ABS Consulting

HAZARD AND OPERABILITY STUDY REPORT

ABB CURRENT LIMITING DEVICE

Prepared for
Electricity North West
by
ABS Consulting Ltd

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Client: Electricity North West

Contact: Geraldine Bryson

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EXECUTIVE SUMMARY

A Hazard and Operability Study has been conducted for Electricity North West for the proposed implementation of current limiting devices to their electrical network. The Study focused on the normal operation of the current limiting device concentrating on the effect potential failures/hazards had on safety of personnel and the commercial impact of equipment being damaged.

This report presents the results from the Hazard and Operability Study undertaken at the Electricity North West offices in Preston on the 6th of May 2014. The Hazard and Operability Study was performed by a multi-disciplinary team made up of individuals from Electricity North West, ABB and facilitated by ABS Consulting.

As part of the Hazard and Operability Study the following seven (7) Nodes were considered:

- Node 1 - Current Transformers.
- Node 2 - Trip Inserts.
- Node 3 - Power Supply Unit.
- Node 4 - Trip Unit.
- Node 5 - Indication Unit.
- Node 6 - Circuit Breaker.
- Node 7 - Overall (general system hazard scenarios).

The output of the Study resulted in 6 recommendations being recorded within the Hazard and Operability worksheets. The table below shows the distribution of the recommendations according to their risk ranking. The risk matrix was used to assess the severity and likelihood of all causes and consequences that were identified and examined. The use of the risk rankings will help to focus resources on the most significant risks.

Level 4	Level 3	Level 2	Level 1	Total
0	3	0	3	6

In summary, there were zero (0) Level 4 recommendations identified with a risk ranking of Level 4 (High). There were three (3) recommendations identified with a risk ranking of Level 3 (Medium), zero (0) recommendations with a risk ranking of Level 2 (Medium-Low) and three (3) recommendations with a risk ranking of Level 1 (Low).

The most prominent hazard identified with a risk ranking of Level 3 (Medium) was the loss of network electrical supply caused by the Is-limiter tripping. The potential consequence of this would be a loss of supply to customers for the duration it took to replace the trip inserts. This is a commercial issue, and not related to safety in any way. The recommendations proposed were to ensure the network was designed to safeguard that supply can be restored as quickly as possible, ensure adequate spare trip inserts are available and to ensure procedures and training are in place to replace trip inserts as quickly and safely as possible. If the recommendations are implemented, then the risk should be reduced to a level that is As Low As Reasonably Practicable.

Overall, there were no safety concerns relating to the implementation of the Is-limiter. There are three (3) independent phases, with only one (1) phase requiring to operate at any giving time giving the conclusion that the Is-limiter is functionally safe to implement to the Electricity North West electrical network.

All of the recommendations from the Hazard and Operability Study will now need to be monitored by Electricity North West and then closed out. Those who are allocated Study recommendation(s)/action(s) shall be responsible to close-out their actions. Actions should not be considered closed unless descriptions are accompanied by suitable and sufficient evidence. In addition reasoning will also need to be supplied to justify and document why a recommendation/action was not implemented.

It should be noted that two (2) potential hazard scenarios were identified concerning the unauthorised entry of personnel to a sub-station that could potentially lead to a fatality, and also the damage caused to equipment due to extreme environmental effects. These concerns were raised during the study to highlight that there are already effective safeguards in place such as sub-station security procedures and maintenance and inspection regimes. The presence of the current limiting device does not have any effect on the risk of these hazard scenarios.

LIST OF ACRONYMS

ALARP	As Low As Reasonably Practicable
CT	Current Transformer
DC	Direct Current
ENW	Electricity North West
HAZOP	Hazard and Operability
LV	Low Voltage
SQEP	Suitably Qualified and Experienced Personnel
UPS	Uninterrupted Power Supply

CONTENTS

List of Appendices

1 Introduction

A Hazard and Operability (HAZOP) Study has been conducted for Electricity North West (ENW) for the proposed implementation of current limiting devices (Is-limiter) to their electrical network. The Study focused on the normal operation of the Is-limiter concentrating on the effect potential failures/hazards had on safety of personnel and the commercial impact of equipment being damaged.

The key function of the Is-limiter is that it will trip before the first peak of a short circuit current, based on the rate of rise of the current flow above a pre-set threshold current. Conventional circuit-breakers cannot provide protection against high peak short-circuit currents, as they will not trip before the first peak of short circuit current. A description of the Is-limiter is detailed in Section 2.

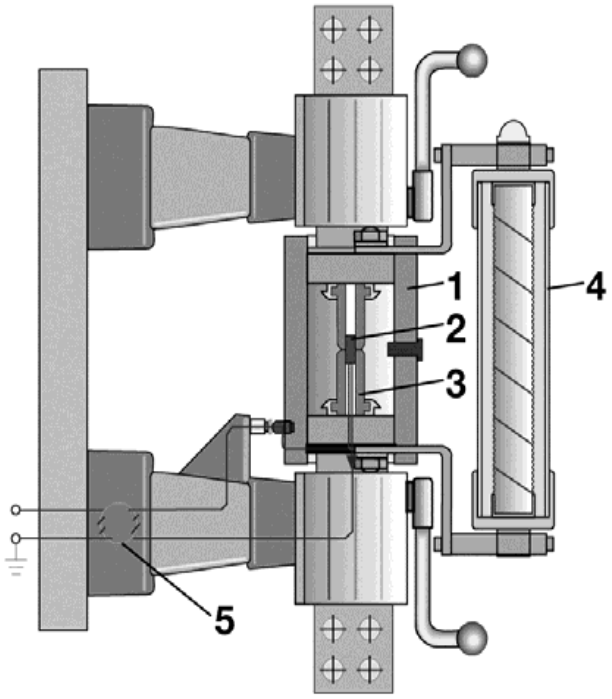
This report presents the results from the HAZOP Study undertaken at the ENW offices in Preston on the 6th of May 2014. The HAZOP Study was performed by a multi-disciplinary team made up of individuals from ENW, ABB and facilitated by ABS Consulting. The team personnel and attendance for the HAZOP Study is attached in Appendix D.

The HAZOP Study is a systematic evaluation process, performed to identify causes that could result in undesirable consequences to legality, financial impact, regulations, health, safety, environment, people, reputation and customer service. Any deviations from the normal operating condition were analysed, together with the relevant causes and consequences, using the applicable parameters, guidewords and deviations. Existing safeguards have been identified and considered when defining the risk associated with the consequences.

This HAZOP Study report comprises of an Executive Summary, Introduction, Is-limiter Description, HAZOP Study Methodology, HAZOP Scope and the HAZOP Study Discussion. The appendices in this report include the complete HAZOP Study worksheets, Action/Recommendation list, Is-limiter schematic, HAZOP Study attendance sheet and the Risk Ranking matrix.

2 Description of ABB Is-Limiter

2.1 Introduction



1. Insulating tube.
2. Charge.
3. Bursting bridge.
4. Fuse.
5. Insulator with pulse transformer.

Figure 1 – Insert Holder and Insert

The Is limiter device is a combination of a fast acting switch with high current carrying capability but low switching capacity and a fuse with high breaking capacity, mounted in parallel. When a short circuit is detected a small explosive charge in the main current carrying conductor is detonated. This ruptures the main current carrying path thus diverting the current to the fuse which quenches it. The entire operation takes place within a few milliseconds.

A small explosive charge is employed to give fast operation of the switch on the main conductor. Once the switch has operated, the current is diverted to flow in the parallel fuse where it is interrupted.

The current flowing through the device is monitored in an electronic measuring and tripping unit which is responsible for initiating the trip when an abnormally high and fast rising current is detected. Both magnitude and rate of rise of the current are monitored and tripping is initiated only when both quantities are above certain set values. The threshold magnitude and rate of rise of current can be set to suit the individual application.

For three-phase applications, the Is-limiter comprises three single pole holders with replaceable inserts, three tripping current transformers and one electronic measuring and tripping unit.

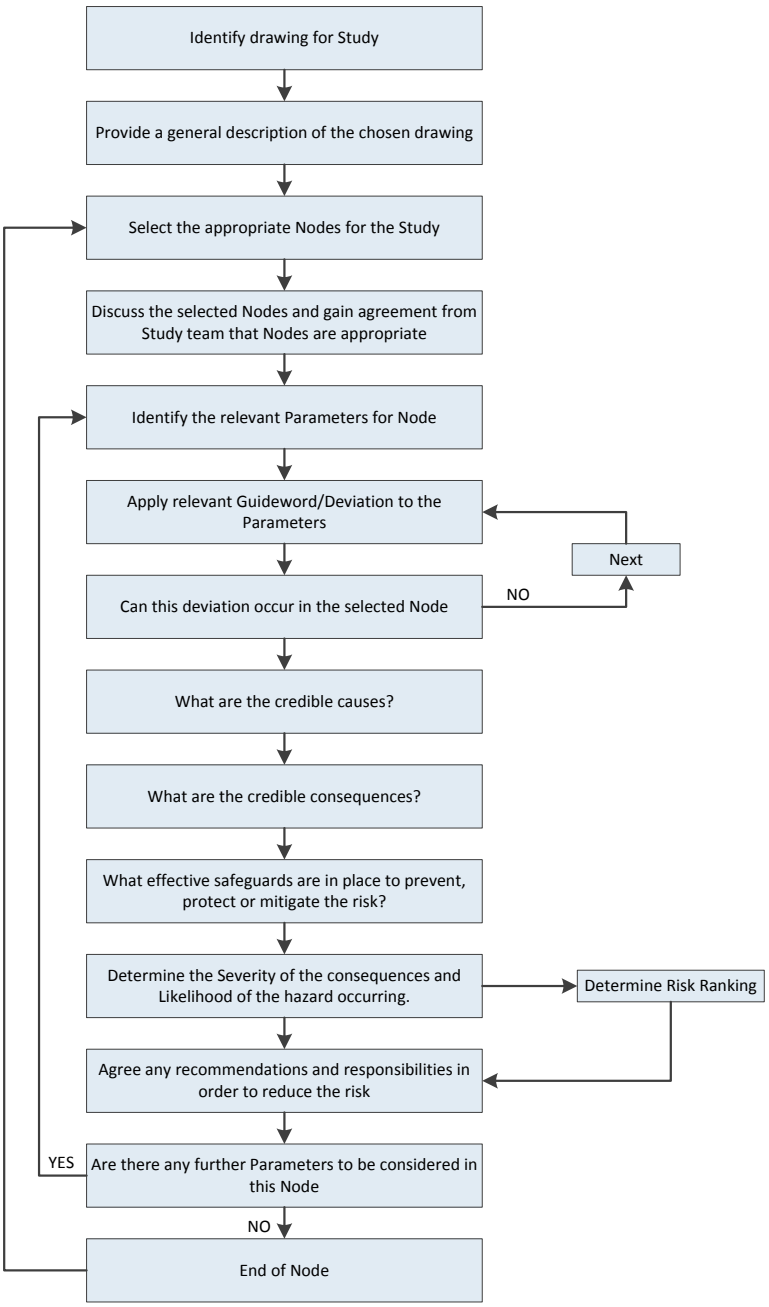
After operation the devices are isolated and inserts containing the fuses and the ruptured conductors are removed and replaced with spares. A circuit breaker is always required in series with the Is-limiter, in order to perform normal circuit opening and closing duties.

3 HAZOP Study Methodology

3.1 HAZOP Study Process

A HAZOP Study is a systematic evaluation performed to identify causes that could result in undesirable consequences to legality, financial impact, regulations, health, safety, environment, people, reputation and customer service. The methodology used followed the "Cause-by-Cause Deviation" technique. Guidewords in conjunction with key Parameters were applied to each section of the system (Node) to generate Deviations from the design (normal) operation. Table 3-1 provides a sample of the Guidewords and Deviations that were considered in the HAZOP Study. The HAZOP process is illustrated with Figure 3-1 below.

Figure 3-1 – HAZOP Study Process Flow Diagram



For the "Cause-by-Cause Deviation" technique, Guidewords in conjunction with key process Parameters were applied to each section of the system (Node) to generate Deviations from the design (normal) operation. Table 3-1 provides a sample of the Guidewords and Deviations that were considered in the HAZOP Study.

Table 3-1 Guidewords and Deviations

Design Parameters	Guideword				
	No	**More**	**Less**	**Early**	**Late**
Voltage	No Voltage	More Voltage	Less Voltage	-	-
Current	No Current	More Current	Less Current	-	-
Data or Control Signals	No Data or Control Signal	More Data or Control Signal	Less Data or Control Signal	Early Data or Control Signal	Late Data or Control Signal
Other	Maintenance, EMC/EMI, Security, Loss of Services, Operator Error, External Environmental Hazards, Common Mode Failure.				

The "Possible Cause" and "Potential Consequence" scenarios were then discussed and documented. A Cause needed to be one that would/could occur within the Node being considered.

The Effective Safeguards that reduce the risk associated with the specific Cause/Consequence scenarios were then discussed and documented.

The above process was repeated for each Node and each Deviation relevant to the Parameters until the planned scope of the HAZOP Study had been analysed.

3.2 Risk Ranking

It is typical to undertake a qualitative risk ranking during the HAZOP Study as this greatly assists the team in knowing when to make a Recommendation (Action Item) and then helping in prioritising actions later. This was performed for all Hazard Scenarios using the Risk Matrix presented in Appendix E.

3.3 Worksheets

The Study proceedings were recorded using PHA Pro software (Version 8), by Dyadem. The Study records were projected onto a screen for comment and agreement by the team members during the sessions. The HAZOP Study worksheets are provided in Appendix A.

3.4 Recommendations

Items identified with a risk ranking of Level 4 (High), require recommendations/action(s) to be recorded to further mitigate the risk to a level which is Tolerable or As Low As Reasonably Practicable (ALARP) (Levels 1-3), while rankings of Level 1 (Low) do not require any recommendation/action(s) to be listed. Items identified with Level 2 (Medium-Low) or 3 (Medium) risk ranking may require listing recommendation/action(s) to reduce the risk further, at the discretion of the HAZOP Study team.

For all of the Cause-Consequence pairings, after consideration of the present safeguards, the “Adequacy” was assessed by the HAZOP Study team. Although the safeguard may have been considered adequate, a recommendation may also have been made. This helps to demonstrate that for Low and Medium Risk items (where recommendations are not mandatory), that all reasonable steps are being, or will be undertaken to control the assessed risk.

Where recommendations/action items were made, the relevant Responsible Party was also recorded on the Worksheet. Refer to the Appendix B for the table showing the distribution of the Recommendation/Actions and their risk ranking.

All of the recommendations from the HAZOP Study will now need to be monitored by ENW and then closed out. Those who are allocated HAZOP Study recommendation(s)/action(s) shall be responsible to close-out their actions. Actions should not be considered closed unless descriptions are accompanied by suitable and sufficient evidence. In addition reasoning will also need to be supplied to justify and document why a recommendation/action was not implemented.

4 HAZOP Scope and Reference Documentation

4.1 Node List

The HAZOP Study focused on the normal operation of the Is-limiter concentrating on the effect potential failures/hazards had on safety of personnel and the commercial impact of equipment being damaged. It was decided that breaking down the Is-limiter device into a list of its associated components, would be the most effective method for this Study.

The list below is the seven (7) Nodes that were considered:

- Node 1 - Current Transformers.
- Node 2 - Trip Inserts.
- Node 3 - Power Supply Unit.
- Node 4 - Trip Unit.
- Node 5 - Indication Unit.
- Node 6 - Circuit Breaker.
- Node 7 - Overall (general system hazard scenarios).

The HAZOP was undertaken using the ABB schematic drawing of the Is-limiter (Reference 1). This is also attached in Appendix C of this report.

Node 7 was not specific to the Is-limiter as it was decided during the Study that a Node was required cover the overall general issues associated with the implementation of the Is-limiter to the ENW electrical network.

5 HAZOP STUDY DISCUSSION AND SUMMARY

This HAZOP Study was undertaken by a multi-disciplinary team, which consisted of Suitably Qualified and Experienced Personnel (SQEP). The HAZOP Study process was conducted in accordance with the methodology presented within Section 3. This consisted of a structured brainstorming exercise of the Is-limiter to identify the associated potential causes that could result in undesirable consequences to legality, financial impact, regulations, health, safety, environment, people, reputation and customer service.

5.1 HAZOP Study Summary

The HAZOP Study consisted of seven (7) Nodes. The output of the Study resulted in 6 recommendations being recorded within the HAZOP worksheets. The table below shows the distribution of the recommendations according to their risk ranking. The risk matrix was used to assess the severity and likelihood of all causes and consequences that were identified and examined. The use of the risk rankings will help to focus resources on the most significant risks.

Level 4	Level 3	Level 2	Level 1	Total
0	3	0	3	6

In summary, there were zero (0) Level 4 recommendations identified with a risk ranking of Level 4 (High). There were three (3) recommendations identified with a risk ranking of Level 3 (Medium), zero (0) recommendations with a risk ranking of Level 2 (Medium-Low) and three (3) recommendations with a risk ranking of Level 1 (Low).

The most prominent hazard identified with a risk ranking of Level 3 (Medium) was the loss of network electrical supply caused by the Is-limiter tripping. The potential consequence of this would be a loss of supply to customers for the duration it took to replace the trip inserts. This is a commercial issue, and not related to safety in any way. The recommendations proposed were to ensure the network was designed to safeguard that supply can be restored as quickly as possible, ensure adequate spare trip inserts are available and to ensure procedures and training are in place to replace trip inserts as quickly and safely as possible. If the recommendations are implemented, then the risk should be reduced to a level that is ALARP.

Overall, there were no safety concerns relating to the implementation of the Is-limiter. There are three (3) independent phases, with only one (1) phase requiring to operate at any giving time giving the conclusion that the Is-limiter is functionally safe to implement to the ENW electrical network.

All of the recommendations from the HAZOP Study will now need to be monitored by ENW and then closed out. Those who are allocated Study recommendation(s)/action(s) shall be responsible to close-out their actions. Actions should not be considered closed unless descriptions are accompanied by suitable and sufficient evidence. In addition reasoning will also need to be supplied to justify and document why a recommendation/action was not implemented.

It should be noted that two (2) potential hazard scenarios were identified concerning the unauthorised entry of personnel to a sub-station that could potentially lead to a fatality, and equipment damage caused by extreme environmental weather. These concerns were raised during the study to highlight that there are already effective safeguards in place such as sub-station security procedures and maintenance and inspection regimes. The current limiting device does not have any effect on the risk of these hazard scenarios.

6 REFERENCES

1 ABB Is-limiter – Structure. Interface of measuring and tripping device.

APPENDIX A – HAZOP STUDY WORKSHEETS

Node: 1. Current Transformers

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Current	1. Open circuit on CT wire	1. No signal to trip units in that phase	1. 3 independent phases	1	1	1			
	2. CT failure	1. No signal to trip units in that phase	1. 3 independent phases	1	1	1			
2. More Current	1. Short circuit current	1. Is limiter will operate	1. Is limiter will trip	1	1	1			

Node: 2. Trip Inserts

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Data or Control Signals	1. Failure of trip unit	1. Is limiter does not trip in that phase	1. 3 independent phases	1	1	1			
			2. Maintenance and inspection procedures						
	2. Broken connection	1. Is limiter does not trip in that phase	1. 3 independent phases	1	1	1			
			2. Maintenance and inspection procedures						
2. Pyrotechnic charge does not operate	1. Manufacturing defect	1. Is limiter does not trip in that phase	1. 3 independent phases	1	1	1			
			2. Manufacturing quality control						
	2. Ageing of the charge	1. Is limiter does not trip in that phase	1. Recommended service life	1	1	1			

Node: 3. Power Supply Unit

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Voltage	1. Loss of main supply from integral VT	1. Auxiliary supply working, no impact	1. Switched to auxiliary supply	1	2	1			
			2. Alarm function						
	2. Loss of auxiliary supply	1. Main supply working, no impact	1. Alarm function	1	2	1			
	3. Loss of main and auxiliary supply	1. Is limiter will not operate	1. Alarm function	3	1	2			
	4. Failure of auto change over switch on loss of main supply	1. Is limiter will not operate	1. Alarm function	3	1	2			
	5. Failure of power supply unit	1. Is limiter will not operate	1. Alarm function	3	1	2			
2. Over Voltage	1. Potential fault on LV cable for auxiliary supply	1. Potential damage to electronics	1. None	2	1	1	1. Consider installation of UPS	ENW	
3. Under Voltage	1. Potential fault on LV cable for auxiliary supply	1. Is limiter could trip early	1. Under voltage protection relay	1	1	1	2. Consider alarm function	ENW/ABB	

Node: 4. Trip Unit

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Voltage	1. Loss of power supply unit, see Node 3								
2. No Current	1. Defective CT, see Node 1								
3. More Current	1. Defective CT, see Node 1								
4. Less Current	1. Defective CT, see Node 1								
5. No Data or Control Signals to trip insert	1. Broken wire	1. Is limiter does not trip in that phase	1. 3 independent phases	1	1	1			
		2. Is limiter trips too early	1. None	1	1	1			
	2. Failure of tripping unit	1. Is limiter trips too early	1. None	1	1	1			
		2. Is limiter does not trip in that phase	1. 3 independent phases	1	1	1			
6. No Data or Control Signals to indication unit	1. Broken wire	1. May not have indication that Is limiter has tripped	1. 3 independent phases	1	1	1	3. Operational procedures put in place to check Is limiter following restoration of fault	ENW	
	2. Failure of tripping unit	1. May not have indication that Is limiter has tripped	1. 3 independent phases	1	1	1	3. Operational procedures put in place to check Is limiter following restoration of fault	ENW	
7. Less energy to activate charge	1. Defective capacitor	1. Is limiter will not trip	1. Self-monitoring alarms	1	1	1			
			2. Maintenance and inspection procedures						
			3. 3 independent phases						

Node: 4. Trip Unit

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
8. Incorrect Data or Control Signals	1. Broken or defective component may send incorrect signal	1. Is limiter may not trip	1. 3 independent phases	1	1	1			
			2. Maintenance and inspection procedures						
		2. Is limiter may trip too early	1. Maintenance and inspection procedures	1	1	1			
9. Common Mode Failure	1. Incorrect settings applied	1. Is limiter may not trip	1. Manufacturers quality control procedures	1	1	1			
		2. Is limiter may trip too early	1. Manufacturers quality control procedures	1	1	1			
		3. Loss of close inhibit to associated circuit breaker	1. Designed to fail safe	1	1	1			

Node: 5. Indication Unit

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Voltage	1. Loss of dc power supply	1. Associated circuit breaker will not trip	1. 110V battery back-up	1	1	1			
			2. Alarm function						
		2. Loss of alarm function	1. 110V battery back-up	1	1	1			
			2. Alarm function (ENW alarm)						
2. No Data or Control Signals	1. Defective indication unit	1. Loss of alarm function	1. 3 independent phases	1	1	1	3. Operational procedures put in place to check Is limiter following restoration of fault	ENW	
		2. Associated circuit breaker will not trip	1. 3 independent phases	1	1	1			
		3. Loss of close inhibit to associated circuit breaker	1. Designed to fail safe	1	1	1			

Node: 6. Circuit Breaker

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. No Voltage	1. Loss of dc power supply	1. Associated circuit breaker will not trip	1. 110V battery back-up	1	1	1			
			2. Alarm function						
		2. Loss of alarm function	1. 110V battery back-up	1	1	1			
			2. Alarm function (ENW alarm)						
2. No Data or Control Signals	1. See indication unit Node 5								

Node: 7. Overall

Drawings / References: Is-Limiter - Structure (Interface of measuring and tripping device)

Deviation	Cause(s)	Consequence(s)	Effective Safeguards	Risk Ranking			Recommendations	Responsibility	Comments
				S	L	RR			
1. More Current	1. Short circuit current	1. Is limiter will operate	1. Is limiter will trip	1	1	1			
	2. Unauthorised system change	1. Is limiter may not operate	1. Connection agreements	4	1	2			
	3. Authorised system change	1. Is limiter may not operate	1. Design procedures prior to network change	1	1	1			
2. Security	1. Unauthorised entry	1. Potential fatality	1. Sub-station security procedures already in place	4	3	3	7. Procedures are in place, Is limiter does not change this		Is limiter does not change the risk
3. External Hazards	1. Extreme environmental hazards (wind, rain)	1. Damage to Is limiter	1. Sub-station security procedures already in place	3	2	2	8. Procedures are in place, Is limiter does not change this		Is limiter does not change the risk
			2. Maintenance and inspection procedures						
4. Incorrect specification	1. Incorrect data from client	1. Is limiter may not operate correctly	1. Quality control procedures on both sides	3	1	2			
	2. Incorrect design from manufacturer	1. Is limiter may not operate correctly	1. Quality control procedures on both sides	3	1	2			
5. Loss of supply	1. Is limiter trips	1. Potential loss of supply to customers for length of time to replace inserts	1. None	3	3	3	4. Correct network design to ensure that supplies can be restored as quickly as possible	ENW	
							5. Ensure procedures and training are in place to replace inserts	ENW	
							6. Make sure adequate spare inserts are available	ENW	

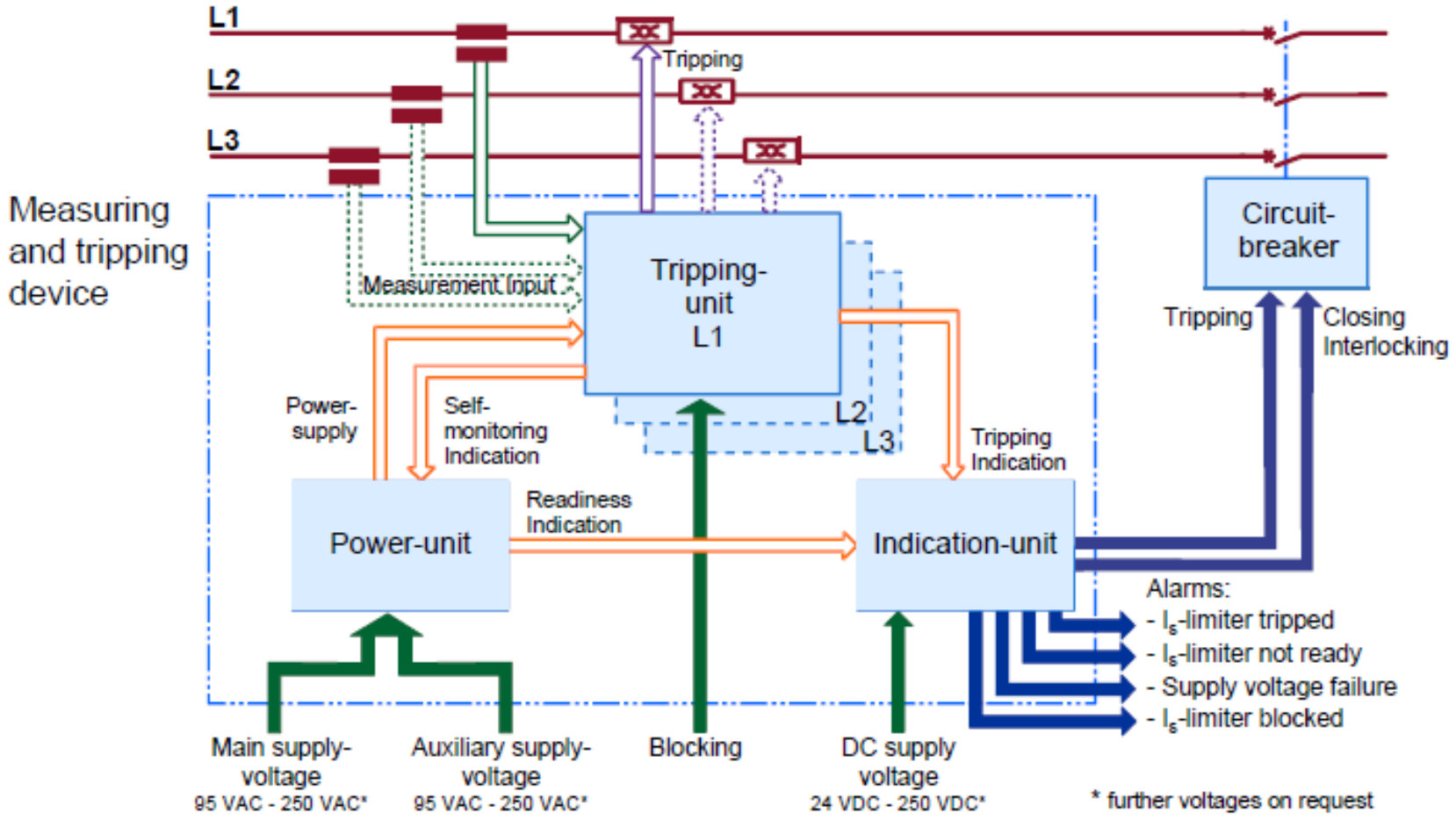
APPENDIX B – HAZOP STUDY RECOMMENDATIONS

Table B-1 – HAZOP Study Recommendations

Recommendations	Place(s) Used	Responsibility	Risk Ranking	Date Completed	Notes
1. Consider installation of UPS	Causes: 3.2.1	ENW	1		
2. Consider alarm function	Causes: 3.3.1	ENW/ABB	1		
3. Operational procedures put in place to check Is limiter following restoration of fault	Causes: 4.6.1, 4.6.2, 5.2.1	ENW	1		
4. Correct network design to ensure that supplies can be restored as quickly as possible	Causes: 7.5.1	ENW	3		
5. Ensure procedures and training are in place to replace inserts	Causes: 7.5.1	ENW	3		
6. Make sure adequate spare inserts are available	Causes: 7.5.1	ENW	3		
7. Procedures are in place, Is limiter does not change this	Causes: 7.2.1		3		Is limiter does not change the risk
8. Procedures are in place, Is limiter does not change this	Causes: 7.3.1		2		Is limiter does not change the risk

APPENDIX C – HAZOP STUDY DRAWINGS

Is-Limiter Structure



APPENDIX D – HAZOP STUDY TEAM MEMBERS

Attendance Sheet

Electricity North West
Preston
06/05/2014

No	Name	Company	Role	Signature
1.	Norman MacLean	ABS Consulting	Chairman	
2.	Stewart Fay	ABS Consulting	Scribe	
3.	MIKE TURNER	ENWL MAJOR PROJECTS	DESIGN MANAGER	
4.	PAUL WHITTAKER	ENWL Network Strategy	Policy & Standards MGR	
5.	GERALDINE BRYSON	ENWL FUTURE NETWORKS	FUTURE NETWORKS TECHNICAL MGR	
6.	TONY CLAYTON	ENW ENV DELIVERY MGR.	ENV DELIVERY MGR	
7.	Volker Schmidt	ABB	Special Project Manager	
8.	JOHN HARCOURT	ABB	ENWL ACCOUNT MGR.	
9.	DAN RANDLES	ENW	INNOVATION MGR	
10.	MATT KAYES	ELECTRICITY NORTH WEST LTD - NETWORK STRATEGY	SYSTEM OPERATIONS MANAGER	
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				

APPENDIX E – HAZOP STUDY RISK RANKING

Table E-1 – Risk Severity Descriptors

Risk Area	1 Negligible	2 Minor	3 Moderate	4 Significant	5 Serious
Financial (impact in a 12 month period)	<£100k	£100k - £1m	£1m - £5m	£5m - 10m	>£10m
Legal	No legal impact.	Criticism from Regulatory Bodies.	Small financial penalties imposed.	Financial penalties imposed. Breach of statutory duty, competition law or corporate manslaughter legislation.	Loss of Licence. Persistent Breach of statutory duty or risk of imprisonment of staff or directors.
Regulatory Performance	No impact on regulatory performance.	Request for performance improvement with no comparative shift in position.	Request for performance improvement requiring movement in comparative position. Small financial penalties imposed.	Failure to deliver promised improvements. Financial penalties imposed.	Significant regulatory penalties are incurred.
Health	On site work related sickness to individual employee.	Short term work related sickness absence exceeds departmental target.	Long term sickness exceeds departmental target. Involvement of company doctor.	Major injury or occupational risk exposure eg contact with hazardous substance / HSE Letter of Concern.	Occupationally contracted disease eg HAVs >5% of employees involved in specific activity/ HSE Enforcement notice or Prohibition Notice issued.
Safety	No impact on safety.	Near miss incident.	Minor accident - HSE request for information after accident.	RIDDOR reportable lost time injury. HSE Letter of Concern.	Major accident. Potential for HSE Enforcement or Prohibition Notice to be issued.
Environment	Near miss incident.	Small localised incident contained on site with minimal remediation resourcing required eg oil leak, diesel spillage.	Large scale on site incident requiring moderate remediation resourcing - EA request information / Improvement Notice issued.	Major incident leading to offsite pollution eg contamination of water course - EA Prohibition Notice or withdrawal of consents.	Catastrophic release causing pollution of Local Nature Reserve (LNR)/ Site of Special Scientific Interest (SSSI)/ RAMSAR site (Int. recognised conservation area). Fundamental break-down in working relationship with EA or Local Authority regulator resulting in prosecution.
People	Insignificant effect on staff morale and will not lead to staff absence/retention issues.	Small impact on staff morale amongst a few individuals, with little impact in terms of staff absence/retention and business continuity.	Decreased staff morale in a small number of teams around the business which may result in absence and productivity issues which need to be managed at line manager level. Corporate absenteeism increases by up to 1% over normal rate. Requires consultation with Union.	Impacts a significant number of company employees and results in uncertainty and lower levels of morale across more than one business directorate with increasing staff absence (<5% above normal rates). This may result in decreased productivity for the business as a whole. Inability to recruit appropriately skilled employees. Potential for extensive consultation/grievance with Union. Limited industrial action.	Decreased staff morale for a large number of staff across all business directorates. Potential for key staff leaving and increasing staff absence (>5% above normal rates) and staff turnover which will leave the business with serious risk exposure in terms of business continuity and productivity. Industrial action including strike action.
Reputation	Insignificant.	Local press article eg ENWL action criticised from key stakeholders such as our shareholders, the Regulator, partner forums, local pressure groups, or other alleged "expert".	Criticism in Industry Press or local/regional press. ENWL proposals/outcomes receive negative reaction in the electricity forums, and/or from Regulator(s) and other key stakeholders such as our shareholders.	Reported in national press/TV. ENWL brand raised into prominence (eg incident, business performance,) and publicised negatively by Regulator, electricity pressure groups or other key stakeholders. Significant effect on or prominence for owning consortia and shareholders.	Headline in national press – TV and newspapers. Failure to adequately address known problem or to anticipate or prepare for unpredictable occurrence. ENWL and owning consortia heavily criticized in media. Heavy criticism from key stakeholders such as our shareholders.
Customer Service	Individual justifiable complaint. If security of supply issue, small number of customers affected. Concluded within 18 hours.	Individual complaint of serious nature. Likely to be taken up by local consumer advocate or champion. Reported in local press. If security of supply issue, small numbers of customers affected after 18 hrs.	Failure to satisfy: >1,000 customers during a single incident; or >200 customers over a period of three months for a common cause; or Likely to generate >100 specific complaints. Headline in local or regional press.	Failure to satisfy: >10,000 customers during a single incident; or >2,000 customers over a period of three months for a common cause; or Likely to generate >1,000 specific complaints Likely to be visible and commented on by key stakeholders. Reported in national press.	Failure to satisfy: >50,000 customers during a single incident; or >10,000 customers over a period of three months for a common cause; or Likely to generate >5,000 specific complaints Likely to be visible and commented on by key stakeholders. Headline in national press.

Table E-2 – Risk Likelihood Descriptors

5	More than likely	>75% chance of happening	Regularity of risk is once in a quarter year.
4	Fairly likely	<75% chance of happening	Regularity of risk is once in one year.
3	Medium chance	<50% chance of happening	Regularity of risk is once in five years.
2	Low chance	<25% chance of happening	Regularity of risk is once in ten years.
1	Very low chance	<5% chance of happening	Regularity of risk is once in more than ten years.

Table E-3 - Risk Grid

	NEGLIGIBLE No impact on safety, financial impact <£100k	MINOR Near miss incident, financial impact £100k - £1m	MODERATE Minor accident, financial impact £1m - £5m	SIGNIFICANT Major injury or occupational risk exposure e.g. contact with hazardous substance / HSE letter of concern. Financial impact £5m - £10m	SERIOUS Major accident. Potential for HSE Enforcement or Prohibition Notice to be issued. Financial impact >£10m
More than Likely >75% chance of happening Regularity of risk is once in a quarter	2	3	4	4	4
Fairly Likely <75% chance of happening Regularity of risk is once in one year	2	2	3	4	4
Medium Chance <50% chance of happening Regularity of risk is once in 5 years	1	2	3	3	4
Low Chance <25% chance of happening Regularity of risk is once in 10 years	1	1	2	3	3
Very Low Chance <5% chance of happening Regularity of risk is once in more than 10 years	1	1	2	2	3

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