COMMISSIONING, SETTINGS AND DESIGN AUTHORISATIONS

PURPOSE AND SCOPE

This procedure defines the training, assessment and documentation requirements for achieving formal authorisation for National Grid, Consultants and Suppliers staff for any of the following roles. Some of the formal roles which do not require separate authorisation are also defined in this procedure.

Commissioning Roles

- Commissioning Panel Chairman
- Commissioning Officer
- Commissioning Engineer (National Grid) & (Supplier)

Settings Engineers

- Settings Engineer (National Grid) & (Supplier)

Design Engineers

- Protection & Control Design Engineer (National Grid) & (Supplier)
- HV Plant Design Engineer (National Grid) & (Supplier)
- Overhead Line Design Engineer (National Grid) & (Supplier)
- Cable Design Engineer (National Grid) & (Supplier)
- Civil Design Engineer (National Grid) & (Supplier)

PART 1 – PROCEDURAL

1 RESPONSIBILITIES

1.1 Authorising Manager

Manager responsible for:-

a) Authorising new engineers,

b) Reviewing, auditing and re-authorising existing engineers,

c) Managing the assessment centre training, and

d) Providing guidance on the commissioning authorisation process.

All formal authorisations are co-ordinated and provided centrally within National Grid Core Construction. This covers National Grid, Consultants and Suppliers. The Authorising Manager is the Design Assurance Manager within Core Construction.

1.2 Line Manager

Line Manager is responsible for:-

a) Nominating candidates with appropriate experience for the assessment centre based modules.

b) For National Grid authorised engineers, reviewing authorisation records annually at the time of the Performance and Development Reviews to ensure experience record is up to date and sign the last column of the Experience Record Form.

c) For Consultant and Supplier authorised engineers, ensuring that an authorised engineer in the appropriate role from National Grid has confirmed the Experience Record Form.

d) Ensuring that when re-authorisation is required after three years the record is submitted to the Authorising Manager.

1.3 Course Director

The course Director is responsible for:-

a) Prior to the assessment confirm administration arrangements with the Assessment Centre. Ensure availability of training material, joining instructions, questionnaires etc have been sent to the delegates. Check availability of assessors and the appropriate presentation material for them.

b) During the assessment manage the sessions with assessors, collate delegate listing and forward a copy to the Authorising Manager

c) After the course, forward any comments on course material, suggestions for improvement, etc and candidates results to the Authorising Manager.

1.4 Authorised Engineer

EACH AUTHORISED ENGINEER IS RESPONSIBLE FOR MAINTAINING THE AUTHORISATION DOCUMENTATION AND FOR JOINTLY REVIEWING AT LEAST ONCE PER YEAR WITH THE LINE MANAGER, TO CHECK IF THE TRAINING AND EXPERIENCE IS SUFFICIENT TO RETAIN THE AUTHORISATION.

2 COMMISSIONING AUTHORISATIONS

2.1 Commissioning Authorisation Requirements

2.1.1 Appendix A defines the requirement to attend the appropriate modules for each commissioning role. Training and assessment is carried out at the Assessment Centre.

2.1.2 Candidates attending the Assessment Centre Module to obtain authorisation for Commissioning Engineer or Commissioning Officer must have a basic understanding of power system theory, a reasonable understanding of commissioning requirements, power engineering experience and HNC/HND or equivalent qualification in electrical engineering.

2.1.3 Prior to embarking upon the Basic or Advanced modules held at Assessment Centre, an engineer must:-

a) Have attended at least two Commissioning Meetings as an observer.

b) Commissioning Engineer (National Grid) requires both Site Operational and Site Safety experience. The candidate must at least be a Senior Authorisation Person 2.

2.1.4 To obtain either basic or advanced authorisation, an engineer must:

a) Complete relevant modules shown in Appendix A.

b) Have the assessment confirmed and signed in Appendix F by the Authorising Manager.

c) Have the Certificate of Authorisation in Appendix F completed and signed by the Authorising Manager.

2.1.5 Appendix B, C and D show the flow process for each commissioning authorisation associated with the Assessment Centre Modules.

2.1.6 Management and Technical modules at both basic & advanced levels require a questionnaire to be undertaken and a pass mark obtained. If on the first attempt the pass mark is not obtained, a second attempt may be undertaken. Failure to pass on the second attempt will require the whole module to be retaken.

2.1.7 The questionnaire is submitted with the candidate's pack for both of the Management Modules, and provided at the end of the module for both of Technical Modules.

2.1.8 To pass the Technical & Management Assessment Centre Modules, the following is required.

a) Pass the questionnaire

b) Display competency to the assessor's satisfaction, in the subject matter, throughout the course.

c) Failure to pass both (a) and (b) above will necessitate a repeat of the module.

2.1.9 Basic Authorisation shall be completed before Advanced Authorisation can be undertaken. The timescales between undertaking the Assessment Centre based modules for Basic and Advanced Authorisation respectively, shall be at least six months.

2.1.10 Experienced commissioning staff that have not completed any of the Assessment Centre Modules can be allowed to undertake Advanced Technical and Advanced Management Modules without the need to complete the Basic Technical and Basic Management Modules at the discretion of the Line Manager & Authorising Manager. The Basic Design Module must be completed first before undertaking advanced modules.

2.1.11 Before Commissioning Officer's authorisation is awarded the engineer is required to complete the Protection & Control Design Authorisation.

2.1.12 The Authorising Manager will provide notification of a pass or fail.

2.2 Basic Design Module for Commissioning

2.2.1 This module is to be completed by Commissioning Engineers and Commissioning Officers for basic level of authorisation. The purpose of the basic design module is to assess the level of understanding with reference to basic transmission design requirements. The objective is to assess an understanding of the purpose of the installed equipment, thereby to eliminate risks to health, safety, and the environment, including security and reliability of the power system.

2.2.2 The design module is to be undertaken in one day. It comprises two components, each lasting about half a day, both of which must be passed. Failure to pass it first time will need further experience on commissioning work for at least for six months before the module can be retaken. The module comprises:

Part 1: Questionnaire

Part 2: Circuitry

Appendix G defines the Subject Matter Syllabus for this assessment.

2.3 Basic Technical Module

2.3.1 This module is to be completed by Commissioning Engineers and Commissioning Officers for basic level of authorisation. The module consists of three components:-

a) Technical Principles: this comprises tutorial on basic technical aspects associated with power system performance, which is a requirement for commissioning.

b) Practical: this comprises practical commissioning exercises at the training substation.

c) Switching Programme: this comprises tutorial and assessment on the requirements and preparation of switching programmes.

2.4 Basic Management Module

2.4.1 This module is to be completed by all Commissioning roles for basic level of authorisation. The module comprises two components.

a) Management Process Tutorial: this consists of TP106, NSI33, TP153 and related procedures.

b) Case Study: consisting of a simulated commissioning exercise.

2.5 Basic Building Blocks Module

2.5.1 This module is to be completed by Commissioning Panel Chairman for basic level of authorisation. The module consists of a tutorial on basic equipment and schemes, to provide a rudimentary understanding of technical performance of the system and technical terminology.

2.5.2 As an alternative the Technical Principles (2 days) under the Basic Technical Module can be completed to satisfy this requirement.

2.6 Advanced Technical Module

2.6.1 This module is to be completed by Commissioning Engineers and Commissioning Officers for advanced level of authorisation. Training and assessment for Commissioning Engineers & Commissioning Officers is carried out at an assessment centre. The module is designed to ensure that those concerned with the technical aspects of commissioning have a broad understanding of the more technically complex items of equipment connected to the transmission system, particularly from a power system perspective.

2.7 Advanced Management Module

2.7.1 This module is to be completed by Commissioning Engineers and Commissioning Officers for advanced level of authorisation. The module comprises two components:-

a) Management Process tutorial: this consists of TP106, NSI33, TP153 and related procedures.

b) Case Study: consisting of a simulated commissioning exercise, covering more advanced subject such as requirements and issuing of HVSCC and Operational Notification procedure.

3 ASSISTANT COMMISSIONING ENGINEER

3.1 This role does not in itself require authorisation. The purpose of this role is to provide on-site training to a reasonably experienced engineer to achieve full authorisation. This does not imply that the standard of commissioning work is reduced. Use of this role to discharge the role of an authorised Commissioning Engineer through (in effect) a proxy is equally unacceptable. The rules pertaining to the use of an Assistant Commissioning Engineer are as follows:-

a) Appointment of this role must be notified to the Commissioning Panel Chairman and recorded in the minutes of the commissioning panel meetings.

b) An authorised Commissioning Engineer will always remain fully accountable for all work undertaken by an Assistant Commissioning Engineer and provide 'Local Supervision'. The authorised Commissioning Engineer will be available at the location to attend the point of work as necessary. This will include signing to accept, authorise and approve all documentation.

c) An authorised Commissioning Engineer must always define the work to be undertaken by an Assistant Commissioning Engineer and must always evaluate the quality and accuracy of the work on completion.

d) An authorised Commissioning Engineer can supervise the work of one Assistant and one Trainee Commissioning Engineer simultaneously.

3.2 An authorised Commissioning Engineer can be assisted by a Trainee Commissioning Engineer who is relatively inexperienced with commissioning work, for example a new graduate engineer. The rules pertaining to the use of a Trainee Commissioning Engineer are as follows:-

a) An authorised Commissioning Engineer will always remain fully accountable for all work undertaken by Trainee Commissioning Engineer and provide 'Personal Supervision'. The authorised Commissioning Engineer will be present at the point of work at all times.

b) An authorised Commissioning Engineer must always define the work to be undertaken by a Trainee Commissioning Engineer and must always evaluate the quality and accuracy of the work on completion.

c) An authorised Commissioning Engineer can supervise the work of one Assistant and one Trainee Commissioning Engineer simultaneously.

4 SPECIALIST TESTING ENGINEER

4.1 Specialist Testing Engineers are defined as those engineers for whom National Grid do not require a certificate of authorisation carrying out specialist tasks in an isolated and defined area – for example, a feeder main protection.

4.2 All Specialist Testing Engineers will work to the requirements of an authorised Commissioning Engineer (Supplier) who will have overall responsibility for test documentation.

4.3 A maximum of three Specialist Testing Engineers (eg Protection & Control, HV Plant and SGT) can be employed under local supervision with each authorised Commissioning Engineer (Supplier).

4.4 Where the Specialist Testing Engineer or Assistant Commissioning Engineer is used, they must be notified to the Commissioning Panel and recorded in the Commissioning Panel meeting minutes.

4.5 Specialist Testing Engineers will not preclude the employment of Assistant or Trainee commissioning engineers working with an authorised Commissioning Engineer (Supplier).

5 LEAD COMMISSIONING ENGINEER

5.1 Where a large project necessitates the employment of a number of Authorised Commissioning Engineers (Supplier) on the same site, one of these engineers should be appointed as Lead Commissioning Engineer (Supplier).

5.2 The Lead Commissioning Engineer must co-ordinate all commissioning activities of the team. This appointment will not necessitate another formal certificate – but it will be recorded in the Commissioning Panel minutes.

6 ANCILLARY EQUIPMENT

6.1 An authorised commissioning engineer must commission all 'main stream' work; the commissioning work which can affect the power system. Work which is other than main stream, eg purely civil engineering projects then formally agreed alternative authorisation arrangements defined by the National Grid representative on the Commissioning Panel may be utilised.

6.2 The alternative authorisation arrangement can be such as sufficient checks on the competency and skill of that engineer carrying out the commissioning.

6.3 Every effort should be made to minimise the risk to the power system. One way this can be achieved is to ensure National Grid engineers are authorised if the small Suppliers or Tier 2 Supplier Partners' engineers are not, for example when undertaking WTI projects.

7 SETTINGS AUTHORISATION

7.1 Settings Authorisation Requirements

7.1.1 The objective of this module is to assess the candidate on a broad spectrum of the more common fault calculations and relay settings, with reference to knowledge that would be expected to be at the 'fingertips' of a practising settings engineer.

7.1.2 To achieve this authorisation the engineer must be:-

a) Suitably qualified in electrical engineering to a minimum HNC/HND level.

b) Be experienced and technically proficient on power system theory.

c) Pass the assessment module defined in the subject matter syllabus in Appendix H

d) Pass the procedural assessment paper on the TP107.

e) Authorised for Protection and Control Design role.

7.1.3 Before Settings Engineer's authorisation is awarded the engineer is required to complete the following authorisations:-

a) Settings Engineer (Supplier) - Protection & Control Design Authorisation.

b) Settings Engineer (National Grid) – Protection & Control Design and Commissioning Officer Authorisation.

7.1.4 The roles of Settings Engineer (National Grid) & Settings Engineer (Supplier) are defined in TP107.

8 DESIGN AUTHORISATIONS

8.1 Design Authorisation Requirements

8.1.1 To obtain any of the following Design Authorisations the engineer is required to

a) Be suitably qualified in the relevant discipline to a minimum HNC/HND level.

b) Experienced and technically proficient in the required engineering disciplines appropriate to the electricity transmission system.

c) Pass the required assessment module for each authorisation as defined in the appropriate subject matter syllabus.

(i) Protection & Control Design Engineer – Appendix I

(ii) HV Plant Design Engineer – Appendix J

(iii) Overhead Line Design Engineer – Appendix K

(iv) Cable Design Engineer – Appendix L

(v) Civil Design Engineer – Appendix M

d) Complete and pass the Health & Safety assessment module shown in Appendix N.

8.2 Design Engineer (Supplier) & Design Engineer (National Grid)

Roles undertaken on Design Verification by Design Engineers (Supplier) and Design Assurance by Design Engineers (National Grid) are defined in TP188A.

Design Engineers undertaking the assurance role on behalf of National Grid are required to have at least five years experience on working with National Grid processes and procedures. In addition, Design Assurance Engineers are required to possess a basic understanding on the design process throughout the project lifecycle.

8.3 Lead Design Engineer

The Lead Design Engineer appointed on each project is required to co-ordinate design activities of all design disciplines. This role must be undertaken by an engineer authorised for any of the other design roles relevant to the project.

In the even of authorised engineer transfers to another consultant undertaking similar work, his/her current authorisation will be retained provided the Authorising Manager is notified. Otherwise the authorisation will be withdrawn.

9 CONSULTANTS

Consultant's engineers may also be authorised to perform Assurance roles on behalf of National Grid. In such instances the National Grid Line Manager for whom the consultant is working should make the necessary arrangements. Consultant engineers must also complete and maintain TP141 Authorisation Records.

10 AUTHORISATION DOCUMENTATION

10.1 Appendix F defines the Authorisation Record. The Authorising Manager will initially complete this record. After this each Engineer is responsible for the retention and maintenance of the authorisation record.

10.2 The Certificate of Authorisation will need to be presented to each Project Manager as verification of authorisation.

10.3 The Authorising Manager will undertake change of authorisation and subsequent re-authorisation.

11 TEMPORARY AUTHORISATION

11.1 At the discretion of the Authorising Manager and in consultation with the candidate's Line Manager, Temporary Authorisation may be given to an experienced engineer for a period not exceeding one year when Assessment Centre modules are not taken. The candidate is required to undertake a questionnaire prior to the award being given. Temporary Authorisation limitation will be noted as TEMPORARY AUTHORISATION on the authorisation record.

11.2 The candidate must complete the outstanding assessment centre modules before full authorisation is awarded.

11.3 The TP141A User Group will periodically audit temporary authorisations.

12 PERIOD OF AUTHORISATION

12.1 Full Authorisation

Full authorisation is awarded when the entire assessment criterion is fully met. This authorisation shall be valid for a period of three years.

12.2 Temporary Authorisation

Temporary authorisation shall be valid for a maximum of one year.

13 RE-AUTHORISATION

13.1 Assessment of re-authorisation should be reviewed annually at the time of the Performance and Development Review (or equivalent) between the Authorised Engineer and Line Manager. If re-authorisation is required the document should be sent to the Authorising Manager.

13.2 Re-authorisation shall be given by the Authorising Manager upon evidence of satisfactory commissioning practice being undertaken, as shown on the Commissioning or Design Experience Record.

13.3 In the event of an authorised engineer transferring to another organisation undertaking a different role, the current authorisation will be reviewed.

13.4 In the event that an authorised engineer transfers to another organisation undertaking similar work, the current authorisation will be retained provided the Authorising Manager is notified and confirms this in writing. Otherwise the authorisation will be withdrawn.

13.5 Evidence of poor performance of an authorised engineer will be managed as follows:-

a) First a 'Notice of Concern' will be issued.

b) On continued poor performance the current authorisation can be suspended.

c) The poor performance could be due to a lack of adherence to procedures or technical ability or both. The lack of adherence to procedures will be discussed with engineer's line manager to put measures in place to improve performance whilst the technical inability will require obtaining sufficient experience for at least six months before allowed to re-take the assessment.

14 MANAGEMENT OF TP141

14.1 Ongoing management of TP141 and the authorisation process, including the carrying out of periodic audits to ensure consistency of application, will be undertaken by the TP141 User Group.

15 FORMS AND RECORDS

15.1 Form TP141.01- Commissioning, Settings & Design Authorisations Record

PART 2 – DEFINITIONS AND DOCUMENT HISTORY

16 DEFINITIONS

16.1 Assessment Centre

National Grid Training Centre at Eakring or alternative agreed venues for formal assessment.

16.2 Commissioning and Design Authorisation User Group

The Authorisation User Group, drawn from Construction, Asset Management, Suppliers and Human Resources, is accountable for both defining the requirements for authorisation, and monitoring & auditing the authorisation process.

16.3 Basic Commissioning Authorisation

Basic Commissioning Authorisation, when conferred on a Chairman of the Commissioning Panel, a Commissioning Engineer or a Commissioning Officer, gives authority to the engineer concerned to discharge these roles on a limited range of projects associated with asset replacement. For example Circuit Breaker change, Protection change, and the installation of SCS etc.

16.4 Advanced Commissioning Authorisation

Advanced Commissioning Authorisation, when conferred on a Chairman of the Commissioning Panel, a Commissioning Engineer or a Commissioning Officer gives authority to the engineer concerned to discharge these roles on all projects including issuing of HVSCC documents. This does not imply expertise on all equipment and schemes but recognises that an appropriate level of training has been undertaken and experience achieved.

16.5 Commissioning Roles

The roles of the Commissioning Panel Chairman, Commissioning Engineer (National Grid), Commissioning Engineer (Supplier) and Commissioning Officer are all defined in TP106, Commissioning & Decommissioning.

16.6 Settings Engineer (National Grid)

An authorised, experienced and technically proficient engineer appointed to carry out relay settings as defined in TP107.

16.7 Settings Engineer (Supplier)

An authorised, experienced and technically proficient engineer appointed to carry out relay settings as defined in TP107 and in accordance with Supplier contractual arrangements.

16.8 Protection & Control Design Engineer (National Grid)

An authorised, experience and technically proficient engineers appointed to undertake Design Assurance role on protection & control equipment.

16.9 Protection & Control Design Engineer (Supplier)

An authorised, experience and technically proficient engineers appointed to undertake Supplier detailed design verification role on protection & control equipment.

16.10 HV Plant Design Engineer (National Grid)

An authorised, experience and technically proficient engineers appointed to undertake Design Assurance role on Substation configuration and its primary plant.

16.11 HV Plant Design Engineer (Supplier)

An authorised, experience and technically proficient engineers appointed to undertake Supplier detailed design verification role on Substation configuration and its primary plant.

16.12 Overhead Line Design Engineer (National Grid)

An authorised, experienced and technically proficient engineer appointed to undertake Design Assurance role on Overhead Lines and its associated primary plant.

16.13 Overhead Line Design Engineer (Supplier)

An authorised, experience and technically proficient engineer appointed to undertake Supplier detailed design verification role on Overhead Line and its associated primary plant.

16.14 Civil Design Engineer (National Grid)

An authorised, experience and technically proficient engineers to undertake Client's design role on civil and structural infrastructure.

16.15 Civil Design Engineer (Supplier)

An authorised, experience and technically proficient engineers appointed to undertake Supplier detailed design verification role on civil, structural & Building infrastructure.

17 AMENDMENT RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	April 1999	New document	Keith Harker	Director of Project Management
2	March 2001	Formatted with provisional authorisation removed and minor refinement to text	Keith Harker	Network Engineering Manager
3	January 2003	Major rewrite	Keith Harker	Engineering Services
4	November 2003	Suppliers authorisation added Local assessment replaced with Design Module Management and co-ordination of commissioning authorisation process revised.	Bal Rehal	Keith Harker Construction Services Manager
5	August 2007	Settings and Design Authorisations added. Document reformatted and further guidance added	Bal Rehal Construction	Keith Harker Technical Assurance Manager – Core Construction

PART 3 – GUIDANCE NOTES AND APPENDICES

18 REFERENCES

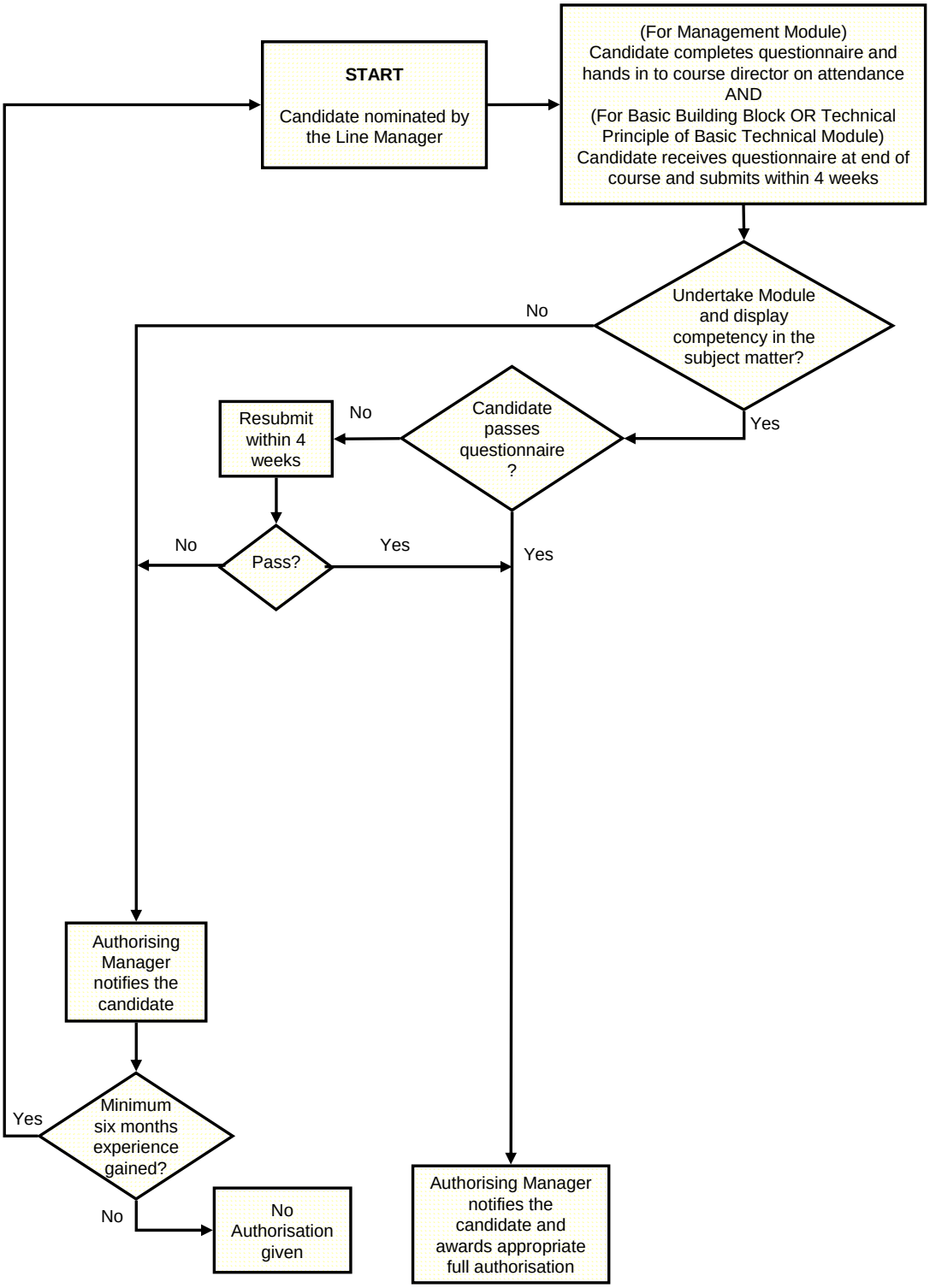
TP106	Equipment Commissioning and Decommissioning
TP107	Management of Relay Settings
TP153	Co-ordination of Project Installation
NSI33	The Addition / Removal of Equipment to/from the Power System

APPENDIX A - SUMMARY OF COMMISSIONING AUTHORISATION MODULES

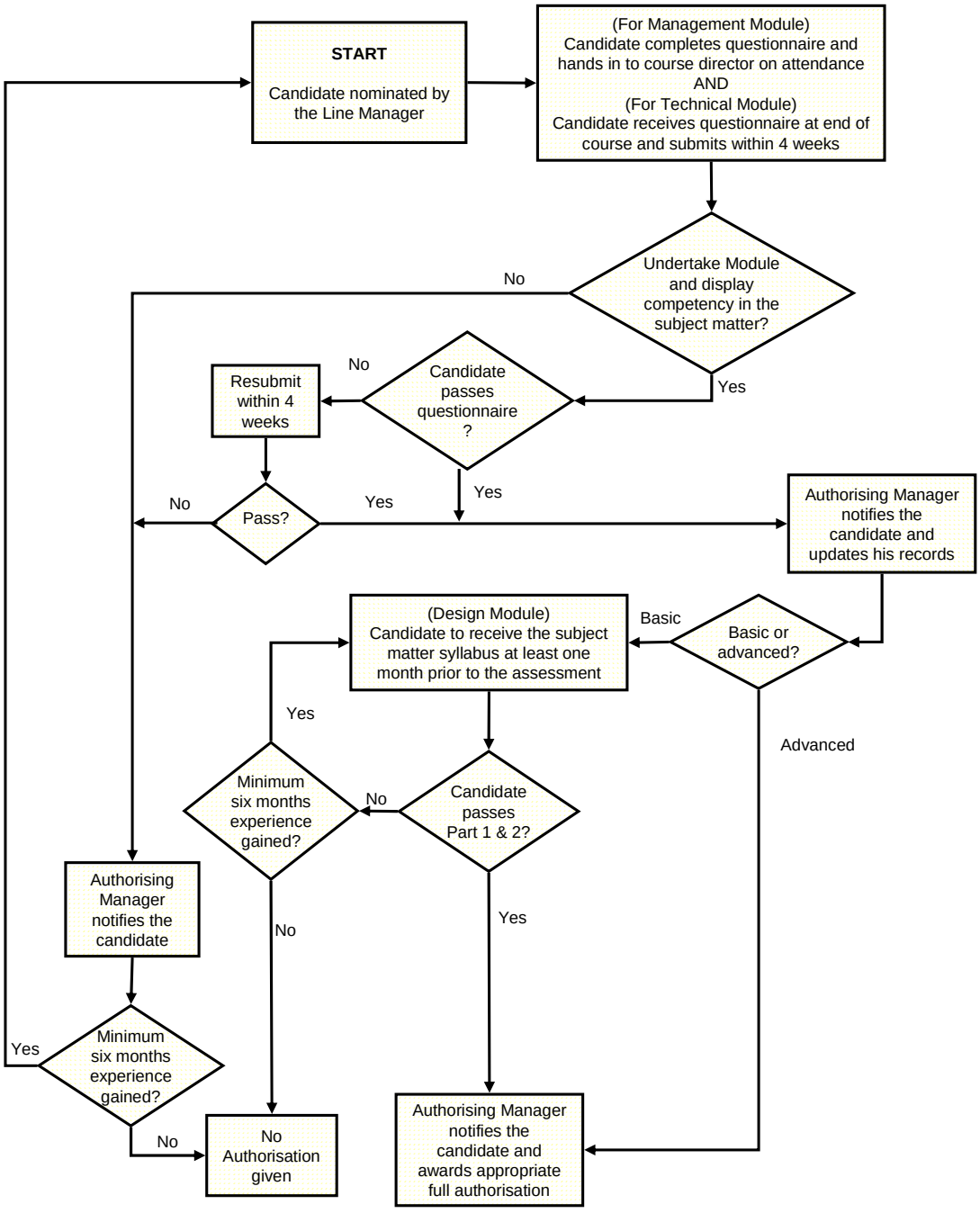
Status	Module		Duration (days)	Commissioning Panel Chairman	Commissioning Engineer (National Grid & Supplier Partners)	Comm Officer
	Title	Components				
Basic	Basic Design Module	-	1	-	✓	✓
	Basic Technical (EG019C)	1. Technical Principles	2	-	✓	✓
		2. Practical	1			
		3. Switching Programme	2			
	Basic Management (EG020C)	1. Management Process	1	✓	✓	✓
		2. Case Study	1			
	Basic Building Blocks (EG021C)	-	½	✓	-	-
Advanced	Advanced Technical (EG022C)	-	2	-	✓	✓
	Advanced Management (EG023C)	1. Management Process	1	✓	✓	✓
		2. Case Study	1			

NB: Codes in brackets = Assessment Centre course numbers

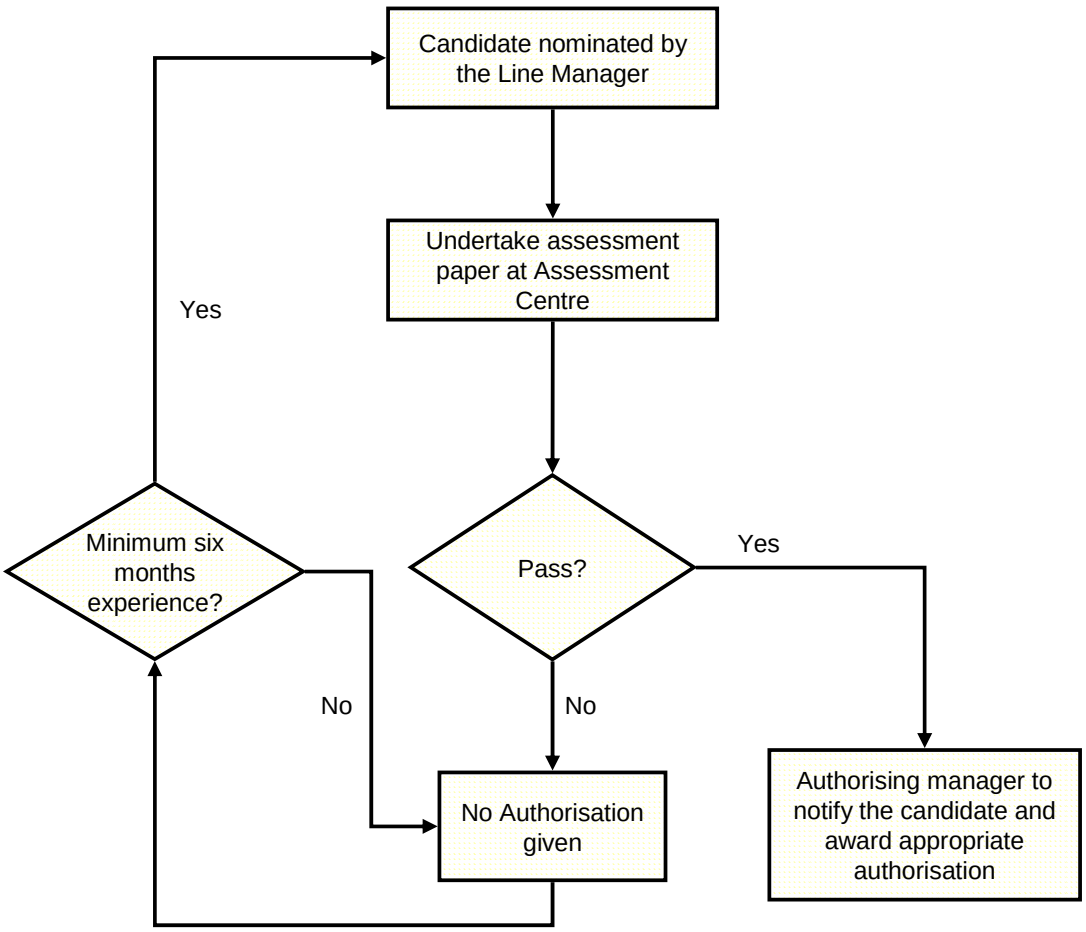
APPENDIX B – COMMISSIONING AUTHORISATION PROCESS - COMMISSIONING PANEL CHAIRMAN



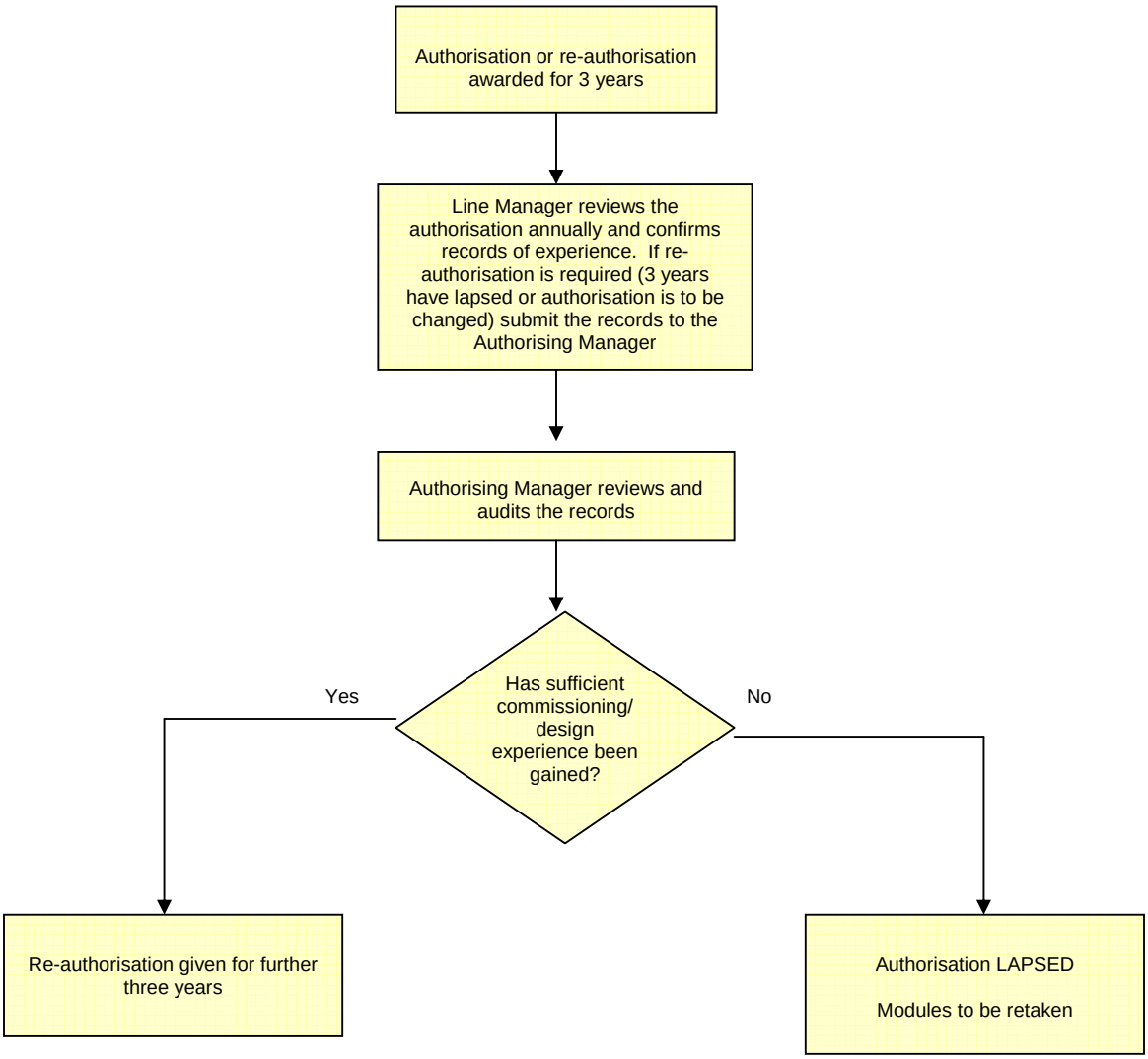
APPENDIX C – COMMISSIONING AUTHORISATION PROCESS - COMMISSIONING ENGINEER & COMMISSIONING OFFICER



APPENDIX D – SETTINGS ENGINEERS AND DESIGN ENGINEER AUTHORISATION PROCESS



APPENDIX E - RE-AUTHORISATION PROCESS



APPENDIX F - AUTHORISATION RECORD

National Grid

Commissioning, Settings or Design Authorisations Record

for

Name: _____

Record of Commissioning, Settings or Design Authorisations

Authorisation	Period of Authorisation	Authorisation Given By	Authorisation Category	Temporary Authorisation
Initial Authorisation				
Review 1				
Review 2				
Review 3				
Review 4				
Review 5				
Review 6				

Authorisation Categories

□	Commissioning Engineer - Basic	: CE - Bas	□	Settings Engineer	: SE
□	Commissioning Engineer - Advanced	: CE - Adv	□	P&C Design Engineer	: P&C DE
□	Commissioning Officer - Basic	: CO - Bas	□	HV Plant Design Engineer	: HV Plant DE
□	Commissioning Officer - Advanced	: CO - Adv	□	OHL Design Engineer	: OHL DE
□	Commissioning Panel Chairman – Basic	: CPC- Bas	□	Cable Design Engineer	: Cable DE
□	Commissioning Panel Chairman – Advanced	: CPC – Adv	□	Civil Design Engineer	: Civil DE

(National Grid) or (Supplier) as appropriate, eg CE (Supplier) - Adv = Supplier Commissioning Engineer to Advanced Level

Engineer's Name _____

Form UKBP/TP141.01

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COMMISSIONING, SETTINGS OR DESIGN AUTHORISATION ASSESSMENT CONFIRMATION RECORD

Module	Required by	Assessment Location	Successful Assessment Confirmed by	Assessment Date
Basic Design Module	CE CO	Assessment Centre		
Basic Technical	CE CO	Assessment Centre		
Basic Management	CPC CE CO	Assessment Centre		
Basic Building Blocks	CPC	Assessment Centre		
Advanced Technical	CE CO	Assessment Centre		
Advanced Management	CPC CE CO	Assessment Centre		
Settings	SE	Assessment Centre		
P&C Design	P&C DE	Assessment Centre		
HV Plant Design	HV Plant DE	Assessment Centre		
OHL Design	OHL DE	Assessment Centre		
Cable Design	Cables DE	Assessment Centre		
Civil Design	Civil DE	Assessment Centre		

Engineer's Name: _____

Form UKBP/TP141.01

Page 3 of 4

Commissioning, Settings or Design Experience Record

Sheet No.....

Date	Project No	Project Title	Role Undertaken	Type of Work	Confirmed by

Engineer's Name: _____

Form UKBP/TP141.01 ..... Page 4 of 4

Authorisation Category

This certificate of Authorisation

is awarded to

by National Grid

Period of Authorisation

Signed: _____

Date: _____

nationalgrid

SPECIMEN

APPENDIX G – BASIC DESIGN MODULE - COMMISSIONING - SUBJECT MATTER SYLLABUS

G1 PART 1 : QUESTIONNAIRE FORMAT

This comprises approximately 100 questions, either multiple choice or a specific answer. It is expected that it will take about 1½ hours to complete – but the candidate may take as long as is required.

A score of 85 marks must be achieved to pass Part 1.

NB: Consideration will be limited to feeders, transformers, double busbar and mesh substations and connected circuitry (ie. no SVC, MSC, QB etc).

G2 PART 2: CIRCUITRY

This comprises a one-to-one dialogue between candidate and assessor on each of five subjects. Each subject comprises one or a number of drawings, requiring the candidate to explain the contact flow sequence for each drawing.

G2.1 Part 1 - Questionnaire Syllabus

G2.1.1 Transmission system fault clearance times

G2.1.2 Equipment maximum fault level ratings and short circuit time

G2.1.3 Protection sensitivity to high resistance earth faults

G2.1.4 Backup protection

a) Types

b) Required operating times

c) Elementary settings (eg. rating/PSM/TM)

d) Which faults will each type detect

e) Purpose of IDMT relay family of curves

f) Backup protection tripping

g) Impact of backup protection on DAR

G2.1.5 Battery

a) Requirement for duplicated supplies

b) Method of earthing

c) Operating voltages

d) Minimum tripping voltages

G2.1.6 Distance Protection

a) Purpose of each zone

b) Which zones operate for certain common system faults

c) Circuitry for a blocked scheme and blocked scheme tripping times

d) Implications of switching a blocked scheme out of service

G2.1.7 Circuit Breaker Fail

a) Basic principles of operation

b) Purpose of ICTR

c) Intertripping requirements for plain and T circuits

G2.1.8 Purpose of Supergrid transformer protection, ie. for which faults is each protection device required to operate. Includes Buchholz and WTI.

G2.1.9 With reference to a transformer

a) Purpose of co-ordinating gaps

b) Fans and pumps

c) Operation of tap changer

d) Meaning of Vector Group

e) Electrical considerations when replacing a transformer

f) Current flow in an auto-transformer

g) Fundamentals of a biased differential scheme

G2.1.10 High Impedance Circulating Current Schemes

a) Understanding of stability voltage

b) Purpose of stability and setting resistor

c) Types of CTs used

G2.1.11 Double Busbar Substation DAR

a) Circuitry operation

G2.1.12 Cable Sheath Earthing

G2.1.13 Trip Circuit Supervision

G2.1.14 Ferroresonance Circuitry Application

G2.2 Part 2 – Circuitry Syllabus

An understanding of contact sequence logic will be requested for each of the following.

G2.2.1 Protection and DAR of a plain feeder

G2.2.2 Operation of synchronising circuitry

G2.2.3 Circuit breaker fail at a double busbar substation

G2.2.4 Auto-switching functionality at a single switch substation. NB: This will not require detailed understanding of the circuitry but what it is intended to do.

G2.2.5 dc logic tests requirements (including negative checks) on a simple circuit diagram.

G2.2.6 CT phasing, busbar protection

APPENDIX H – SETTINGS ENGINEER - SUBJECT MATTER SYLLABUS

1. Relationship between MVA, MW and MVAR.

2. Relationship between power, volts and amps for a three phase balanced network.

3. Meaning of Base MVA with reference to percentage impedance, and ability to translate from one Base MVA to another.

4. Meaning of percentage impedance and derivation of fault levels from percentage impedance.

5. Ability to derive percentage impedance from ohms, and vice versa.

6. Ability to draw the phase sequence network for both single phase to earth faults, and phase to phase faults, and the derivation of fault MVA and fault currents.

7. Phase sequence networks for two winding and auto-transformers, and the ability to determine the fault current in the neutral connection, when the transformers are subject to earth fault.

8. Ability to draw phase sequence networks for the instance of a fault being fed from both a generator and the infinite busbar, including an understanding of the various generator impedances.

9. Estimation of fault currents at the far end of a feeder, given maximum and minimum fault infeeds to a busbar.

10. Calculating IDMT overcurrent settings on a transmission feeder.

11. IDMT grading criterion.

12. Ability to derive transformer HSOC settings.

13. Translation from primary to secondary ohms.

14. Determination of residual compensation for a feeder.

15. Determination of apparent impedances due to throttling effect.

16. Determination of distance protection Zone 1, Zone 2 and Zone 3 settings as per NGT policy.

17. Current transformer types and application.

18. Calculation of high impedance circulating current protection settings.

19. Feeder unit protection (working on sequence component measurement) settings.

20. Setting of transformer biased differential protection.

21. Circuit breaker fail timer settings and fault clearance time settings.

22. Synchronise relay settings and appreciation of the meaning of slip.

23. Delayed auto-reclose circuitry time delays.

APPENDIX I – P&C DESIGN ENGINEER - SUBJECT MATTER SYLLABUS

1. Target system tripping times
2. Protection and CT requirements for OHL feeders
3. Trip relay reset requirements for OHL feeders
4. OHL feeder protection types
5. Cable feeder protection types
6. Application of distance protection (plain, blocked,integral intertrip) to OHL
7. Application of blocked distance protection applied to 'T' feeders
8. Limitations to the performance of distance protection when applied to short length feeders
9. Feeder protection sensitivity (National Grid only)
   Distance protection zone & application (Supplier only)
10. Powerline carrier feeder protection and intertripping (National Grid only)
    Transformer vector groups (Supplier only)
11. Feeder protection communication link diversity
12. Teleprotection communication channels
13. Transformer protection and CT arrangements
14. Transformer trip circuitry design
15. Transformer biased differential and REF protection
16. Two winding transformer protection
17. Tap change impact upon two winding transformers
18. ATCC
19. CT polarity and connection convention
20. CT location for different types of switchgear
21. VT earthing arrangements
22. Busbar protection zones
23. Busbar fault position
24. Busbar protection disconnector changeover
25. High impedance busbar protection
26. Design requirements and performance of low impedance busbar protection
27. CT locations for mesh substation

28. Direct and indirect tripping requirements

29. Electrical interlocking design criteria

30. Application of DAR to cable circuits

31. Synchronising

32. Voltage selection scheme and associated synchronising relay application

33. Performance of 110v batteries and associated cable voltage drops associated with tripping

34. ARS, MSC, ATCC application

35. Numerical relays

36. Wire colour code

37. System considerations

    - max fault current
    - max short circuit current duration
    - effect of X/R ratio

APPENDIX J – PLANT DESIGN ENGINEER - SUBJECT MATTER SYLLABUS

1 Application of switchgear

2 Short circuit rating

3 Short time continuous ratings

4 Vector grouping

5 PSSR 2000 regulation

6 Safety distance clearances

7 Access to switchgear

8 Mechanical interlocking

9 Substation earthing, spigots, step and touch potential

10 Busbar forces

11 Basic Insulating material including SF6

12 Viewing windows

13 Angle of Buchholz equipment

14 Super Grid Transformer short term rating

15 Creepage & co-ordination gaps

16 Trip charge

17 Ferroresonance

18 Ancillary Equipment

19 Diesel generators

20 Stored energy

21 High level understanding of National Grid safety rules

22 Type Registration requirements

APPENDIX K – OVERHEAD LINE DESIGN ENGINEER - SUBJECT MATTER SYLLABUS

1 Standards, specifications and statutory requirements

2 Electrical characteristics of OHLs

3 Bundle and tower-top geometry

4 Insulation coordination

5 Conductor types

6 Conductor fittings, joints and spacers

7 Sags, tensions and clearances

8 Thermal ratings

9 Methods of thermal rating enhancement

10 Earthwire systems

11 Vibration control

12 Insulators and Fittings

13 Mechanical loading

14 Failure containment and strength co-ordination

15 Tower structural design

16 Foundation design

17 Line termination structures

18 Special towers, river crossing, temporary masts

19 Provisions for erection and maintenance

20 Tower fabrication and erection

21 Corrosion prevention

22 Prevention of access and safety signs

23 Miscellaneous tower accessories

24 Stringing techniques and method of earthing

25 Induced currents

26 Telecommunication equipment on towers

27 Environmental aspects

28 OHL deterioration and refurbishment

29 OHL failure modes

30 Type Registration requirements

APPENDIX L – CABLES DESIGN ENGINEER - SUBJECT MATTER SYLLABUS

1 Conductor type and insulation

2 Policy regarding the use of XLPE vs Oil

3 Method of earthing and bonding

4 Transposition

5 Sheath voltage limiters

6 Installation techniques & maintenance requirements

7 Cable bending radius

8 Backfill types and thermal characteristics

9 Hydraulic systems

10 Cable (hydraulic) profiles

11 Stop joint design

12 Types of termination

13 Cable sealing end design

14 Cable cooling systems and ancillary equipment

15 Sealing end compound and joint bay scaffolding

16 Induced voltage into ancillary & power cables

17 Touch potential

18 Temperature monitoring and Distributed Temperature Sensors

19 Thermal Rating Schedules

20 MET Office system rating

21 Short circuit capability

22 Work on cables under induced voltage conditions

23 HSG47 underground requirements

24 Testing and commissioning

25 Leak detection and repair techniques

26 Oil leakage management and protection of environment

27 Cable refurbishment

28 Cable system failure modes

29 Telecom fibre-optic provision

30 Type Registration requirements

APPENDIX M – CIVIL - SUBJECT MATTER SYLLABUS

The candidate shall be expected to demonstrate a generic and National Grid specific understanding of the technical aspects relating to the following electricity substation assets. Due to the diverse nature of the subject matter the purpose of the module is not to confirm that an individual is capable of carrying out detailed design in all the specified subject areas themselves but rather that they are sufficiently aware of the key high level issues that they are able to manage the overall design process calling on the services of discipline specific technical specialists as required.

1. Access roads
2. Footpaths
3. Drainage
4. Oil containment works
5. Fencing
6. Site Security
7. Surfacing
8. Ducts & Trenches
9. Building
10. Site and building services (including electricity and telecommunications services)
11. Foundations
12. Pilling works
13. Earthworks
14. Ground improvement/stabilisation
15. Plant support structures
16. Holding down systems
17. Fire protection and control
18. Cable Tunnels
19. Acoustic enclosures
20. Site lighting
21. Landscaping
22. Other enabling infrastructure (Operational & Non operational) – e.g. retaining structure, bridges, culverts etc.

APPENDIX N – H&S ASSESSMENT QUESTIONNAIRE SYLLABUS

1 QUESTIONNAIRE OBJECTIVE

1.1 To provide the means by which an engineer is assessed in the subject of health and safety.

1.2 To define and give visibility to the subject matter – both statutory and National Grid specific – that those with formal responsibilities for Construction ought to be knowledgeable.

1.3 A complementary questionnaire to Managing Safely – which is hazard/risk management focus.

2 HOW TO USE THIS SYLLABUS

2.1 The purpose of this syllabus is to identify, in sufficient detail, the subject matter that will be assessed. As such the syllabus provides a concise tutorial on the subject matter.

PART 1 : LEGISLATION & SUPPORTING DOCUMENTS

1. HIERARCHY OF LEGISLATION

This comprises a table of ten boxes into which must be inserted, in order of seniority, the legislation, ACOPS, HSG guidance notes and National Grid safety documentation – including the National Grid Safety Rules.

2. 1974 HSAW ACT

This section examines
(a) duties of employers (section 2 and section 3)
(b) duties of people with control of premises (section 4)
(c) duties of those who design, manufacture, erect or install articles for use at work (section 6)
(d) the enforcing authorities of the HSWA (section 18)
(e) powers of HSWA Inspectors (section 20)
(f) the types of notice that may be served by enforcing officers (section 21 and section 22)

3. 1989 ELECTRICITY AT WORK REGULATIONS

This section examines
(a) to whom the act applies (regulation 3)
(b) the requirements relating to construction and maintenance of electrical systems (regulation 4)
(c) requirements prior to electrical equipment entering service (regulation 5)
(d) requirements relating to
- excess currents (regulation 11)
- means of preventing danger (regulation 12)
- undertaking work on an electrical conductor (regulation 13)
- space, lighting and knowledge requirements (regulation 15 and regulation 16)

4. 2007 CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS

This section examines
(a) Meaning of the term ‘construction’
(b) Duties of
- The Client
- The CDM Co-ordinator

- The Principal Contractor
- A designer

(c) Application of CDM to 'design'
(d) Meaning of the term 'designer'
(e) Hierarchy of risk control

5. 1995 RIDDOR REGULATIONS

(a) to what the Regulations apply (regulation 3)
(b) enforcing authorities (regulation 3)
(c) reporting timescales (regulation 3)
(d) what comprises 'major injuries' (regulation 1)
(e) what comprise 'dangerous occurrences' (regulation 2)

6. 1999 MANAGEMENT OF HEALTH AND SAFETY AT WORK REGULATIONS

(a) Responsibilities of employers and employees (regulations 3, 5, 6, 7, 8, 12)
(b) Requirements for risk assessments, method statements and hazard reporting (regulation 3)
(c) Requirements for procedures to avoid danger (regulation 7)
(d) Provision of training and information (regulations 8, 11)

7. 2002 CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

(a) Those upon whom the Regulations impose responsibilities (regulations 6, 7, 8, 9)
(b) Key requirements of the Regulations:
- substance and hazard awareness (regulation 6)
- hazard reduction (regulation 7)
- data sources (regulation 12)
- records (regulation 9)
- PPE (regulation 7)

8. THE HSE MODEL CONSTRUCTION HEALTH AND SAFETY CHECKLIST

(a) Content of the checklist (see HSE publication 'Health & Safety in Construction')

9. ELECTRICITY, SAFETY, QUALITY AND CONTINUITY OF SUPPLY REGULATIONS 2002 (WERE THE ELECTRICITY SUPPLY REGULATIONS)

(a) Responsible organisation for preparing the Regulations (section 31, para 9)
(b) High level objectives of the Regulations (see presentation objectives)
(c) Key requirements of the Regulations (part 11, part 111, part v, section 32)

PART 2 : APPLICATION

11. TP137A (CDM REGULATIONS)

(a) Purpose of TP131A
(b) Roles and Responsibilities
(c) CDM Timeline
(d) Competency
(e) Summary Log
(f) Pre-construction SHES Information Pack
(g) Construction Phase SHES Plan
(h) SHES File
(i) Form F10
(j) CDM demarcation zone /sensible monitoring

12. NSBP136 (SHE AUDIT)

(a) Categories of audit
(b) Levels of non-conformance – timescales for requiring corrective action

13. CONTRACTOR MANUAL

(a) Purpose

14. SAFETY LINE POLICY

(a) When it applies
(b) Extent of PPE to be worn
(c) Exemptions

15. GOLDEN RULES

(a) What comprises the Golden Rules

16. HSG47 (EXCAVATION OF UNDERGROUND SERVICES)

(a) Location methods
(b) Actions following route identification
(c) Actions when service cannot be located
(d) Actions when service is close to proposed excavation
(e) Requirements for machine excavation

17. INV1 (INCIDENT REPORTING/INVESTIGATION)

(a) Action required by National Grid staff
(b) Incident classification
(c) Immediate and underlying causes
(d) Action required by a Contractor

18. NATIONAL GRID SAFETY RULES

(a) Purpose of:
- Safety Rules
- Limited Access Certificate
- Permit for Work
- Sanction for work

(b) Role of:
- Person
- Competent Person
- SAP

(c) Documentation associated with NSI33

19. NATIONAL GRID SURVEILLANCE OF CONTRACTORS (OCCUPIER'S LIABILITY ACT 1957 AND 1984)

Surveillance requirements by National Grid:
(a) When a Contractor works upon a National Grid site (ie. National Grid is the occupier)
(b) When a Contractor to National Grid works upon a site for which the Contractor is the occupier

20. LEVELS OF SECURITY ALERT

(a) Number of levels and colour code of each level
(b) Level at which National Grid stand – and requirements of that level