IACS);
- c) BS EN 15714-2:2009 Industrial valves-Actuators BRITISH STANDARD;
- d) EN 15714-2:2009 Industrial Valves Actuators Part 2: Electric actuators for industrial valves — Basic requirements (European Standard).
- e) EU RO Framework Document for the Mutual Recognition of Type Approval.

8. MAINTENANCE / CLARIFICATION OF TECHNICAL REQUIREMENTS

Anyone wishing to propose changes to this document or request clarification of technical issues should contact the EU RO MR Group Secretariat in the first instance: Secretariat@euomr.org.

Review and approval of change requests shall follow the EU RO MR Maintenance Process detailed in the EU RO Framework Document for the Mutual Recognition of Type Approval: <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition>.

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