



Sub-System Completion Certificate:

Scope:

- ❖ In the case of new installations or modifications to existing installations, where part of the installation traverses hazardous areas, this Sub-system Completion Certificate must accompany the associated ETCI ET101:2008 Completion Certificate.
- ❖ The Sub-System Completion Certificate must be completed in its entirety whenever any part of the installation traverses a hazardous area, whether or not there are a number of contractors on a project.
- ❖ These guidelines do not propose to provide complete information on all aspects of testing and certification.
- ❖ These guidelines should be read in conjunction with the guidelines for completion certificates given in ET101:2008.
- ❖ See also the current edition of ET105:2011 & I.S.EN60079 series of standards
- ❖ This Sub-System Completion Certificate must be held in the project Safety File as required by the 2006 Safety Health & Welfare at Work (Construction) Regulations.

Introduction:

- ❖ The client, designer, installer, constructor or inspector who signs the Sub-System Completion Certificate is making a formal declaration that, as far as that person can reasonably ascertain, the installation as installed, complies with all of the relevant National Rules for Electrical Installations and current relevant legislation and is ready for final connection/operation.
- ❖ The associated Explosion Protection Document (EPD) or Design Dossier must be made available, fully complied with where applicable and a reference copy held in the project Safety File as required by the 2006 Safety Health & Welfare at Work (Construction) Regulations.

Filling in the Sub-System Completion Certificate:

- ❖ The Test Records should be filled in as construction proceeds and should be completed (except in the case of new installations where "power-on tests" are required after connection to the supply), before filling-in the Sub-System Completion Certificate.

Certificate Specifics:

Page 1:

- ❖ This is available for purchase from ETCI and will contain a unique certificate reference number to be used on all subsequent attachments.
- ❖ The installation may require a tick ✓ in more than one box per line e.g. Zone 1 & Zone 2
- ❖ Under Section 5 'Nature of ignitable materials', the intention is to record the extent of the range of Zones, Groups and Classes and not just the worst case scenario. The designer therefore is requested to tick ✓ all applicable boxes pertaining to the installation associated with the certificate.
- ❖ Referred to in Section 5 is an EPD. An EPD is an explosion protection document which contains the findings of a risk assessment of any work activity involving flammable/or explosive atmospheres. It may be



incorporated or at least referenced in the Safety Statement, be part of other risk assessment documentation or included in the Safety Report for those establishments subject to the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations.

Page 1, 2 & 4:

- ❖ *If additional comments are required to substantiate any part of this certificate, then the use of a 'Comment Sheet' shall be utilized.*

Page 2, 3 & 4:

- ❖ *The definition of 'Affiliation' includes 'Others' to mean those suitably qualified, trained and experienced in this field with the authority to sign accordingly. Adequate support documentation shall be provided and filed with this certificate.*

Page 2 Design & Selection:

- ❖ *This section must be completed by the person(s) allocated the responsibility for certifying compliance, to the best of their abilities, to all associated DESIGN and SELECTION works. If the design and selection is divided between different parties it must be agreed before the commencement of the work and clearly indicated on this certificate.*

Page 3 Installation:

- ❖ *This section must be completed by the person(s) allocated the responsibility for certifying compliance, to the best of their abilities, to all associated ERECTION/CONSTRUCTION works.*

Page 4 Inspector:

- ❖ *This section must be completed by the person(s) allocated the responsibility for certifying compliance, to the best of their abilities, to all associated installation INSPECTION works.*

Page 4:

- ❖ *The comments section allows for relevant comments which are not otherwise provided for in the certificate. Because the certificate is a completion certificate it is not acceptable to write "not accessible" or the like. 'N/A' means "not applicable" and should only be used if the particular section does not apply.*
- ❖ *All the boxes must be filled in with a tick ✓.*
- ❖ *Confirmation of satisfactory test values in accordance with ET101:2008 is confirmed by reference to the associated ETCI Completion Certificate. Confirmation of the remaining parts of this section is by reference to the Test Record Sheets for the installation.*
- ❖ *The "Visual Confirmation" section refers to the documentation for the sub-system. These documents must be made available to enable confirmation of the suitability of apparatus, cables & protective conductors and to verify the test measurements detailed in the Test Record Sheets.*
- ❖ *Diagrams, warning notices and signage must be verified in conjunction with the Client and confirmed in line with associated current legislation.*
- ❖ *Confirmation of current calibration certificates relates to test instruments used only for verification purposes and to confirm copies of the associated test instruments are attached to this certificate.*



GUIDELINES FOR SUB-SYSTEM COMPLETION CERTIFICATES AND TEST RECORDS FOR ELECTRICAL INSTALLATIONS IN POTENTIALLY EXPLOSIVE ATMOSPHERES

- ❖ Verification of documentation also assures the availability of documentation for future maintenance and periodic inspection and testing.
- ❖ Declarations of Conformity fulfill the statutory obligations of the plant operator in this respect. (NOTE: Declarations of Incorporation if not bridged to Conformity need to be viewed carefully and brought to the attention of the Designer for review).
- ❖ Verification of Classification of hazardous areas includes Temperature Class for all equipment types in every gas and/or dust group present in the area.
- ❖ Verification of inspection schedules of ET105:2011 Annex J provides an accommodation for any detailed inspections not otherwise covered in the Test Record Sheets for the particular installation e.g. gas pressures, flow indicators etc. at EEx'p' installations.

Test Record Sheet:

- ❖ ETCI Test Record Sheets are available for Power circuits and EExi device records.
- ❖ The effectiveness of earthing systems is verified by tests which assure a resistance to the general mass of earth which can be reliably sustained and is compatible with other earth electrodes in the installation, e.g. lightning protection electrodes at vertical storage tanks where the maximum acceptable combined value is 10 Ohms.
- ❖ In verifying the effectiveness of protection devices, account should be taken of the change-over time setting at star/delta starters of rotating electric machines. Note also that special conditions apply in the case of variable frequency drives.
- ❖ Insulation resistance is verified by tests between each current carrying conductor (including neutrals), which give a value in excess of 10 Mega-ohms.
- ❖ Verification of EExi circuits is satisfactory when the test values of the EExi Test Record Sheet are in accordance with the system documentation. Note that additional tests shall be required as specified in the design documentation of uncertified systems.

(SI 732 of 2007) Regulation 89: Certification

- ❖ After the installation has been tested and found to be in compliance, the contractor or other person responsible for the construction of the installation, or a person duly authorized to act on his or her behalf, must sign a statement to that effect.
- ❖ In addition to the certificate, the employer must retain Test Record Sheets containing the results of tests carried out.
- ❖ The certificate must be completed by an authorized person having adequate qualifications, training, technical knowledge and experience.
- ❖ The installation shall be tested by an appropriate person from time to time having regard for the nature, location and use of the installation or at any time if an inspector so requires.

Distribution of Certificates:



GUIDELINES FOR SUB-SYSTEM COMPLETION CERTIFICATES AND TEST RECORDS FOR ELECTRICAL INSTALLATIONS IN POTENTIALLY EXPLOSIVE ATMOSPHERES

- ❖ *The original Sub-System Completion Certificate and Test Record Sheets must be handed over and held in the Project Safety File as required by the 2006 Safety Health & Welfare at Work (Construction) Regulations.*
- ❖ *Working copies of both documents must be held by the Plant Manager and the Tester to facilitate periodic inspection, testing and maintenance.*

Technical Notes:

- ❖ *Effectiveness of phase-earth fault impedance is confirmed by test values which satisfy the requirements of Chapter 43 of ET101:2008 and which allow minimum prospective fault currents which satisfy the formula: $I^2t = k^2S^2$, so that under fault conditions (not exceeding 5 seconds), temperatures will be lower than the ignition temperature of the explosive atmosphere and the short time temperature rating of the cable. ('t' is the operating time of the disconnecting device, 'S' is the cross sectional area of the conductor in mm^2 , and 'k' is a factor dependent on the conductor initial and final temperature).*
- ❖ *Phase to Phase impedance tests are required to determine the prospective fault current value. In a three phase system the phase to phase short-circuit fault current will always be higher than the phase to earth fault current. The measured values will be required in the selection verification for the operating characteristics and to ensure the correct breaking capacity of the protective device.*
- ❖ *Insulation resistance testing of circuits is required to verify that, for compliance with ET101:2008, the insulation of conductors and electrical accessories and equipment is satisfactory and that live conductors or protective conductors are not short-circuited or do not show a low insulation resistance.*
- ❖ *Conductivity of protective conductors is confirmed by test values which satisfy the I^2t formula (*above). Conductivity of bonding conductors is confirmed by test values which confirm continuity from the main earth terminal to frameworks and enclosures.*
- ❖ *Equipotential and supplementary bonding is confirmed by test values which satisfy the formula: $R \times Ia \leq 50$ Volts, where 'R' is the resistance in ohms and 'Ia' is the operating current in amperes of the protective device. In addition, in Zone 0, and Zone 1 areas, the test values should confirm that the resistance in ohms between any two simultaneously accessible parts does not exceed the value of 'R' in the formula: $R = 12 Z / U$, where 'Z' is the phase-earth loop impedance and 'U' is phase/earth voltage (reference to ET 101:2008 sub-clause 613.6.5).*
- ❖ *Insulation testing of EExi circuits is necessary to confirm that they are earthed or insulated from earth throughout in accordance with ET105:2011. Note: systems which are isolated from earth may have electrostatic discharge protection via an earth connection of 0.2 to 1.0 M Ω . Insulation of screens is confirmed when the screens are disconnected at the point specified in the documentation, for the duration of the tests, and the screens are then confirmed to be clear of earth.*
- ❖ *The integrity of non-isolated EExi earth connections is confirmed by measurement of the resistance of the earth connection between the EExi circuits and the earth point (per system documentation).*
- ❖ *Electrical parameters of EExi circuits are confirmed by measurement and by reference to the maximum permissible values ascertained from the associated apparatus, documentation and marking plates.*



Details required on the Descriptive System Document of Intrinsically Safe or other Energy Limiting Systems include:

<i>IS System Design</i>								
<i>Details required on the Descriptive System Document of Intrinsically Safe or other Energy Limiting Systems.</i>								
Tag No.	Description	Make	Model No.	EC Cert No.	Marking			
<i>Electrical Parameters</i>								
<i>Field Equipment</i>		<i>Cables/Leads</i>		<i>Associated</i>		<i>Conditions of Intrinsic</i>		<i>IS System Status</i>
<i>U_i</i>	<i>* V_{dc}</i>			<i>U_o</i>	<i>* V_{dc}</i>	<i>U_i >= * U_o</i>	<i>* V_{dc} >= * V_{dc}</i>	
<i>I_i</i>	<i>* mA</i>			<i>I_o</i>	<i>* mA</i>	<i>I_i >= * I_o</i>	<i>* mA >= * mA</i>	
<i>P_i</i>	<i>* W</i>			<i>P_o</i>	<i>* W</i>	<i>P_i >= * P_o</i>	<i>* W >= * W</i>	
<i>L_i</i>	<i>* mH</i>	<i>L_c</i>	<i>* mH</i>	<i>L_o</i>	<i>* mH</i>	<i>L_i + L_c <= * L_o</i>	<i>* mH <= * mH</i>	
<i>C_i</i>	<i>* uF</i>	<i>C_c</i>	<i>* uF</i>	<i>C_o</i>	<i>* uF</i>	<i>C_i + C_c <= * C_o</i>	<i>* uF <= * uF</i>	
<i>L/R_i</i>	<i>*</i>	<i>L/R_c</i>	<i>*</i>	<i>L/R_o</i>	<i>* uF/ohm</i>	<i>L/R_i + L/R_c <= * L/R_o</i>	<i>* uF/ohm <= * uF/ohm</i>	
<i>In accordance with I.S. EN60079-14 & 25</i>								

General Notes:

- ❖ *The Sub-System Completion Certificates and Test Record Sheets are issued and signed by the person responsible for the design, selection, construction, inspection and/or testing of the installation or a person duly authorized to act on his or her behalf.*
- ❖ *The Sub-System Completion Certificates and the associated Test Record Sheets must be submitted to the Project Supervisor (Construction) Stage (PSCS) and included in the project safety manual.*
- ❖ *Electrical installations should be inspected and tested periodically to comply with relevant statutes and standards.*
- ❖ *Further information can be found on the ETCI website. <http://www.etcie.ie>*

The Electro-Technical Council of Ireland is not responsible for the electrical installation or for the accuracy of the information given on the Sub-System Completion Certificates and Test Record Sheets.