



AUSTRALIAN RAIL TRACK CORPORATION LTD

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Discipline

Engineering Standard - NSW

Category

Electrical

Title

Isolation of High Voltage Equipment for Work Outside Substations

Reference Number

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Document Control

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The technical content of this document has been approved by the relevant ARTC engineering authority and has also been endorsed by the ARTC Safety Committee.

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About This Standard

This publication sets out the procedures to be followed by all contractors for the isolation of ARTC high voltage overhead lines and cables for work outside substations and subsequent restoration of supply.

In particular, it specifies the standard switching document: - the Working High Voltage Instruction (WHVI). This is an ARTC standard form to be used by all contractors undertaking field operation of the ARTC high voltage system. All Permits for which the isolation is required are linked to the WHVI. The procedures for managing this system are included.

This publication also specifies the associated interface with the State Rail Authority's Electrical System Operators – part of ARTC's electrical system control contractor.

Document History

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List of Amendments –

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1 Introduction

1.1 General

A Working High Voltage Instruction (WHVI) and an appropriate Permit must be issued for all work outside a substation that requires isolation and earthing of a high voltage overhead line or cable, except that:

- lines under construction may not need a WHVI. Refer to PMP 09 – "Work Near High Voltage Equipment – Permit Requirements and Safe Working Distances", or
- an appropriate Permit may be used to work on or near a pole mounted substation transformer, switchgear and associated substation equipment and including any associated high voltage equipment mounted on the same pole without the issue of a WHVI. If another high voltage service is mounted on the same pole as the Substation, that service must be isolated in accordance with a WHVI and the work near that service carried out under an appropriate Permit linked to that WHVI.

Where other Network Operator's services have to be isolated and earthed for the work, an Operating Agreement must be received from the Network Operator concerned by the Person in charge of the WHVI for the work near its services. The Electrical System Operators will be responsible for all arrangements for the isolation of the other Network Operator's services.

The standard ARTC WHVI form is shown at Sections 2.2 (front side) and 2.3 (reverse side).

1.2 Removal of Jumpers

Where equipment is isolated by the removal of bridges, jumpers or permanent connections and this removal requires both sides to be isolated, tested dead and earthed, each stage must be shown separately on a WHVI and a separate Permit is required for each of the following steps:

- the work of removing the bridges, jumpers or permanent connections,
- the work for which the bridges, jumpers or permanent connections are being removed, and
- the restoration of bridges, jumpers or permanent connections.

2 Working High Voltage Instruction (WHVI)

2.1 Information to be Included

A WHVI must specify:

- (i) The high voltage overhead lines or cables and low voltage overhead lines where required, that need to be isolated and earthed.
- (ii) The date and time of isolation.
- (iii) Any necessary Special Instructions. These must include:
 - a) Details of 1500 volt equipment for which a Permit must be received to allow work to be carried out at a specific location.
 - b) Details of other Network Operator services for which an Operating Agreement must be received to allow work to be carried out.
 - c) For high voltage overhead lines:
 - d)
 - all feeders carried on the poles concerned, distinguishing between those which are to be isolated and earthed and those which are to be treated as live,
 - any exposed electrical equipment that crosses under the isolated line within the work area, and
 - any high voltage equipment that crosses over the isolated line within the work area and which may present a hazard.
 - e) For high voltage cables:
 - all cables in the trench, troughing or on a cable tunnel shelf at the worksite, distinguishing between those which are to be isolated and earthed and those which are to be treated as live.
 - f) reference to any other WHVI that may be affected by or associated with this WHVI.
- (iv) All switching operations required to isolate the high and low voltage overhead lines or cables and to earth them where applicable, and the location of safety earths.
- (v) The area in which Permits and/or Operating Agreements may be issued.
- (vi) Any special tests that need to be done before the equipment is returned to service.
- (vii) The group that is to carry out the work.

2.2 "Working High Voltage Instruction" Form - Front Side

RAIL INFRASTRUCTURE CORPORATION
WORKING HIGH VOLTAGE INSTRUCTION

Revision 6
June 2001

No. _____

EQUIPMENT TO BE ISOLATED (including other Network Operator's Services) _____

DATE AND TIME _____

SPECIAL INSTRUCTIONS _____

THE ELECTRICAL SYSTEM OPERATOR SHALL ARRANGE FOR THE FOLLOWING SWITCHING AND SAFETY EARTHING:

CIRCUIT BREAKER / SWITCH / LINK

LOCATION

ACTION

AREA IN WHICH PERMITS MAY BE ISSUED _____

BY _____

ESO USE ONLY:

Telephoned/Facsimiled to _____
ISSUED BY _____
For System Control Engineer _____

Held by Authorised Person 1. _____ 3. _____
2. _____ 4. _____
Date _____

Clearance to proceed given to _____ Time _____
APPROVED BY _____
Authorised Person _____

2.3 "Working High Voltage Instruction" Form - Reverse Side

AUTHORISED PERSON IN CHARGE OF THIS WHV

Print

Signed

Date

Time

**RELIEVING AUTHORISED PERSON IN CHARGE OF THIS
WHVI**

Print

Signed

Date

Time

OTHER NETWORK OPERATOR'S OPERATING AGREEMENTS RECEIVED FOR THIS WHVI:

The Operating Agreement No must be advised to the Electrical System Operator if received.

Network Operator	Operating Agreement No	Service	Cancelled by	Time

THE FOLLOWING PERMITS AND / OR OPERATING AGREEMENTS HAVE BEEN ISSUED ON THIS WHVI:

The Permit and/or Operating Agreement Nos must be advised to the Electrical System Operator after the Permit and/or Operating Agreement issues have been completed.

Permit / Operating Agreement No.	Issued to	Issued by	Cancelled by	Time
-------------------------------------	-----------	-----------	--------------	------

WHEN ALL PERMITS AND / OR OPERATING AGREEMENTS ISSUED ON THIS WHVI HAVE BEEN CANCELLED AND ALL WORKING EARTHS HAVE BEEN REMOVED THIS WHVI MAY BE CANCELLED.

WHVI CANCELLED BY Print Signed AUTORISED PERSON Time

THE ELECTRICAL SYSTEM OPERATOR WHEN ADVISED THAT THIS WHVI HAS BEEN CANCELLED SHALL ARRANGE FOR SUPPLY TO BE RESTORED.

THE CANCELLED WHVI TO BE FORWARDED TO THE APPROPRIATE OFFICE.

Revision 6 June 2001

3 Arranging for Planned Work

3.1 Issuing Officer

A WHVI for planned work will be issued by an officer authorised to do so by the System Control Engineer. This officer is referred to as the “Issuing Officer” throughout Section 3.

3.2 Establishing the Need for a Permit

A contractor’s Electrical Safety System shall require that the person responsible for organising each job must establish whether a Permit is required in accordance with:

- PMP 09 – “Work Near High Voltage Equipment – Permit Requirements and Safe Working Distances”,
- PMP 13 – “Work Near 1500 Volt Equipment – Permit Requirements and Safe Working Distances”,
- PMP 14 – “Work Near Low Voltage Equipment – Permit Requirements and Safe Working Distances”.

The contractor’s Electrical Safety System shall require that if uncertainty exists about the identification of any equipment, advice must be obtained from a suitably Authorised Person prior to nominating the equipment from which removal of supply is requested.

3.3 Nominated Person

A Contractor shall nominate a suitably Authorised Person or Persons to:

- Co-ordinate orders for the isolation of high voltage overhead lines and cables,
- Liaise with the Issuing Officer, and
- Approve WHVI’s in the normal course of business.

This person is referred to as the “Nominated Person” throughout Section 3.

3.4 Order for Isolation of High Voltage Overhead Lines and Cables for Work Outside Substations

The person organising each job that requires a Permit and/or an Operating Agreement must forward an order for the electrical equipment to be isolated to the appropriate Nominated Person.

This order must include the following details:

- Dates and times,
- The location and extent of the work, e.g. pole number to pole number,

- A description of the work including plant,
- The overhead line or cable from which supply is requested to be removed.

Note

Where supply is required to be removed from 1500 volt overhead wiring for work to be carried out, the requirements of RailCorp publication EP 95 20 00 03 SI – "Isolation of 1500 Volt Overhead Lines and Cables for Work Outside Substations" must be complied with.

3.5 Liason with the Issuing Officer

The Nominated Person must obtain confirmation from the Issuing Officer that the high and low voltage overhead lines or cables, including other Network Operator's services where required, may be taken out of service on the date and for the time proposed for the work.

3.6 Order for WHVI

Using the information from:

- the order for the isolation submitted by the person responsible for organising the job,
- reference to controlled copies of Operating Diagrams, and
- field inspection if necessary,

the Nominated Person must forward to the Issuing Officer the Order for the WHVI which includes the details set out in Section 2.1 (i), (ii), (iii), and (vi).

If the requirements for several jobs are compatible, the details may be combined on a single order for a single WHVI.

The order must be submitted:

- a minimum of 3 working days prior to the work where an Operating Agreement is not required, or
- where another Network Operator is involved, by 0900 hrs on the Monday of the week prior to the work being carried out.

3.7 Issue of WHVI

The Issuing Officer should issue the WHVI to the Nominated Person a minimum of 1 working day prior to the work.

3.8 Checking and Approval of WHVI

3.8.1 Field Copy

A Nominated Person approving WHVI's must be authorised to do so.

The Nominated Person must check the field copy of the WHVI against both the details of the order as detailed in Section 3.4 and the order for the WHVI as detailed in Section 3.6.

This checking must include that:

- (i) The area in which Permits and/or Operating Agreements may be issued is correct and complete.
- (ii) The high and low voltage overhead lines or cables (including other Network Operator's services where required), from which supply is to be removed, fully cover the area in which Permits and/or Operating Agreements may be issued.
- (iii) Any special instructions are correct and complete.
- (iv) The switching operations required to isolate the high and low voltage overhead lines or cables and to earth them where applicable, are correct and complete.
- (v) The locations of safety earths are correct.
- (vi) The dates and times are correct. When satisfied that the WHVI is correct, the Nominated Person may then approve the WHVI. **Note**

The person who co-ordinates, checks and forwards the Order should preferably be the same Authorised Person who approves the WHVI.

In the event where an alternative Authorised Person is to approve the WHVI, care must be taken to ensure that all relevant information is available prior to approving.

After approval, the Nominated Person must forward the WHVI to the person who will be in charge of the WHVI together with details of the work to be carried out on each Permit.

3.8.2 Electrical System Operator Copy

The Electrical System Operator must check:

- Items (i), (ii) and (iii) of Section 3.8.1 as far as can be determined from the Operating Diagrams or other electrical safety documents available at the Electrical Operating Centre, and
- Items (iv), (v) and (vi) of Section 3.8.1 and sign the Electrical System Operators copy.

3.8.3 Minor Alterations to a WHVI After it Has Been Issued

If it becomes necessary to make minor alterations to a WHVI after it has been issued, the person making the alteration must ensure that all copies have been amended. The WHVI must then be re-checked by both the Nominated Person and an Electrical System Operator. This rechecking must include checks of any relevant details in Section 3.8. Each amendment must be initialed and dated by the person checking.

Once a WHVI is in force, no alterations may be made to it in respect to the switching required for the isolation except as permitted in Sections 3.9.1 and 3.9.2.

If it becomes necessary to alter a WHVI in a way that will cause the electrically safe work area to be altered, any Permit holder who has been instructed in the electrically safe work area must be re-instructed for the new area.

3.9 Alterations to the Switching for a WHVI

3.9.1 Maintaining Supply

The Electrical System Operator may amend the switching required to maintain supply to allow for changes to the system arrangements.

3.9.2 Overhaul of Line Air Break Switch at a Substation

If it is necessary to overhaul a line air break switch, which is a point of isolation for the WHVI, it is permissible to extend the high voltage isolation within the Substation to allow the line air break switch to be overhauled. This must be done by an Authorised Person who must have the concurrence of the Electrical System Operator. In this case, the Permit for the overhaul of the line air break switch must be endorsed with the words "Line Air Break Switch No. _____ is to be checked open and Danger Tagged in accordance with current WHVI No. _____ prior to the cancellation of this Permit."

The Electrical System Operator may then authorise the removal of the Danger Tag that was attached for the WHVI. The person holding the Permit must replace this Danger Tag before cancelling the Permit and advise the Electrical System Operator that the Danger Tag applied for the WHVI has been replaced.

The safety earths on the line for the WHVI must not be removed in connection with work carried out in accordance with the above provisions.

4 Arranging for Emergency Work

A WHVI for emergency work will be issued by an officer authorised to issue emergency WHVI's by the System Control Engineer. This officer is referred to as the "Issuing Officer" throughout Section 4.

4.1 Contractor's Authorised Person on Site

The requirements for a WHVI for emergency work shall be coordinated by the contractor's Authorised Person on site.

This person shall:

- Co-ordinate the requirements for the isolation of high voltage overhead lines and cables with those parties who will require Permits for those services in order to carry out the emergency work;
- Liaise with the Electrical System Operator; and
- Approve the emergency WHVI.

4.2 Order for WHVI (Verbal)

The contractor's Authorised Person on site must communicate verbally with the Issuing Officer regarding the high and low voltage overhead lines or cables, including other Network Operator's services, that need to be isolated and earthed for the work to be carried out safely. Reference shall be made to controlled copies of Operating Diagrams and an appropriate field inspection shall be carried out.

Once agreement has been reached about the services to be isolated and the timing of the isolation, the contractor's Authorised Person on site must communicate to the Electrical System Operator the details required to be included on the WHVI as set out in Section 2.1 (i), (ii), (iii), and (vi).

4.3 Issue of WHVI

The Issuing Officer must issue the WHVI to the contractor's Authorised Person on site. This may be done verbally, in which case the Authorised Person on site must record the details on a WHVI form. Alternatively, the WHVI may be issued by fax or may be hand delivered.

Care must be taken to ensure that work does not proceed until any discrepancy resulting from transcription or fax transmission has been resolved.

4.4 Checking and Approval of WHVI

The field and Electrical System Operators' copies of the emergency WHVI must be checked and approved in the same way as for a WHVI for planned work. Minor alterations to an emergency WHVI after it has been issued must be dealt with in the same way as for a WHVI for planned work.

5 Procedure for Isolation

Note:

A WHVI must be issued in accordance with the procedure detailed in Section 3 or 4.

5.1 Responsibilites of the Electrical System Operator

The Electrical System Operator must:

- (i) Arrange for the switching operations listed on the WHVI to be carried out.
- (ii) Arrange for proving dead and for the safety earthing operations listed on the WHVI to be carried out.
- (iii) Where other Network Operator's services need to be isolated:
 - request the other Network Operator to remove supply from its services, and
 - obtain confirmation from the person in charge of the WHVI that the required Operating Agreement has been received.
- (iv) On completion of the switching and safety earthing operations, inform the person in charge of the WHVI that:
 - supply has been removed in accordance with the WHVI, and
 - safety earths have been applied where applicable in accordance with the WHVI, and
 - clearance is given to proceed with the proving dead, earthing and issuing of Permits and/or Operating Agreements.

5.2 Responsibilites of the Person in Charge of the WHVI

- (i) Prior to work commencing, the person in charge of the WHVI must contact the Electrical System Operator and advise their name, the number of the WHVI held and the staff arrangements for field switching.
- (ii) When given clearance to proceed with proving dead, earthing and issuing of Permits and/or Operating Agreements by the Electrical System Operator, the person in charge of the WHVI must:
 - a) Sign the back of the WHVI as the person in charge of the WHVI and enter the date and time.
 - b) Ensure that an Operating Agreement is received from another Network Operator where required and list the details on the back of the WHVI. The other Network Operator's Operating Agreement must be kept with the WHVI until the Operating Agreement is cancelled.
 - c) For high voltage overhead lines and cables, arrange for proving dead to be carried out.

- d) For high voltage overhead lines and cables, arrange for safety earths to be applied.
- e) For low voltage overhead lines, arrange for proving dead to be carried out.

6 Management of a Current WHVI

6.1 Arrangements for Issuing of Permits

6.1.1 General

The person in charge of the WHVI must ensure that each person who will be issuing a Permit or an Operating Agreement has a copy of the approved WHVI.

Once the procedure in Section 5 has been completed, the person in charge of the WHVI must arrange for an appropriate Permit and/or an Operating Agreement to be issued to each separate work party to carry out work on or near the specified overhead lines or cables.

The details of all Permits and/or Operating Agreements issued on the WHVI must be listed on the back of the WHVI form.

6.1.2 Numbering of Permits and Operating Agreements

Each Permit or Operating Agreement must be numbered in accordance with PMP 06 – “Permit System”, Section 3.

6.1.3 Backup Record of Numbers of Permits Issued

The person in charge of the WHVI must contact the Electrical System Operator immediately after the issue of one or more Permits and/or Operating Agreements and advise the identifying numbers of the Permits and/or Operating Agreements issued. This requirement also applies to other Network Operator’s Operating Agreements if received.

The Electrical System Operator must record the following details on the reverse side of the Electrical System Operator’s copy of the WHVI:

- the identifying number(s) of the Permits and/or Operating Agreements issued on the WHVI, and
- the identifying number(s) of any other Network Operator’s Operating Agreements received for the WHVI,

as advised by the person in charge of the WHVI.

6.1.4 Advice of Possible Late Restoration

If the person in charge of the WHVI becomes aware that work will not be completed in time for supply to be restored by the time stated on the WHVI, the Electrical System Operator must be informed immediately. The WHVI remains in force until all Permits and/or Operating Agreements issued have been cancelled.

6.2 Transfer of Responsibility

- (i) The person in charge of the WHVI must:
- advise the Electrical System Operator before ceasing to be in charge of the WHVI, and
 - advise the Electrical System Operator where the WHVI and the other Network Operator's Operating Agreement, if received, will be left for the next shift.

When ceasing duty, the person in charge of the WHVI relinquishes responsibility for holding the WHVI.

- (ii) The person taking over the WHVI must:
- advise the Electrical System Operator, and
 - take responsibility for the WHVI and the Operating Agreement if received, by signing the WHVI in the space provided and entering the date and time.

6.3 Procedure in Case of the WHVI Being Lost

In the event that the original copy of the WHVI is lost, the person in charge of the WHVI must contact the Electrical System Operator immediately and arrange for a replacement WHVI. The replacement may be transmitted verbally and transcribed onto the appropriate form, or may be transmitted by fax. Both sides of the form must be replaced. The replacement WHVI must be endorsed "REPLACEMENT - Original Lost". The date, time and initials of the Person in charge of the WHVI must be included with this endorsement.

When completing the reverse side of the replacement form, the identifying numbers of all Permits and Operating Agreements issued on the lost WHVI, and other Network Operator's Operating Agreements if received, as recorded on the Electrical System Operator's copy, must be used to ensure that all Permits and Operating Agreements that were issued, and other Network Operator's Operating Agreements if received, are included on the replacement WHVI. The book copies of Permits and Operating Agreements, or other methods, should then be used to establish who the individual Permits and Operating Agreements were issued to. At the required time, cancellation of the WHVI must then proceed in accordance with the normal procedures.

6.4 Cancellation of WHVI's

The person in charge of the WHVI must:

- (i) Ensure that any special tests that need to be done before the equipment is energised have been completed satisfactorily.
- (ii) Arrange for all Permits and Operating Agreements issued on the WHVI to be cancelled and for all working earths to be removed.
- (iii) Enter the time each Permit or Operating Agreement is cancelled in the space provided on the WHVI.
- (iv) Cancel the WHVI with the Electrical System Operator.
- (v) Sign and enter the time of cancellation on the back of the WHVI, and
- (vi) Forward the cancelled WHVI to the appropriate office.

7 Procedure for Energising at Line Voltage to Carry out a Phase Check

7.1 General

This procedure provides for energising at line voltage to carry out phase checking. The WHVI does not need to be cancelled. All Permits and/or Operating Agreements issued on the WHVI must be cancelled as required in Sections 7.2 and 7.3. The line may be re-isolated and additional Permits and/or Operating Agreements issued on the original WHVI if required to allow alterations to be made.

7.2 Responsibilities of the Person in Charge of the WHVI

The person in charge of the WHVI must:

- (i) Ensure that any special tests that need to be done before the equipment is energised have been completed satisfactorily.
- (ii) Arrange for all Permits and/or Operating Agreements issued on the WHVI to be cancelled and for all working earths to be removed.
- (iii) Advise the Electrical System Operator that:
 - all Permits and/or Operating Agreements issued on the WHVI have been cancelled and that no further Permits and/or Operating Agreements will be issued without clearance from the Electrical System Operator,
 - all working earths have been removed, and
 - the overhead lines or cables may be energised for phase checking.

7.3 Responsibilites of the Electrical System Operator

The Electrical System Operator must:

- (i) Accept clearance to energise only from the person in charge of the WHVI.
- (ii) Arrange for the safety earths to be removed.
- (iii) Arrange for the relevant Danger Tags to be removed and for the necessary switching operations to energise the equipment to be carried out.
 - If the phasing is found to be correct, advise the person in charge of the WHVI and request that the WHVI be cancelled in accordance with Section 6.4 and that supply be restored in accordance with Section 8.

Note

Some steps of the procedures set out in Sections 6.4 and 8 will already have been completed and need not be repeated.

- If the phasing is found to be incorrect:
 - advise the person in charge of the WHVI, and
 - remove supply again in accordance with Section 5 and the original WHVI to allow alterations to be made.

8 Procedure for Restoration of Supply

Prior to restoration of supply, the WHVI must be cancelled in accordance with Section 6.4.

WARNING

The equipment must not be returned to service until any necessary cable tests and phase checks have been carried out.

8.1 Responsibilites of the person in charge of the WHVI

The person in charge of the WHVI must:

Sign off all other Network Operator's Operating Agreements if received. Advise the Electrical System Operator that:

- all Permits issued on the WHVI have been cancelled,
- all working earths have been removed,
- all other Network Operator's Operating Agreements have been signed off, and
- supply may be restored to the overhead lines or cables specified on the WHVI.

8.2 Responsibilities of the Electrical System Operator

The Electrical System Operator must:

- (i) Accept clearance to restore supply only from the person in charge of the WHVI.
- (ii) Arrange for the safety earths to be removed.
- (iii) Arrange for the relevant Danger Tags to be removed and for the necessary switching operations to restore supply to be carried out.
- (iv) Advise other Network Operators that their Operating Agreements have been signed off and supply may be restored as far as the RAC is concerned.
- (v) On restoration of supply, advise the person in charge of the WHVI that the associated supply has been restored so far as that WHVI is concerned.