



Technology Training that Works

Practical Electrical Substation Safety for Engineers and Technicians

Contents

1	An overview of safety hazards	1
1.1	Overview	2
1.2	Industrial hazards	3
1.3	Electrical hazards	5
1.4	Electrical accidents and safety measures	8
1.5	Summary	8
2	Basic theory of electrical safety	11
2.1	Introduction	11
2.2	Shock hazard	12
2.3	Role of protective earthing	18
2.4	Indirect contact hazard-Equipment classes	22
2.5	Sensing of earth faults	24
2.6	Equipotential bonding for safety against indirect contact	25
2.7	Use of protective equipment	28
2.8	Electric shock hazard-Lightning	29
2.9	Arc flash danger in electrical equipment	30
2.10	Summary	33
3	Safety aspects in electrical equipment design	35
3.1	Objectives of safe design	35
3.2	Preventing electric shock	36
3.3	Importance of insulation in electrical safety	37
3.4	Importance of enclosures in ensuring safety	40



Technology Training that Works

3.5	Prevention of adverse thermal effects	44
3.6	Isolation arrangements	52
3.7	Role of codes and standards in equipment/installation safety	52
3.8	Summary	53

4	Safe operation and maintenance of electrical equipment	55
----------	---	-----------

4.1	Introduction	55
4.2	Key safety factors in O&M of electrical installations	56
4.3	Isolation during maintenance of electrical installations	60
4.4	Visual checks for safety	62
4.5	Earthing for safety during maintenance	62
4.6	Safety in O&M of outdoor substations and switchyards	63
4.7	Safety aspects for repair work on cable installations	64
4.8	Safety appliances	65
4.9	Role of caution boards/warning signs	66
4.10	Gas safety and ventilation in substations	67
4.11	Working with compressed fluids	68
4.12	Emergency and first-aid training	69
4.13	Summary	69

5	Safety in battery installations	71
----------	--	-----------

5.1	Introduction	71
5.2	Applicable codes and regulations	72
5.3	Hazards in battery installations	72
5.4	General Safety Precautions	73
5.5	Safety aspects of battery premises	74
5.6	Ventilation	75
5.7	Transportation, handling and storage	76
5.8	Installation accessories-salient points	77
5.9	Precautions during inspection of batteries	77
5.10	Safety aspects during dismantling and disposal	78



Technology Training that Works

5.11	First aid	78
5.12	Hygiene and housekeeping	79
5.13	Personal protective equipment	79
5.14	Summary	79

6	Organizational aspects of safety	81
----------	---	-----------

6.1	Introduction	81
6.2	Organizational responsibility for safety	82
6.3	Safety functions and coordination	83
6.5	Accident reporting and records	84
6.6	Summary	86

APPENDICES

A1	UK regulations on safety	87
A2	Inspection of electrical systems for safety (UK)	101
B	Australian regulations on safety	107
C	Australian/ New Zealand Standard and regulations	125
**	Exercises	