

# HV Live Work - Mid Span Isolator Maintenance Guideline

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This guidance note has been developed by the Victorian Electricity Supply Industry (VESI) HV Live Work Committee.

*Published by the  
Victorian  
Electricity Supply  
Industry*

July 2021

DATE	VERSION	AMENDMENT
July 2021	1.0	INITIAL VERSION
July 2021	1.1	Update to include: <ul style="list-style-type: none"><li>1. Compliance date in Scope</li><li>2. Appendix A – Method for installation/removal of mid span isolators</li><li>3. Appendix B – VESI Memo re this Guideline</li></ul>

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## 1 INTRODUCTION

Mid Span Isolators (MSI) are installed on energised High Voltage (HV) Conductors to provide a temporary isolation point. The maximum rated breaking current for an MSI fitted with arc chutes is 400 amps.

## 2 PURPOSE

The purpose of this document is to provide consistency across the Victorian industry regarding the ongoing and routine maintenance of Mid Span Isolator Units (MSI) units. It does not cover off the electrical connections required as that is an individual VESI Distribution Business (DB) decision. This guideline applies to MSI's fitted with or without arc chutes

## 3 SCOPE

This guideline applies to all VESI network operators, employers and Live HV lineworkers who perform HV Live Work and establishes the requirements for the inspection and maintenance of MSI's.

Network operators and employers are to implement the outcomes described in this Guideline by June 30, 2022.

For works in the period prior to June 30 2022, any MSI that has not yet been mechanically tested can still be used subject to inspection prior to use and current electrical test date.

## 4 GENERAL

Always inspect MSI units prior to removal and if the condition of an in-service MSI is suspect, procedures exist that involve the use of a tensioning device, (e.g. Lugall) to bypass the entire mechanical load taken by the MSI and turnbuckles, thus allowing its safe removal. Refer to Appendix A

## 5 INSPECTION & MAINTENANCE OF MID SPAN ISOLATORS

### 5.1 MSI ELECTRICAL CERTIFICATION

MSI's are electrically tested and certified by the High Voltage Test Laboratory and retested at the VESI Distribution Companies prescribed test intervals.

### 5.2 MSI MECHANICAL CERTIFICATION

Switches should be mechanically tested and certified by an approved testing facility prior to use and retested at intervals not exceeding 12 months;  
Switches shall be visually inspected for defects to the insulator and endcaps prior to undergoing mechanical testing.

The test should be conducted in a horizontal plane with the round holes in line with the insulator at either end of the switch used to test pull to 15kN.

Correct turnbuckle alignment inline with the insulator



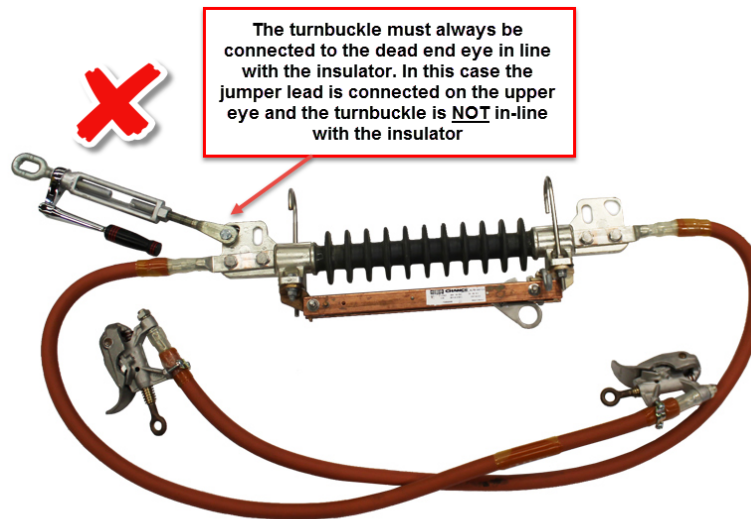
#### Correct turnbuckle alignment

Turnbuckle and straining devices are inline with the insulator



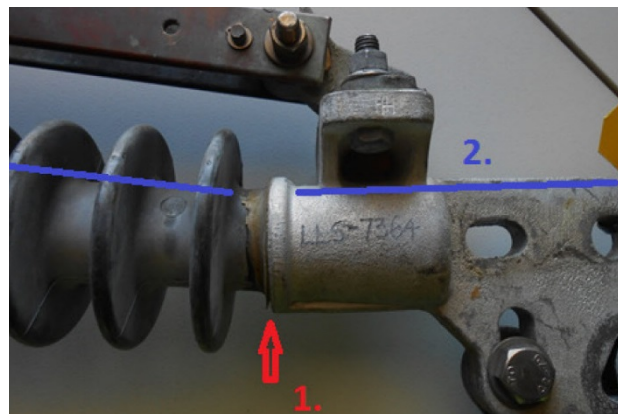
### Incorrect turnbuckle alignment

Turnbuckle installed in upper position not inline with the insulator.



If the switch you are inspecting **has been tensioned / strung up from the incorrect position**, please ensure you thoroughly inspect:

1. The RTV seal around the insulator to ensure it has not cracked (as per Figure below) or
2. The alignment of the Insulator to the end fittings is required to be in a straight line.



## 5.3 FIELD INSPECTION AND MAINTENANCE




MSI units have a duty cycle that varies with the currents broken. In addition to the scheduled electrical testing, the following inspection & maintenance shall be carried out on the switchgear.

This includes inspecting the units for:


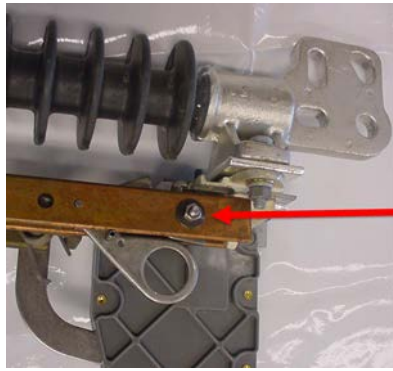
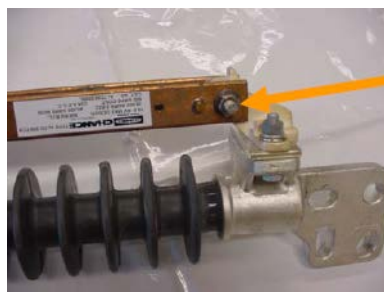

- General appearance and cleanliness; contacts for signs of overheating or local arc damage;
- Moving contacts and jaws to confirm suitable pressure remains after lubrication
- Condition and alignment of the arc control devices for breakages, wear, heat or arc damage;
- Condition of covered leads and connection points, particularly for heat damage or fraying;
- Condition of clamps, including heat or arc damage on the inside of the jaws, and free operation of threads.

## 5.4 ANNUAL MSI MAINTENANCE

Records of annual maintenance should be available for crew or stickers indicating when due for next annual maintenance is to be completed.

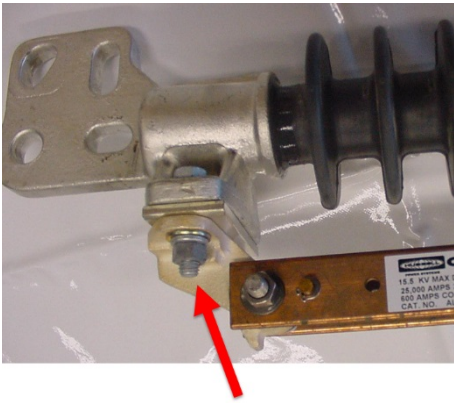
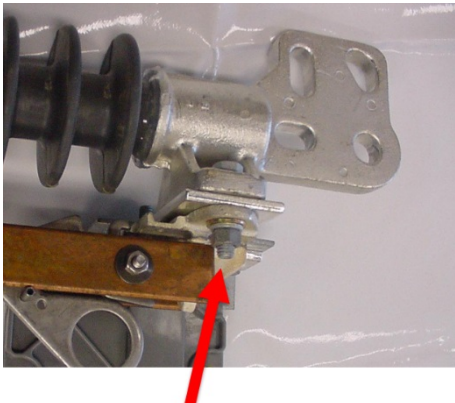
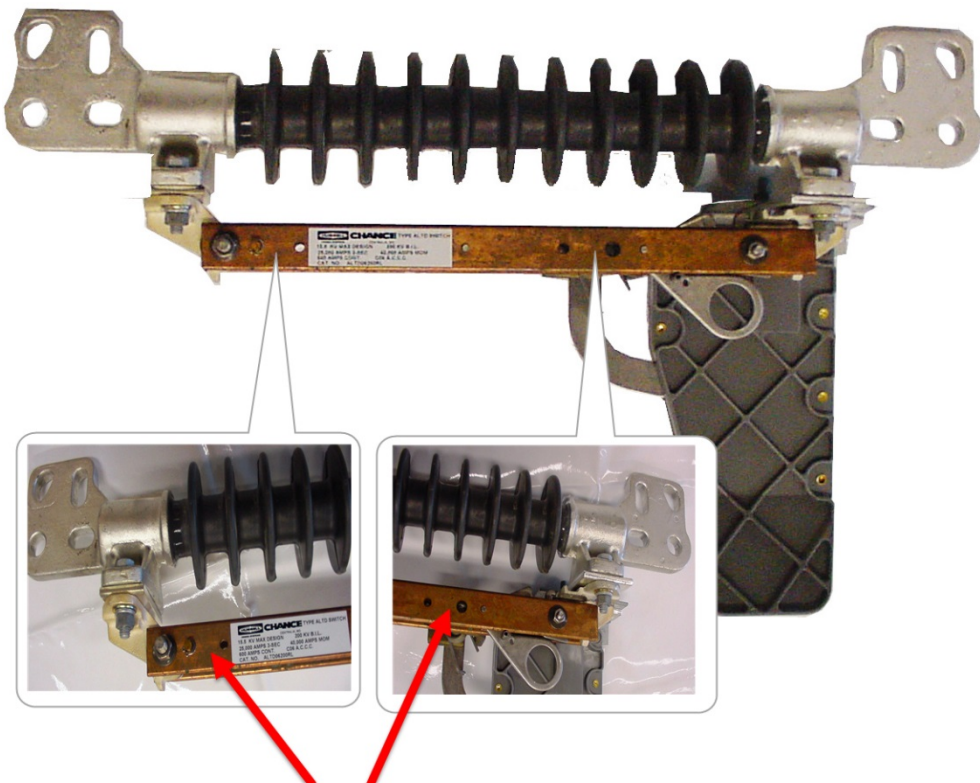
HV MSI Maintenance		
Step No	Description	
1.	<b>Moving Parts Check</b> 	<ul style="list-style-type: none"> <li>a. Check that the spring-loaded catch is operating correctly.</li> <li>b. Lubricate the moving parts with light machine oil.</li> </ul>
2.	<ul style="list-style-type: none"> <li>a. Check that the blade does not open unless the operating ring loop is pulled.</li> <li>b. The underneath catch should operate freely when the ring is pulled and prevent opening if the ring is not pulled.</li> </ul>	
3.		<p>Check the contacts for pitting on the blade. The open end.</p> <p><b>Note:</b> If the blades are pitted replace the unit.</p>

## HV MSI Maintenance


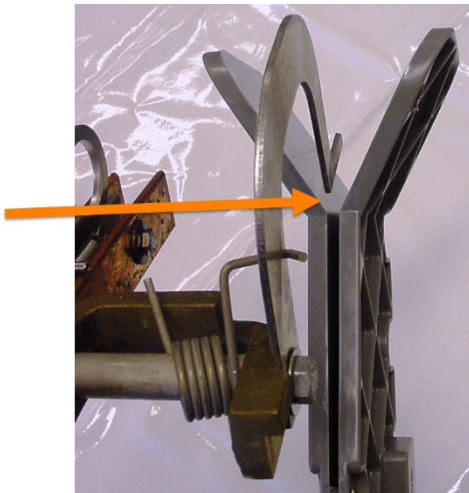
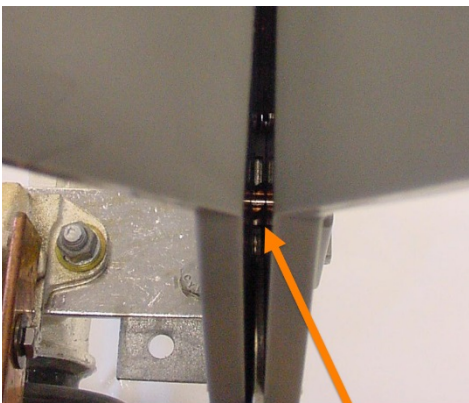

Step No	Description	
4.	<p>a. When closed the blade should be parallel with the contact (contact area to have consistent pressure)</p> <p>b. Apply a small amount of conductive grease to the contact points</p>	
5.		<p><b>Tighten</b> the <b>3/8"</b> bolt to <b>20 ft.lb</b> or <b>27.1Nm</b>.</p> <p><b>Note:</b> Bevelled washers are needed to ensure smooth blade operation.</p> <p><b>Note:</b> Use Loctite Thread lock (Red) 271 to secure the nut from accidental loosening.</p>
6.		<ol style="list-style-type: none"> <li>Lubricate the hinge bolt</li> <li>Check tension on the hinge bolt "Fixed Contact" <ol style="list-style-type: none"> <li>Tighten to a torque of <b>30/in-pounds</b> or <b>3.4 Newton Metres</b> using a small tension wrench.</li> </ol> </li> </ol> <p><b>Note:</b> Use Loctite Thread lock (Red) 271 to secure the nut from accidental loosening.</p>
	<p>b. Now adjust the tension on the hinge bolt so a force of <b>12-15 lbs</b> or <b>5.4-6.8 kgs</b> of pull is required to move the blade.</p> <p><b>Note:</b> Use a spring scale, hooked into the ring pulling at 90° to the latch.</p>	




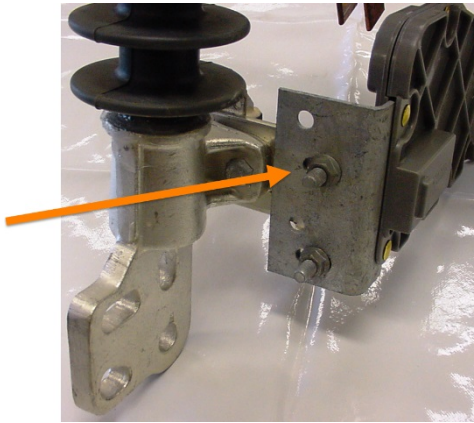
## HV MSI Maintenance

Step No	Description
7.	<div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;"><b>Tighten 1/2" bolts to <i>30ft.lb</i> or <i>40.7 Nm</i></b></p>
8.	 <p style="text-align: center;">Check that all pins, rivets and spacers in the main contact blade are tight and in place.</p>


## 5.5 ARC CHUTE INSPECTION

Arc Chute Inspection		
Step No	Description	
1.	<p>Check the arc chute is not broken.</p> <p>Look for fractures and replace if required.</p>	
2.	<p>Check that the arc break blade aligns in the middle of the arc chute.</p>	
3.	 	<p>When the switch is closed the flicker blade shall be underneath the catching pin in the arc chute.</p> <p><b>Note:</b> This provides the arc break capability of the unit.</p>

## Arc Chute Inspection

Step No	Description	
4.	For correct operation of the unit the flicker blade will remain engaged until the main contact is opened approximately 120mm.	
5.	<p>Replacement arc chutes are fitted by undoing these two bolts and replacing the arc assembly.</p> <p><b>Note:</b> Slots allow for correct alignment of the flicker blade.</p>	




## 5.6 INSULATOR INSPECTION

Insulator Inspection	
Step	Description
1.	 <ol style="list-style-type: none"> <li>Check that the insulator is in good condition.</li> <li>Clean the sheds so they are free of contaminants.</li> <li>Inspect the end cap fittings to ensure that the epoxy resin is not cracked.</li> <li>HV test sticker (In date).</li> <li>Lifting tackle inspection (in date).</li> </ol>

## 5.7 TURNBUCKLE INSPECTION

### Inline turnbuckle Mechanical Certification

- Turnbuckles shall be mechanically tested and certified by an approved testing facility prior to use and retested at intervals not exceeding 12 months;
- Turnbuckles shall be visually inspected for defects to the turnbuckle and threaded section prior to undergoing mechanical testing. Refer to Figures 5 to 8.
- The test should be conducted in a horizontal plane with the round holes in line with the insulator at either end of the switch used to test pull to 15kN

Turnbuckle Inspection	
Step	Description
1.	<p>Two types of ratchetting turnbuckle have been supplied: Townley (Figure 1) and Noble and sons (Figure 2).</p> <ul style="list-style-type: none"> <li>It was identified that the Noble and Sons turnbuckle threaded section is looser than the Townley version.</li> <li>Replace turnbuckles with loose threaded sections with the Townley brand of turnbuckle</li> </ul>
2.	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Figure 1</p> </div> <div style="text-align: center;">  <p>Figure 2</p> </div> </div>
3.	<p>Ratchet turnbuckles must have adequate welds to prevent the threaded eye completely unscrewing from the body of the turnbuckle.</p> <div style="text-align: center;">  </div>



4. Ensure the turnbuckle operates freely.  
Lightly oil the thread.



Worn Damaged Threads or stripped internal threads.

The pitch of the thread becomes worn over time and can lead to the loss of conductor tension under load.

**Note:** If excessive wear is visible in the body or on the thread or if excessive free play is noticeable replace the turnbuckle.

- 5.



6. Ensure that any supporting bolts have a split pin in place.



## 6 APPENDIX A - METHOD FOR INSTALLING AND REMOVING MSI GLOVE & BARRIER METHOD

**Note:** The steps detailed in this section are to be used as a guide to install and remove MSI's and shall be undertaken in accordance with each VESI DB's HV Live Work Manuals.

Step	Description
1.	<b>Planning &amp; JSA</b> <ol style="list-style-type: none"> <li>Complete Tool box JSA</li> <li>Appoint a Safety Observer</li> <li>Contact the Control room to obtain permission to proceed and to suppress auto reclose and enable work tag or live line sequence.</li> </ol>
2.	Inspect the MSI's prior to installation to ensure that they are fit for service: <ol style="list-style-type: none"> <li>General appearance and cleanliness including contacts for signs of overheating or local arc damage;</li> <li>Condition and alignment of the arc control devices for breakages, wear, heat or arc damage;</li> <li>Condition of covered leads and connection points, particularly for heat damage or fraying;</li> <li>Condition of clamps, including heat or arc damage on the inside of the jaws, and free operation of threads</li> <li>Correct latching of jaws</li> <li>In electrical test date</li> <li>Turnbuckles are aligned with the switch and fitted to correct position, (see page 5)</li> </ol>
3.	<b>Technique</b> <ol style="list-style-type: none"> <li>Identify where insulating barriers will be fitted (including the "drop zone", adjacent circuits and assets).</li> <li>From below commence fitting the insulating barriers (when fitting insulating barriers always commence fitting to the nearest conductive structure or conductor).</li> <li>When installing MSI's on a horizontal three phase circuit, consideration should be given to staggering the centre phase isolator by 1.5 metres to enable for the easy matting/covering of the adjacent phase conductor (i.e. application of hard covers causes less sag and sway issues that become apparent if flat mats are applied over the isolators).</li> </ol>
4.	<b>Install MSI's</b> <ol style="list-style-type: none"> <li>Position the MSI in the span as close to the crossarm as practicable to minimise conductor sway.</li> <li>Confirm the MSI blade is closed.</li> <li>Position MSI against and hook onto conductor. Isolator blades to be positioned so blades open towards the de-energised / isolated side.</li> <li>Take up the tension with a tensioning device creating a shallow loop and secure the isolator to the conductor using the installed termination (e.g. preformed dead-ends or bolted clamps).</li> </ol>

- e. Clean the conductor and make the lead connections from each end of the MSI to the main conductor beyond the helical grip eyes.
- f. Confirm with the Safety Observer everything is in order to proceed
- g. Cut the shallow loop of conductor and secure the tails back along the line. The isolator is now ready for operation as required.
- h. Repeat the process for other phases.

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## 5. Remove MSI's

- a. Inspect the MSI units prior to removal to ensure that the units can be removed safely.
- b. Check MSI blades are fully closed.
- c. Identify where insulating barriers will be fitted (including the “drop zone”, adjacent circuits and assets).
- d. From below commence fitting the insulating barriers (when fitting insulating barriers always commence fitting to the nearest conductive structure or conductor).
- e. Fit a tensioning device across the conductor break and take some weight to enable the sleeving of the conductors.

*Note: A tensioning device is a Live Line webbing strap (e.g. Lugall brand) or a turnbuckle. A Lugall type tensioning device can be installed to completely bypass the MSI, this is similar to repairing damaged conductor using G&B method.*

- f. Untie the secured conductor ends and prepare conductor for compression jointing.
- g. Check sag of conductors and clearance to subsidiary circuits (if applicable).
- h. Install full tension compression sleeve/splice.

*Note: Full tension sleeves and dies need to be selected specifically for the conductor to be joined.*

- i. Slowly remove tension from the tensioning device.

*Note: Unwinding the helical termination to slip the cable through until cable tension is taken is not permitted.*

*Note: When removing an MSI with turnbuckles fitted it is possible to run out of thread before full tension is applied to the conductor. In such cases a Lugall type device shall be fitted across the MSI bypassing the MSI unit.. The MSI shall be removed and weight transferred onto the conductor and sleeve/splice via the Lugall.*

- j. Seek approval from the Safety Observer to remove the jumpers/leads and MSI from the conductor.
- k. Remove the mid span isolator from conductor.
- l. Repeat the process for the other installed MSI's
- m. Remove tools and equipment

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## 6. Contact System Control Centre and advise that all work has been completed and auto reclose protection can be restored to normal.



## 7 APPENDIX B VESI MEMORANDUM RE MID SPAN GUIDELINE

### VESI HV Live Work Committee



<b>To</b>	All VESI Network Operators, employers and Live HV lineworkers
<b>CC</b>	
<b>From</b>	The VESI HV Live Work Committee
<b>Title</b>	VESI HV Live Work - Mid Span Isolator Maintenance Guideline
<b>Date</b>	July 26, 2021

On Friday July 23, the ETU published a "OH&S Safety Alert" that referred to the new VESI Guideline for Mid Span Isolator (MSI) Maintenance.

The purpose of this Memo is to clarify the VESI position and to provide additional information regarding the Guideline.

The Guideline was produced to provide consistency across the VESI and recommends testing requirements that are over and above any manufacturer's MSI recommendations. Currently there is no requirement from the manufacturers of MSI units or in Australian Standards to undertake mechanical testing of MSI's.

The intention of this guideline is for it to be implemented over a 12-month period in line with the current mechanical inspection and testing of lifting equipment. This time period for implementation was not included in the initial publication of the VESI guideline as it was always intended to circulate via additional information to network operators and employers which is the standard protocol for implementing such change.

The Scope of the HV Live Work - Mid Span Isolator Maintenance Guideline has been amended to reflect the 12-month implementation timeframe.

The annual testing of turnbuckles and MSI's can be undertaken as a single unit, (to test all components simultaneously), however aspects of the test procedure can be modified according to the company's testing requirements.

Always inspect the MSI units prior to removal and if the condition of an in-service MSI is suspect procedures exist that involve the use of a tensioning device, (e.g. Lugall) to bypass the entire mechanical load taken by the MSI and turnbuckles, thus allowing its safe removal.

These techniques have been established since Live HV work commenced in Victoria and in principle is the same as when replacing a damaged section of conductor, (either dead or G&B method).

The use of tensioning devices such as Lugalls to make mid span repairs to conductors has been in use for many years and is taught to apprentice lineworkers and again to trainee Live HV workers.

In summary, the VESI Guideline has been introduced to increase safety for lineworkers using MSI's and raises the standards for safety beyond what is established in current frameworks.

If you have any questions, please contact the VESI Live HV Committee via the 'Contact Us' link on the home page.

VESI HV Live Work Committee

## 8 REFERENCE

VESI	Minimum Rules for carrying out HV Live Work
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