

Operating Process – Work on Low Voltage or Mechanical Apparatus

Summary

This document supports the Power System Safety Rules and its requirements detailed in Work on Low Voltage and Mechanical Apparatus – Category 4.

It applies to the operation of Low Voltage and Mechanical Apparatus for the purpose of issuing an Access Authority and subsequent restoration.

Document Control

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1. Purpose

This document supports the Power System Safety Rules and its requirements detailed in Work on Low Voltage and Mechanical Apparatus – Category 4.

2. Scope

This procedure applies to the operation of Low Voltage and Mechanical Apparatus for the purpose of issuing an Access Authority and subsequent restoration.

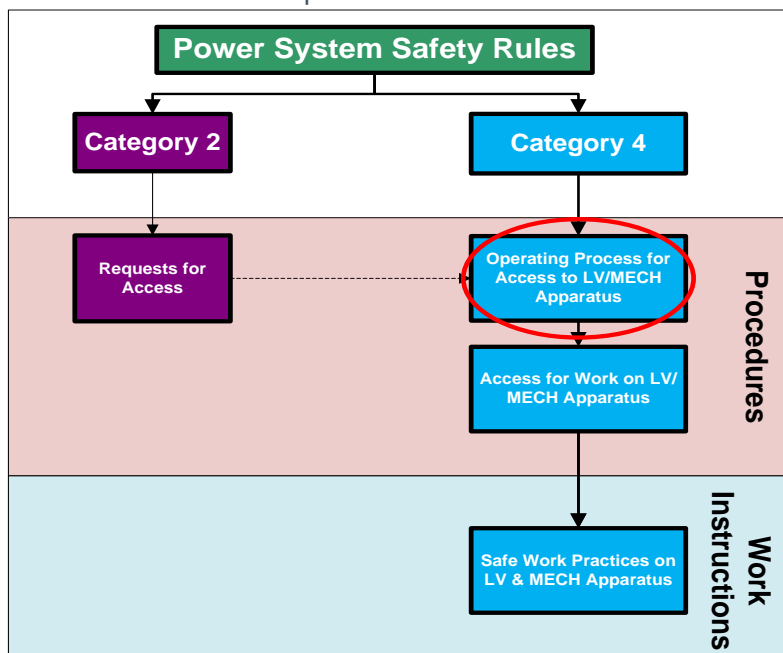
It applies for access to Low Voltage and Mechanical Apparatus in the charge of a Controller.

The sections within this document cover the generic sequence required to safely prepare Low Voltage or Mechanical Apparatus ready for the issue of a LV/MECH Access Authority or performed as part of the Local Safety Precautions prior to the issue of a High Voltage Access Authority. It also covers the generic restoration sequence required after cancellation of a LV/MECH Access Authority or during restoration of Local Safety Precautions.

This document should be read in conjunction with the ‘Access for Work on Low Voltage and Mechanical Apparatus’ and ‘Access for Work on HV Apparatus’, which cover the issue and cancellation of Access Authorities. It should also be read in conjunction with OM 412 which covers the operation of Low Voltage links for system security purposes.

2.1 Document Location

The following diagram describes the relationship between this and other relevant PSSR procedures.



3. Definitions

Term	Definition
Low Voltage and Mechanical Apparatus	Apparatus that falls within the scope of apparatus in the charge of a Controller, Power System Safety Rules (PSSR) section 4.1. Such apparatus could affect operation of the High Voltage (HV) power system because: <ul style="list-style-type: none"> (a) It is capable of causing operation of HV apparatus (for example: trip or prevent

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Term	Definition
	<p>tripping of circuit breakers).</p> <p>(b) It could affect the operation of HV apparatus (for example: cause or prevent tap changing of transformer);</p> <p>(c) It requires an outage of HV apparatus for safety of staff. This includes situations where work is to be carried out under an Access Authority on low voltage/mechanical apparatus, but access to high voltage exposed conductors is not required.</p> <p>Low Voltage (LV) or mechanical apparatus includes the following equipment where such equipment affects the operation of the high voltage system or operating facilities:-</p> <ul style="list-style-type: none"> • Alarm and metering circuits and equipment • Automatic generation control (AGC) equipment • Load shedding equipment of any description • Automatic voltage control equipment (on generating units, synchronous condensers, transformers and static compensators) • Auxiliary transformers and auxiliary supplies • Fire protection equipment associated with HV apparatus or LV apparatus (E.g. Deluge Systems) • Intertrip protection signalling equipment • LV or mechanical apparatus requiring HV apparatus out of service to provide personal safety requirements for the LV or mechanical work • LV or mechanical apparatus, which, if withdrawn from service, would preclude the associated HV apparatus staying in service • Protection relays and associated circuitry • Signalling controls instrumental to the operation of HV or LV apparatus • Supervisory control and monitoring equipment of any description (SCADA etc.) • Equipment associated with provision of sustained auxiliary supplies • HV equipment ancillary apparatus such as: cooling system fans and pumps; tap changer motors; performance monitoring facilities etc. <p>Any other Low Voltage or Mechanical apparatus is regarded as apparatus not in the charge of a Controller and for which PSSR Section 3.1.3 applies and is outside the scope of this procedure.</p> <p>If unsure of whether LV apparatus falls into the category of being in the charge of a Controller, contact Network Operations staff for clarification.</p>
Serviceable	<p>When an Access Authority is suspended, serviceable indicates that the apparatus could be returned to service if required by Network Operations.</p> <p>When cancelling an Access Authority, serviceable indicates whether your portion of the work has been completed successfully. Where this is a single portion of a structured series of outages cancelling serviceable does not necessarily mean that the apparatus would be suitable for return to immediate service.</p>

4. Operating Requirements

4.1 Requirements to make Low Voltage and Mechanical Apparatus safe for work

A Low Voltage and Mechanical Access Authority (LVMAA) is required for work on LV/MECH apparatus in the charge of a controller. Prior to the issue of a LVMAA, LV/MECH apparatus must be isolated, discharged and proven in the de-energised/discharged state in accordance with the requirements of the work, specified on the RFA.

A Low Voltage and Mechanical Preparation and Restoration Instruction (LVMPRI) is prepared, checked and used to perform the necessary low voltage and mechanical operations.

For information on the requirements for preparation of LVMPRI's consult: Appendix A - Preparation of LVMPRI's and section 4.3.3 of the PSSR.

4.2 Relationship between HVPRI and LVMPRI

The HVPRI is the controlling document for all aspects of HV isolation and earthing in accordance with the requirements of the PSSR. It also contains provisions for LV link operations for system security purposes and additional general operational requirements. The HVPRI does not specify isolations for LV/MECH safety.

The LVMPRI is the controlling document for all aspects of Low Voltage and Mechanical Safety. The LVMPRI should not rely on LV isolations performed as part of the HVPRI but shall cover in its entirety all aspects of Low Voltage and Mechanical safety isolations and operations for the work to be performed safely.

4.3 Using Low Voltage and Mechanical Preparation and Restoration Instructions

Each operating step in the LVMPRI requires the following 8 step method to be applied:

1. Read the LVMPRI step;
2. Take the LVMPRI to the point of operation;
3. Check the equipment description against the LVMPRI;
4. Prepare to perform the required actions;
5. Check again the equipment description and required actions against the LVMPRI;
6. Perform the required actions;
7. Check device has operated and all actions completed correctly; and
8. Cross off the step in the LVMPRI.

All LVMPRI's shall be listed in the Warning and Hazard Assessment Form for the work and the LV Access Authority.

Note: Each LVMPRI step shall be crossed off individually including nil action steps in existing LVMPRI's.

Where a step has sub components for nil actions they shall be crossed off as shown in Appendix A, Figure 3.

4.4 Special requirements for AVC equipment and Pilot Cables

4.4.1 Transformer Automatic Voltage Control Equipment

When Low Voltage access requires the automatic voltage control on a transformer to be taken out of service, this shall be done by a person authorised category 5.5 who will be responsible for maintaining the busbar voltage by manual control, as directed by the Controller.

The equipment shall be returned to automatic on completion of the work, as directed by the Controller.

E.g.: For a maintenance of a solid state AVR, Low Voltage Access only is required, however, the Authorised Person In Charge must be a person authorised category 5.5 to ensure they have suitable knowledge to operate the AVR system.

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4.4.2 Pilot Cables

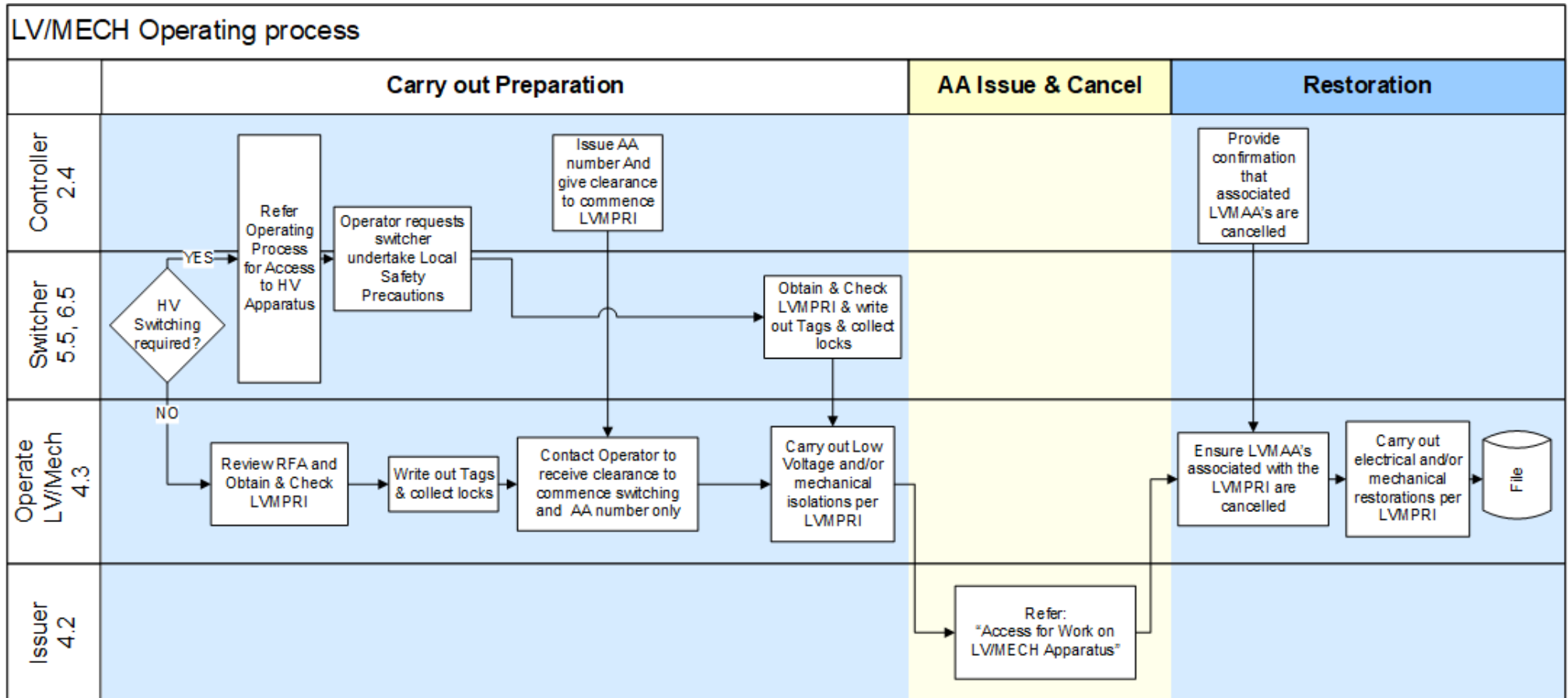
An RFA shall be submitted when work is to be performed on pilot cores carrying signals associated with:

- System security such as protection intertrips;
- System monitoring and control such as SCADA transmissions;
- Important telephone circuits.

Work by distributor staff on customer or joint use pilot cables requires the issue of an Access Authority for Test in accordance with the distributor's Electrical Safety Rules. As such, co-ordination of outages will be required as set out in OM 908 and a verbal clearance will be required from TransGrid's Controller.

All work by TransGrid staff on pilot cables shall be carried out in accordance with the procedures set out in ['Safe Work Practices on HV Cables' GD SR G3 172](#).

5. Operating Process



Note 1: This process is a generic sequence. Some sites have specific requirements, which can be found in the relevant substation OM's.

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5.1 Preparation

The LV/MECH Switcher shall follow the generic steps listed below:

Step	PSSR Authorisation	Task	Comments	Reference Document
1	5.5	If a HVPRI needs to be performed then at the Local Safety Precautions step the relevant steps below will be followed.		Operating Process for Access to HV Substation Apparatus
2	4.3	Obtain LVMPRI and ensure collation is correct		
3	4.3	Check Request For Access (RFA) matches the AA and LVMPRI		
4	4.3	Check LVMPRI sequence against work requested		
5	4.3	Write out required Tags (Do Not Operate or Warning tags)	Ensure correct information is written on Tags.	
6	4.3	Collect O1 locks if required		
7	4.3	Receive clearance to commence LVMPRI and receive LV/MECH AA number from the Controller.	If the Access Authority (AA) recipient is known at this time they can also be advised to the Controller.	
8	4.3	Follow steps of LVMPRI	Cross out steps as completed with a non-obliterating line.	

5.2 Access Authority Issue and Cancellation

Step	PSSR Authorisation	Task	Comments	Reference Document
1	4.2	Issue LV/MECH Access Authority		Access for Work on LV/MECH Apparatus
2	4.1	Cancel LV/MECH Access Authority		Access for Work on LV/MECH Apparatus

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5.3 Restoration

Step	PSSR Authorisation	Task	Comments	Reference Document
1	4.3	Ensure relevant LV/MECH AA's are cancelled	If the person performing the return switching was not part of the work party. They should call the Operator to confirm that the Access Authorities have been cancelled and advise the operator they will be commencing the LV/MECH restoration.	
2	4.3	Follow the restoration steps of LVMPRI	Cross out steps as completed with a non-obliterating line.	
6	4.3, 5.5	File 'completed LVMPRI' and associated documentation in designated filing cabinet.		

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6. Low Voltage and Mechanical Apparatus Tagging Requirements

Tags are used to indicate temporary abnormal conditions of apparatus. Printed tags are physically attached to equipment whereas electronic tags associated with supervisory systems (SCADA and HMI etc.) are graphic symbols shown adjacent to a device on the display.

The following tags are in use:

- Do Not Operate Tag (DNOT)
- Warning tag (WT)
- Control Inhibited Tag

6.1 Do Not Operate Tags and Warning tags

Use of DNOT's and WT's is controlled because they are part of the process to set up safe working conditions on or near High Voltage, Low Voltage and Mechanical apparatus in the charge of a Controller. Application and removal of DNOT's and WT's in this circumstance shall only be carried out by a person authorised PSSR Category 4.3, 5.5, 5.6 or 6.5.

- **Do Not Operate Tag** - PROHIBITS workers from operating any device switch, control, valve, link etc., to which it is attached. When used in conjunction with a LVMPRI the DNO Tag shall show the number of the associated LVMPRI and the date affixed.
- **Warning Tag** allows LIMITED OPERATION of the device or control to which it is attached, to the extent indicated on the tag. When used in conjunction with a LVMPRI the Warning Tag shall show the number of the associated LVMPRI, the associated AA number and the date affixed. Warning tags should also be endorsed, in the space headed "Comments", with any special instructions or conditions applicable to the restoration of the isolation, or operation of the control.

6.1.1 Obsolete Do Not Operate Tags or Warning tags

If a DT or WT is found attached to apparatus which is required to be operated, and it is likely that the tag is obsolete the matter shall be investigated by the Controller, who shall establish from records of Access Authorities whether the tag is no longer applicable and can be removed.

6.2 Control Inhibit Tags

A Control Inhibit Tag cannot be relied upon to prevent operations of the device they are attached to. Therefore, Control Inhibit Tags shall only be used as a visual indication to other work parties accessing the HMI. Safety Isolations shall be achieved by devices which provide certainty of the isolation. E.g. supply links

6.3 Tagging of LV or Mechanical Apparatus

6.3.1 Tagging of items identified as a group

In cases where links or fuses are identified as a group, one Do Not Operate Tag or Warning tag may be used to cover the group. In the case where control points, mechanical charging points and isolation points are located inside a cabinet, one tag may be applied to the closed door to cover those items and where a Do Not Operate Tag is used the door(s) are to be locked if practical.

6.3.2 LVMPRI Isolation and Tagging Requirements

At the completion of the LVMPRI, isolation points for the LV/MECH apparatus under access can be in one of three states as described below.

State	Code	RFA Type	Status of LV conductors and Mechanical apparatus in the work area
Operation of apparatus is NOT required.	NO	LV/MECH*	Isolated and Proven De-Energised

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State	Code	RFA Type	Status of LV conductors and Mechanical apparatus in the work area
Operation of apparatus IS required but NOT at the start of work	IN	Testing LV/MECH*	Isolated and Proven De-Energised
Operation of apparatus IS required at the start of work	IS	Testing LV/MECH*	Circuits and Mechanical Apparatus required operational immediately on receipt of the Access Authority are energised. All other circuits are isolated and proven de-energised.

*Where only a type of HV access is specified on the RFA the answers to question 4 and 5 on the RFA will determine the required LVMPRI type and state of apparatus to be accessed.

6.3.2.1 No operation of apparatus required for work (NO)

This is the state relevant to a standard LV/MECH Access Authority.

When there is no requirement for the operation of the apparatus by the person holding the Access Authority, then the PRI shall have steps for Do Not Operate Tags to be applied to all points of isolation and be locked where practical.

6.3.2.2 Operation of apparatus IS required, but NOT at start of work (IN)

This state is permitted when points of LV/MECH isolation need to be restored during the course of the work for conducting LV/MECH testing work, but the testing is not the first action to occur under the AA.

The PRI shall have steps for Warning tags to be applied to points of low voltage or mechanical isolation that may be restored during the course of the work and to all control points that are able to operate the apparatus during an operational test. Points of low voltage or mechanical isolation which do not need to be restored during the work shall have DNOT's applied and be locked where practical.

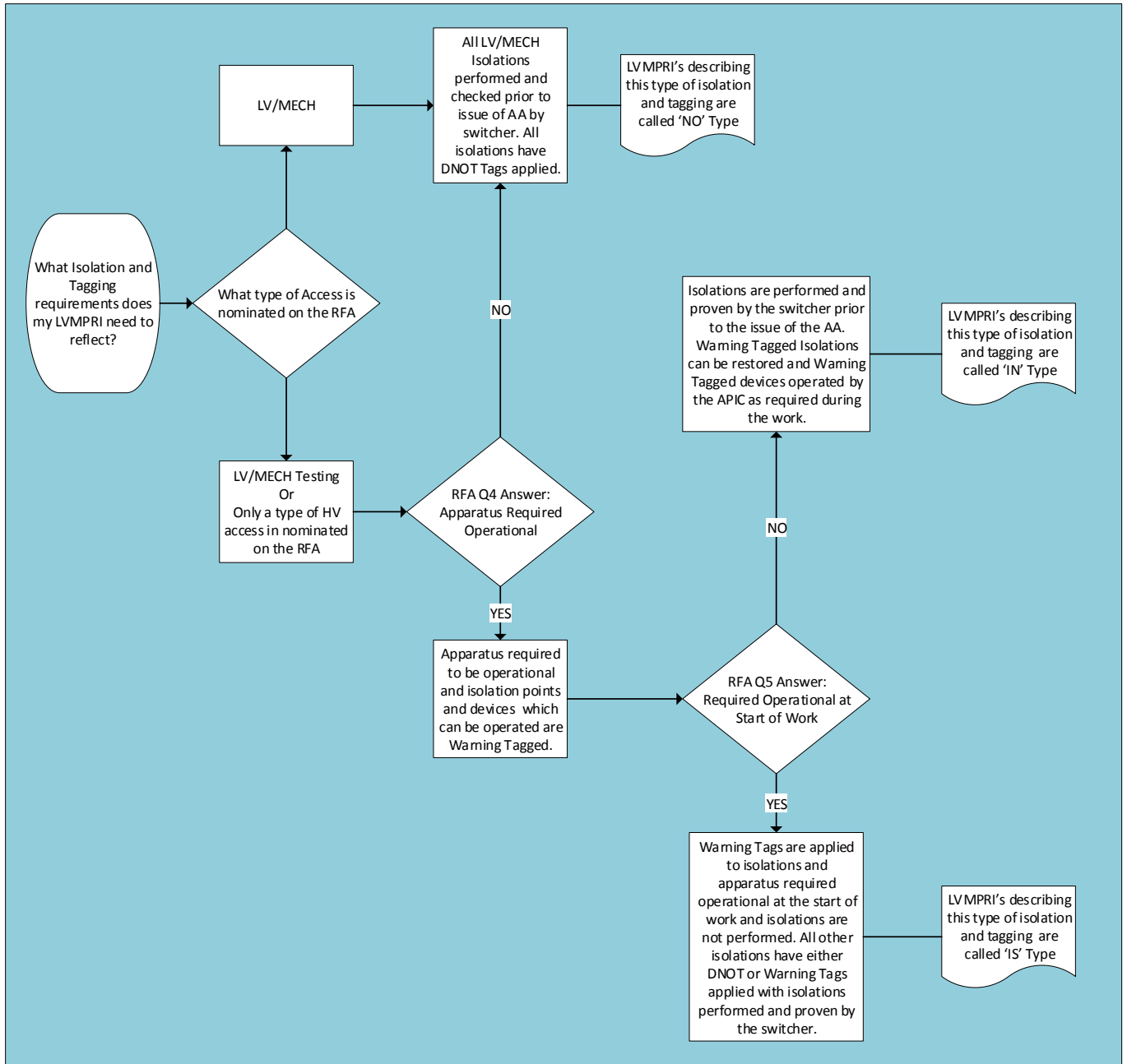
6.3.2.3 Operation of apparatus IS required at start of work (IS)

This state is permitted when testing requiring LV/MECH apparatus operational is the first action to be performed once the Access Authority is issued.

Warning tags shall be applied to isolation points of LV or Mechanical apparatus that may be altered during the course of the work and to all control points from which it is possible to operate the apparatus during the test. Points of low voltage or mechanical isolation which do not need to be restored during the work shall have DNOT's applied and be locked where practical.

6.3.2.4 LVMPRI Isolation and Tagging Requirements Decision Tree

The following decision tree describes the isolation and tagging requirements the LVMPRI should specify.



6.3.3 Control system isolations

If it is necessary to open a control supply link associated with SCADA or other remote control at an electrical station to prevent remote operation of HV apparatus (e.g. from the substation HMI), then the point of isolation shall be tagged. Should operational checks from the remote operation point be required during the work, Warning tags shall be applied to the open link(s). Otherwise, a Do Not Operate tag shall be applied to each point of isolation.

Appropriate tagging shall also be carried out at the remote operation point(s) within the substation.

6.3.4 Shared Isolation Points

Where multiple LVMPRI's utilise the same DNO tagged isolation point, then a DNOT shall be applied for each LVMPRI.

Where an LVMPRI restoration requires restoration of a double tagged isolation point only the tag for the LVMPRI being restored shall be removed. The state of the isolation point shall not be changed.

A DNOT and a Warning Tag shall not be applied to the same isolation point.

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7. Electrical and Mechanical Operating Work

Electrical operating work is the operation of switching devices, links, fuses, or other connections intended for ready removal or replacement, proving conductors de-energised, locking and tagging of electrical apparatus and the erection of barriers and signs.

Mechanical operating work is the operation of devices that control sources of energy and the implementation of control measures to prevent the unintentional release of that energy.

When electrical or mechanical operating work is carried out on apparatus in the charge a Controller steps shall be detailed in Low Voltage/ Mechanical Preparation and Restoration Instruction (LVMPRI) or a PMWI.

The preparation and restoration of Low Voltage and Mechanical apparatus shall be carried out in accordance with the following:

- (a) A LVMPRI is only carried out by a person authorised category 4.3 and a PMWI is only carried out by a person on the “PMWI Approved Person List”;
- (b) Electrical operating work on apparatus in the charge of a Controller be carried out at the direction of the Controller;
- (c) Isolation of electrical apparatus is carried out in accordance with section 7.1 De-energising, Isolating and Proving De-energised exposed conductors,
- (d) Isolation of mechanical apparatus is carried out in accordance with section 7.2 Discharging Mechanical Apparatus
- (e) Isolation measures such as tagging and, where practicable, securing the isolation should be verified/reviewed by the authorised person in charge and the work party as part of the demonstration process. Once the Access Authority is issued, all isolations must be managed in accordance with the requirements of the Access Authority.
- (f) In emergency circumstances involving danger to life or risk of damage to apparatus, electrical or mechanical operating work and/or other appropriate emergency operations shall be carried out in accordance with approved procedures provided the person carrying out the emergency operations considers it safe to do so. The Controller shall be advised of the emergency circumstances and of the emergency operations undertaken as soon as practicable.
- (g) The restoration steps of the LVMPRI shall not be commenced unless all Access Authorities associated with the LVMPRI are cancelled and all persons are clear;

7.1 De-energising, Isolating and Proving De-energised exposed conductors

Low Voltage and Mechanical apparatus shall be de-energised, isolated and proven de-energised in accordance with the requirements of the LVMPRI. When performing the LVMPRI the authorised person shall:

- Secure the isolations with locks where practicable
- Prove de-energised all conductors to be accessed. Test equipment used to prove conductors de-energised is to be proven on a known source immediately before and after the test.

7.2 Discharging Mechanical Apparatus

Control measures taken to isolate mechanical apparatus shall:

- (a) Prevent the activation or energising of apparatus or services including secondary sources of energy that are likely to adversely cause the activation or energising of the mechanical apparatus;
- (b) Ensure, if required, the mechanical apparatus is unwound, un-tensioned or drained, vented and depressurised;
- (c) Prevent the introduction of materials or substances through equipment such as piping, ducts, vents, drains, conveyors, service pipes;

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- (d) Prevent the uncontrolled movement or rotation of the mechanical apparatus;
- (e) Ensure, where practicable, that the devices isolating the mechanical apparatus are tagged and secured; and
- (f) Remain in place until all persons working under the authority have signed off.

8. System Security Isolations

8.1 Protection Isolations

Some types of work will require protection isolations to maintain system security.

The required protection isolations shall be detailed in the HVPRI for the outage except as allowed in 8.1.1(a) and (b). Protection isolations not covered as steps in a HVPRI shall be carried out using the appropriate Protection and Metering Withdrawal Instruction (PMWI). Required information shall be submitted under question 8 of the RFA submission.

8.1.1 Protection isolations delegated to protection staff

When work on protection equipment is to be performed by workers on the PMWI Approved Person List they may be delegated the responsibility for performing protection isolations subject to the criteria and associated actions in part (a) and (b) below.

- (a) When no other working party's safety relies on circuit breakers or unit protection associated with the protection being worked on.

Where this criteria is met and responsibility for system security isolations has been delegated to protection staff, such isolations shall be carried out using the relevant PMWI, after receiving an Access Authority and before commencing the designated work.

- (b) Where protection isolations have been included as steps in the PRI, additional protection isolation or restoration steps required for protection work may be carried out by the protection technician as part of their work, provided any proposed alterations to the isolations will not conflict with system security or the safety of any other work party.

In this situation, the Controller shall advise the protection technician, prior to the issue of an Access Authority, of any protection links previously opened in any relevant PRI. The protection technician shall list or reference these previously opened links on the Access Authority and on the PMWI. The protection technician shall carry out additional isolations using the relevant PMWI after receiving an Access Authority and before commencing the deFAsignated work.

Further information on responsibility for system security isolations are detailed in OM 412 – Operation of Low Voltage Links.

8.2 Control System Isolations

Requirements for system security isolations to perform work on control systems are determined by the Digital Infrastructure Manager.

9. Accountability

Title	Responsibilities and Accountabilities
Head of Health, Safety and Environment	> Ownership of this Procedure
Power System Safety Rules Manager	> Maintenance of this Procedure

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Title	Responsibilities and Accountabilities
Manager – Training	> Implementation of training programs associated with this procedure
Authorised Persons	> Comply with this procedure

10. Implementation

This procedure is to be implemented in conjunction with the implementation of TransGrid’s Power System Safety Rules. It will be available as a resource, published on the Wire.

11. Monitoring and review

The Power System Safety Rules Manager is responsible for the ongoing monitoring and review of the documents associated with the Power System Safety Rules. This can include but is not limited to:

- Requesting regular feedback on the effectiveness of procedures and work instructions. Appropriate feedback tools include focus groups and WHS consultative committees.
- Where a change has occurred in our processes; and
- Recommendations arising from incidents.

12. Change from previous version

Revision no	Approved by	Amendment
0	Lionel Smyth, EGM/Network Services & Operations	> Replaces in part documents ‘Operating Requirements – General’ GD SR G2 005; Operating Requirements - Work On System Low Voltage Or Mechanical Apparatus - GD SR G2 012; and ‘Operating Requirements - Local Safety Precautions’ GD SR G2 007.
1	K McCall, Manager Health, Safety & Environment	> This procedure has been reviewed and reissued with no changes.
2	K McCall, Manager Health, Safety & Environment	<ul style="list-style-type: none"> > Section 4 deleted > Section 5 summarised in line with other PSSR documents > Section 5.4.4 “Operation of apparatus IS required at start of work” revised to remove option of not carrying out LVMPRI > Attachments 2 & 3 updated to current templates
3	M Gatt, EM Works Delivery	<ul style="list-style-type: none"> > Definitions added. > Section 4 updated to include reference to Local Safety Precautions. > Document update throughout with references to OM 412. > Section 4.3 and Appendix A updated to address requirements for nil action steps. > Section 5 and section 7 the requirement for approval from the Controller to commence restorations was removed. > Former Electrical and Mechanical Operating Work sections combined to remove repetition. > Section 6.2 updated to clarify that Control Inhibit Tags should

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		<p>not be used for safety isolations.</p> <ul style="list-style-type: none"> > Section 4.2 and 6.3.2 added to improve clarity of intent. > Shared isolation points section added. > Section 7.1 contradictory information removed. Some information previously in this section moved to Appendix A. > Section 7.2 revised to be more specific and remove repetition > Section 4.4.1 example added. > Section 4.4.2 terminology clarified. > Section 8.2.1 updated to provide clarity about linkage to LVMPRI and provide linkage to the demonstration process. > Protection Isolation and control isolations moved into a system security isolations section > Appendix A updated > More detail provided on requirements around Nil action steps in Appendix A > Previous example LVMPRI's removed – templates can be accessed on the SharePoint site. > Appendix B created from specific mechanical isolation requirements content. > Appendix B section 1 updated with “where possible” to acknowledge that it is not always possible to reduce devices to a zero energy state and also to clarify that the LVMPRI should specify the sequence of steps to perform the mechanical isolations safely.

13. References

- > Power System Safety Rules
- > Access for Work on Low Voltage or Mechanical Apparatus
- > Safe Work Practices on Low Voltage and Mechanical Apparatus
- > Isolation and Restoration of Protection and Metering Equipment
- > Requests for Access
- > OM412 – Operation of Low Voltage Links

14. Attachments

Appendix A – Preparation of a Low Voltage/Mechanical Preparation and Restoration Instruction

Appendix B – Mechanical Isolation Methods

Appendix A – Preparation of a Low Voltage/Mechanical Preparation and Restoration Instruction

The Low Voltage/Mechanical Preparation and Restoration Instruction (LVMPRI) provides the step-by-step procedure required to be followed in order to prepare the identified LV or mechanical apparatus for access and restore the apparatus to service.

LVMPRI's written for maintenance will normally have isolations and restorations which mirror each other. LVMPRI's written for construction work where the asset is being changed may have a series of stages related to each phase of the work.

The isolation requirements for *Low Voltage or Mechanical Apparatus* will be derived from the relevant Request for Access (RFA).

The LVMPRI number is to have the format: (associated RFA No.) / (Sequence No.) e.g.

If there will be two LVMPRI's to be carried out for RFA No. 561, the first LVMPRI will be 561/1 and the second LVMPRI will be 561/2. The LVMPRI No. shall be used on the associated Do Not Operate Tags and Warning tags.

Alternate LVMPRI structured numbering can be used if necessary, the numbering systems and associated documents (e.g. commissioning program) must provide the switcher and Controller with ready reference between the isolations specified under the LVMPRI and the Access Authorities which rely on the LVMPRI isolations.

As per the PSSR clause 4.3.3 (d) The LVMPRI shall:

- (a) Be prepared using the standard templates available on the LVMPRI SharePoint site;
- (b) Be prepared and checked by two independent persons authorised category 4.3;
- (c) Nominate each device or item of equipment that is to be tagged and the required status of the device;
- (d) Specify the type of tag whenever a tag is to be applied;
- (e) Include steps to prove the integrity of the isolation e.g. proving de-energised;
- (f) Include, if required, steps to cover the exchange of operating clearances from other operating groups; and
- (g) Include details of warnings when required e.g. Take Local Safety Precautions as per Power System Safety Rules.

LVMPRI templates are available to authorised users at <http://thewire/projects/LVMPRI/Pages/default.aspx>

A.1 Electrical Isolation Requirements

If isolation is not possible (in addition to the de-energisation) then the point of de-energisation must be tagged and locked where possible, or otherwise secured in the open position and proven de-energised at the point of work to ensure that the circuit is de-energised.

If both a point of de-energisation and a point of isolation have been provided, one of these points must be tagged and locked where possible or otherwise secured in the open position to prevent its inadvertent operation.

A.2 Mechanical Apparatus Isolation Requirements

When workers are required to work on mechanical apparatus all materials, substances, agents or conditions harmful to persons should be isolated and rendered inoperable to prevent the activation or energisation of mechanical apparatus or services which could pose a risk to the health and safety of workers. This is to be performed in accordance with the requirements of the LVMPRI.

Specific mechanical apparatus isolation requirements are detailed in Appendix B.

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A.3 Nil Action Steps

Some existing LVMPRI's have nil action steps. It is acceptable to continue to use these LVMPRI's but they should be updated to have the nil action steps removed where practical. New LVMPRI's should not use nil action steps. Nil action steps shall be crossed out in accordance with the advice in Section 4.3.

A.4 LVMPRI Step format for group tagging

As per section 6.3.1 in some circumstances items can be tagged as a group.

For IN type LVMPRI's each isolation and/or operation point shall be identified by a **separate step** with the group tagging step as the final step as per the example below.


Location: No2 330kV/132kV Transformer				
Step	Item	Link/Fuse ID	Action	Tag
9.	415V AC & 120V DC Isolation Switches	F1, F2, F18	Switch to "OFF"	
10.	Fan and Pump CBs	F5, F6	Switch to "OFF"	
11.	Tapchanger MR Main Supply CB	F15	Switch to "OFF"	
12.	Cooling Control Switch	S1	Switch to "Manual"	
13.	Transformer Cooling Control Cabinet AC and DC controls supplies		Prove supplies de-energised	
14.	Transformer Cooling Control Cabinet		Apply tag	

Figure 1: Standard isolation step format for isolations identified as a group in IN type LVMPRI's


Location: No2 330kV/132kV Transformer				
Step	Item	Link/Fuse ID	Action	Tag
4.	Transformer Cooling Control Cabinet		Remove tag	
5.	415V AC & 120V DC Isolation Switches	F1, F2, F18	Check switched to "On"	
6.	Fan and Pump CBs	F5, F6	Check switched to "On"	
7.	Tapchanger MR Main Supply CB	F15	Check switched to "On"	
8.	Cooling Control Switch	S1	Check Switched to "Auto"	

Figure 2: Standard restoration step format for isolations identified as a group in IN type LVMPRI's

For IS type LVMPRI's each isolation and/or operation point which does not have its state changed shall be identified as a **sub part of the single step** with the action to apply the tag as per the example below. This is called an action and identification step. The restoration shall have discrete steps as per the example below.


Location: No2 330kV/132kV Transformer				
Step	Item	Link/Fuse ID	Action	Tag
9.	Transformer Cooling Control Cabinet		Apply tag, covers items below	
	415V AC & 120V DC Isolation Switches	F1, F2, F18	Nil	
	Fan and Pump CBs	F5, F6	Nil	
	Tapchanger MR Main Supply CB	F15	Nil	
	Cooling Control Switch	S1	Nil	

Figure 3: Standard isolation step format for an action and identification step in an IS type LVMPRI


Location: No2 330kV/132kV Transformer				
Step	Item	Link/Fuse ID	Action	Tag
4.	Transformer Cooling Control Cabinet		Remove tag	
5.	415V AC & 120V DC Isolation Switches	F1, F2, F18	Check switched to "On"	
6.	Fan and Pump CBs	F5, F6	Check switched to "On"	
7.	Tapchanger MR Main Supply CB	F15	Check switched to "On"	
8.	Cooling Control Switch	S1	Check Switched to "Auto"	

Figure 4: Standard restoration step format for isolations identified as a group in IS type LVMPRI's

Appendix B Mechanical Isolation Methods

B.1 Methods of Isolation from Moving Parts

Before work is permitted on any mechanical apparatus which has the potential to move, or in which agitators, fans or other moving parts that pose a risk to workers are present the possibility of movement should be prevented. Isolation procedures should ensure that movement is prevented by the relevant method described below or by approved alternative methods affording an equivalent level of safety.

- (a) Equipment or devices with stored energy, including hydraulic, pneumatic, chemical, mechanical, thermal or other types of energy, should be reduced, where possible, to a zero energy state. Where shafts, agitators, blades and other moving equipment are involved, then the risk of their free movement should be taken into account, and control measures such as chocking, wedging, chaining or removal of these parts considered. A warning of the stored energy and its status at the time of commencement of work, such as charged or discharged, shall be included on the Access Authority Warning and Hazard Assessment Form.
- (b) Positive steps shall be taken to achieve de-energisation, tagging and, where practicable, securing of machinery, agitators or other apparatus containing moving parts. This could require additional isolation, blocking or de-energising of the mechanical apparatus itself to guard against the release of stored energy. An example is the stored energy of springs.

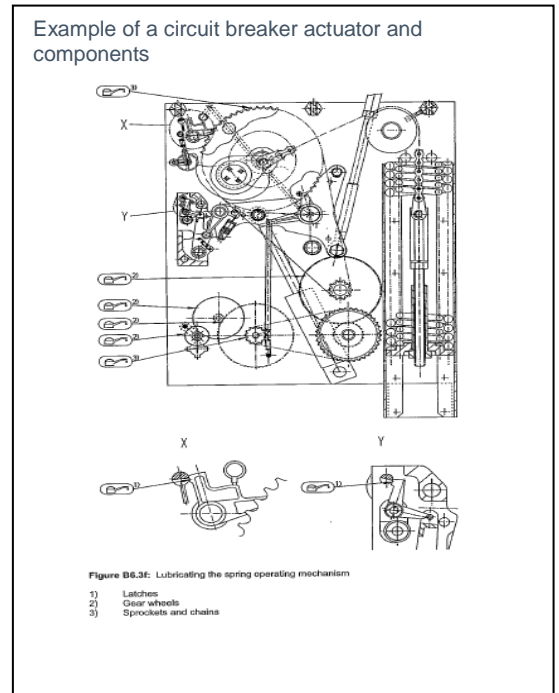
Such positive steps include:

- i. Operation of the circuit breaker to remove all stored energy;
- ii. Tagging and, where practicable, a means of securing should be placed on the open circuit breaker or open isolating switch supplying electric power to the mechanical apparatus with hazardous moving parts.
- iii. Where a power source cannot be controlled readily or effectively, a belt or other mechanical linkage should be disconnected and tagged to indicate the belt or linkage should not be reconnected until all work on the apparatus has been completed. When the removal of electrical components, such as fuses, is used as a means of isolation, then the electrical component should be removed and the circuit tagged. Circuits shall always be tested to ensure isolation is effective;
- iv. Moveable components should be tagged and, where practicable, secured and switches, clutches or other controls should be tagged to indicate that the tags and securing devices should not be removed until the work has been completed; and
- v. Secondary control circuits should be isolated by the removal of fuses or links, or the opening of circuit breakers, where appropriate.

The LVMPRI shall detail the sequence of steps in order to perform the mechanical isolations safely.

B.2 Methods of Isolation from Substances through Piping

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Piping isolation prevents the introduction of materials or substances through equipment such as piping, ducts, vents, drains, and service pipes.

The methods of isolation of piping should be in accordance with one of the methods described below or by an approved alternative method affording an equivalent level of safety:

- (a) Removal of a valve, spool piece, an expansion joint in piping leading to, and as close as practicable to, the work and blanking or capping the open end of the piping. The blank or cap should be identified to indicate its purpose. Blanks or caps should be of a material that is compatible with the liquid, vapour or gas with which they are in contact. The material should also have sufficient strength to withstand the maximum operating conditions such as pressure, temperature and surges, which may occur in the piping; or
- (b) Insertion of a suitable full-pressure spade (blank) in piping between the flanges as close as practicable to the work. The full pressure spade (blank) should be identified to indicate its purpose; or
- (c) Isolation by means of closing, tagging and, where practicable, securing (or both), of valves in the piping associated with the apparatus. A drain valve between the two closed valves should also be tagged and, where practicable, secured (or both) as part of this method.

NOTE: Where no pressure indicators have been installed in blanked-off pipe sections, consideration should be given to the possibility of pressure build-up occurring during the blanked-off time.

