

BSS Examination Checking Procedures – Part 3 - Electrical systems

Recommendations for change May 2012

3.1.2	Are batteries secure against excessive movement in any direction?	R
<p>Check <u>by visual assessment</u> the extent all batteries, and battery boxes, <u>cradles, frameworks etc.</u>, can move.</p> <p>Apply light manual force <u>to all battery boxes, cradles, frameworks etc.</u> to verify the extent of possible movement.</p>		<p><u>All battery boxes, cradles, frameworks etc, must be free of signs of movement or possible movement.</u></p> <p>All batteries must be incapable of movement in excess of 10mm in any direction.</p>
<p>Applicability – restraint against vertical movement is generally required. However batteries may be secured by means of a cradle or framework sufficient to ensure batteries remain secure under any condition up to 45° to the horizontal. Recesses, cradles or frameworks extending to half the height of the battery meet this allowance.</p>		
<p>Rationale – to clarify what examiners should examine visually or apply light manual force to (neutral impact change)</p>		
3.3.1	Are all electrical cables supported in a safe position?	R
<p>Check the run of all cables which can be seen and identify any structure or item of equipment likely to cause impact or abrasion damage.</p> <p>Identify any cables subject to the possibility of impact or abrasion damage and check for means of protection or support.</p> <p>Check arrangements where cables can be seen passing through bulkheads or structural members.</p> <p>Check the condition of all cable conduit or <u>cable</u> trays which can be seen.</p>		<p>All electrical cables must be:</p> <ul style="list-style-type: none"> • <u>located where they will not be susceptible to impact or abrasion damage; or,</u> • supported away from <u>any structure or item of</u> equipment likely to cause impact or abrasion damage; or, • contained in a conduit or cable tray supported away from it. <p>Cables passing through bulkheads or structural members must be protected against chafing damage by the use of grommets, sleeves or sealant used effectively.</p> <p>Cable conduit or cable trays must be free of signs of overheating or damage.</p>
<p>Applicability – this check applies to both a.c. and d.c. cables.</p> <p>Applicability – for cables confirmed as double-insulated cables, where such cables pass through bulkheads and other structural members, the outer insulation (sheathing) should be considered as adequate protection, providing the insulation is in good condition.</p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • <u>checking section - to add the missing word 'cable' in front of 'trays' (editorial change)</u> • <u>requirements section - for clarity, and for consistency with checking action (neutral impact change)</u> 		
3.4.1	Are all battery cable connections effective and in good condition?	R
<p>Check the type and condition of connectors to the cables listed at Checklist Item 3.2.2.</p>		<p>All battery cables listed at Checklist Item 3.2.2 must be fitted with soldered or crimped lug connectors or other pre-made connections of suitable proprietary manufacture.</p>

	<p>All battery cable connections on cables listed at Checklist Item 3.2.2 must be free of:</p> <ul style="list-style-type: none"> • missing components or loose or poorly made connections; and, • signs of damage or deterioration; • excessively exposed or damaged cable strands.
<p>Applicability - battery terminals fitted with screw clamps are acceptable if the cable strands are protected by the use of spreader plates or tinned cable ends in the terminal.</p> <p><u>Applicability – ‘crocodile’ type clips are not acceptable as battery connections for permanently installed cables.</u></p>	
<p>Rationale – to clarify the approach, in view of the likelihood that crocodile clips will be found (neutral impact change)</p>	

3.4.3	Are shore power and battery charging lead connections splash proof to BS EN 60309?	A
<p>Check the type of shore power or battery charging appliance inlet connections fitted in any location likely to be subject to the weather or splashing.</p> <p>Check the markings on the appliance inlet connection.</p> <p>Shore power and battery charging lead connections likely to be subject to the weather or splashing need to be of a weatherproof type to BS EN 60309 Part 2 or equivalent to pass this check.</p>		
<p>Applicability – if the appliance inlet connection for shore power or battery charging leads is of the female type then the plug on the connecting lead will have exposed pins. Owners should be warned of the electrocution risk presented by the exposed pins on the lead and the procedure followed at Appendix A.</p> <p>Applicability – existing connections marked to BS 4343 are equally as acceptable.</p>		
<p>Rationale – this check is removed in favour of a series of checks at 3.8 below. See 3.8 (neutral impact change)</p>		

3.5.1	Are all <u>a.c. and d.c.</u> fuses and <u>miniature</u> circuit-breakers appropriately rated, complete and in good condition?	R
<p>Check the rating, completeness and condition of all miniature circuit-breakers (<u>MCBs</u>) and fuses which can be seen.</p> <p>Fuses and MCBs circuit-breakers must be <u>complete and free of signs of heat damage or deterioration, and be fitted securely.</u></p> <ul style="list-style-type: none"> • rated not greater than the rating specified on the fuse holder or the body of the circuit-breaker; and, • rated less than the current carrying capacity of the cable protected; and • complete and free of signs of heat damage or deterioration; and, • fitted securely. <p><u>Fuses and fuse wire must be rated not greater than any rating marked on the fuse holder</u></p> <p>Fuse holders must contain appropriate <u>fuses or fuse wire</u> ‘fuse wire’ and not nails, silver paper, etc.</p> <p>MCBs Circuit-breakers must not be held closed by the use of tape or other devices.</p>		
<p>Applicability - examiners are encouraged to confirm during prior dealings with the owner, the</p>		

location of the fuse box/distribution board and any in-line fuses, and to encourage their accessibility for examination. On d.c. systems the lack of a fuse or ~~MCB circuit-breaker~~ is not in itself a fail point. A.c systems are subject to a check for the presence of a consumer unit, see 3.9.2.

Applicability – examiners are not to remove/unscrew fuses or fuse wire holders or remove miniature circuit breakers. The checking action for fuses and miniature circuit breakers which cannot be seen without their removal should be confined to the checks for completeness and condition.

Advice for owners – it is strongly advised that a Residual Current Device (RCD) is installed to provide appropriate electric shock protection on a.c. systems.

~~Applicability – this check applies to both a.c and d.c. systems.~~

Rationale –

- check question – clarifies scope of the check (editorial change)
- checking section – introduces acronym (editorial change)
- requirement section – replaces bullets into two paragraphs (editorial change)
- requirement section – deletes check for fuses/MCBs to be rated less than the current carrying capacity of the cable protected because, with improvements in cable design and construction, it is no longer possible for examiners to visually assess the current carrying capacity of any given cable. (neutral impact change)
- requirement section – replaces ‘fuses’ with ‘fuses or fuse wire’ (editorial change)
- 1st applicability – clarifies check application to d.c systems and points to the new check for a consumer unit for a.c. systems (editorial change)
- New 2nd applicability - to clarify that examiners should not remove fuses and fuse holders and to help ensure examiner safety (neutral impact change)
- the ‘advice for owners’ emphasises to need for RCD personal protection on a.c. systems (neutral impact change)

3.5.2	Are all fuse panels, boxes and holders and <u>consumer units distribution boxes</u> complete and in good condition?	R
<p>Check all fuse panels, boxes and holders and <u>consumer units distribution boxes</u> which can be seen for the presence of lids or covers covering exposed terminals, when designed to have one.</p> <p>Check the condition of all fuse panels, boxes and holders and distribution boxes which can be seen.</p>		<p>All fuse panels, boxes and holders and <u>consumer units distribution boxes</u> designed to have a cover must:</p> <ul style="list-style-type: none"> • have lids or covers covering exposed terminals; and • be free of signs of damage or deterioration.
<p>Applicability – this check applies to both a.c. and d.c. supplies.</p>		
<p>Rationale – checking question, checking and requirement section – ‘consumer unit’ replaced distribution box, in line with modern terminology and new check 3.9.2 (editorial change)</p>		

3.6.2	Do all electrical circuits pass through a battery isolator, or are those requiring a continuous supply otherwise protected?	R
<p>Identify any <u>d.c.</u> electrical circuits bypassing the battery isolator.</p> <p>Check that any electrical circuits bypassing the battery isolator supply the following equipment:</p> <ul style="list-style-type: none"> • automatic bilge pumps; • security alarms (including marine radios); • fire pumps; 		<p>All <u>d.c.</u> electrical circuits must pass through a battery isolator, except those which feed equipment requiring a continuous supply which must be protected by a suitable fuse or circuit-</p>

<ul style="list-style-type: none"> • electronic navigation equipment with memories; • any other equipment where the manufacturer's instructions indicate or specifically require direct connection to a battery, such as diesel-fired central heating boilers; • battery charger outputs; • inverters or combination inverter/chargers; • <u>solar panels and wind turbines.</u> <p>Check electrical circuits supplying any equipment on the specified list, and which bypass a battery isolator, for the presence of a fuse or circuit-breaker, where the circuit can be seen.</p>	breaker.
<p>Applicability – in cases where circuits which do not lie in the specified list are found directly connected to the battery examiners must verify compliance by examining any presented declaration from the manufacturer or supplier.</p> <p>Applicability – if the fuse or circuit-breaker protecting specified equipment bypassing a battery isolator cannot be found in places where the circuit can be seen, mark the BSS Checklist as a fail. This because it is extremely unlikely that the fuse or circuit-breaker will be either located where the circuit is hidden, or be more than a short distance from the battery.</p>	
<p>Rationale –</p> <ul style="list-style-type: none"> • checking and requirements sections – ‘d.c.’ is added for consistency (editorial change). • checking section - to add to the equipment list of equipment acceptable to by-pass the battery isolator, if fused (neutral impact change) 	

3.6.4	Are battery isolators and connections complete and in good condition?	R
<p>Check the completeness and condition of all battery isolators and connections <u>where they can be seen.</u></p>	<p>Battery isolators and connections must be:</p> <ul style="list-style-type: none"> • free of missing fixings; and, • free from signs of <u>damage or deterioration</u> heat-damage indicating an inability to carry the maximum current of the circuit. and, • free from other signs of damage or deterioration. 	
<p><u>Examiner action – in cases where the connections to battery isolators are not accessible for inspection, assess only the isolator for completeness and condition and make a note in your records accordingly.</u></p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • checking section - to reflect that not all battery isolator connections will be accessible (neutral impact change) • requirement section – to reflect the consistent approach relying upon the glossary definition of ‘damage or deterioration’ (editorial change) • examiner action – to help protect examiners by way of maintaining adequate records (neutral impact change) 		

3.8 Shore-power and other alternating current (a.c.) electrical inlet and lead connections

<u>3.8.1</u>	<u>Are all a.c. shore-power and battery charging lead inlet connections of the correct type in good condition, and suitably protected from the weather?</u>	<u>A</u>
<p><u>Check the type, condition and location of all a.c. shore-power and battery</u></p>		<p><u>Shore-power and battery charging inlet connections must be of suitable proprietary manufacture and must be a plug</u></p>

<u>charging inlet connections.</u>	<p><u>(male) type.</u></p> <p><u>Shore-power and battery charging inlet connections must be:</u></p> <ul style="list-style-type: none"> • <u>securely fitted;</u> • <u>free of missing components; and,</u> • <u>free of signs of damage or deterioration.</u> <p><u>Shore-power and battery charging inlet connections not obviously splash-proof must not be located where they are likely to be subject to the weather or splashing.</u></p>
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Applicability – do not disconnect shore power or battery charging leads, but if present the owner should be invited to, providing they first make the system safe to do so. If the type or condition of a shore power or battery charging inlet connections cannot be determined mark the BSS Checklist 'not verified' and note the reason why in your records.

Applicability – if an obvious risk of electrocution is determined take the actions described in Appendix A.

Rationale –

- **New check** introduces a check for condition of a.c. inlet connections as per the outcome of the a.c. risk review. The impact assessment is that, as an 'advice' check, it is for the owner to decide to take remedial action and so there is no imposed cost. It is estimated that between 10 - 20 boats will be affected. The risk assessment is the change is necessary to address the accepted potential for inlet connections in poor condition to present a risk of electrocution to persons on the vessel.
- 1st requirement - this new check takes the place of the deleted 3.4.3 and includes the check for inlet connections to have male pins **(neutral impact change)**
- 1st requirement - note that the check for inlet connected subject to splashing to be marked weatherproof type to BS EN 60309 is removed because there is no consistency in product markings – instead reliance is placed upon products encountered being assessed as of 'suitable proprietary manufacture'. Expected markings can be covered in training and reference material **(neutral impact change)**.
- brings in an advice, as previously introduced at 3.4.3 **(neutral impact change)**
- New 1st applicability – provides safety advice for examiners **(neutral impact change)**
- New 2nd applicability – guides examiners to class the vessel as immediately hazardous, in the event an electrocution risk is identified **(neutral impact change)**

3.8.2	<u>Are all shore-power, battery charging, and other a.c. power source lead connections of a suitable type?</u>	<u>A</u>
<p><u>Check the type of any shore-power, battery charging or other a.c. lead connections where they can be seen.</u></p> <p><u>Check for the presence of any alternating current leads used to connect individual power sources (e.g. generators and inverters) to the alternating current distribution system. Where such leads are present check the type (e.g. male plug, or female socket) of the lead connections.</u></p>		<p><u>Shore-power and battery charging leads must be fitted with a female type socket at the end which connects to the vessel's inlet connection.</u></p> <p><u>Alternating current leads within the vessel used to connect individual power sources to the vessel's alternating current distribution system must be fitted with a male type plug (or be permanently connected) at the end which connects to the power source, and a female type socket at the end which connects to the</u></p>

	distribution system.	
<p><u>Applicability - do not disconnect alternating current leads, but if present the owner should be invited to, providing they first make the system safe to do so. If the type of any lead connections cannot be determined mark the BSS Checklist 'not verified' and note the reason why in your records.</u></p> <p><u>Applicability – if an obvious risk of electrocution is determined take the actions described in Appendix A.</u></p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • New check introduces a check a suitable type of shore-power, battery charging, and other a.c. power source <u>lead</u> connections as per the outcome of the a.c. risk review. The impact assessment is that, as an 'advice' check, it is for the owner to decide to take remedial action and so there is no imposed cost. It is estimated that between 10 - 20 boats will be affected. The risk assessment is the change is necessary to address the accepted potential for the inappropriate type of connections to present a risk of electrocution to persons on the vessel. • includes the check for electrocution risk associated with exposed male pins on shore leads as previously introduced at 3.4.3, which is now removed (neutral impact change) • New 1st applicability – provides safety advice for examiners (neutral impact change) • New 2nd applicability – guides examiners to class the vessel as immediately hazardous, in the event an electrocution risk is identified. (neutral impact change) 		
3.8.3	<p><u>Are all shore-power, battery charging, and other a.c. power source leads and connectors in good condition?</u></p>	<u>A</u>
<p><u>Check the condition of any shore-power, battery charging, and other a.c. power source lead cables where they can be seen.</u></p> <p><u>Check the condition of the connectors fitted to the cable/s.</u></p>		<p><u>Shore-power, battery charging, and other a.c. power source lead cables must be free of:</u></p> <ul style="list-style-type: none"> • <u>signs of damage or deterioration;</u> • <u>repairs.</u> <p><u>Shore-power, battery charging, and other a.c. power source lead connectors must be complete, secured onto the cable with no inner conductors visible, and be free of:</u></p> <ul style="list-style-type: none"> • <u>signs of damage or deterioration;</u> • <u>repairs.</u>
<p><u>Applicability – do not disconnect shore-power, battery charging, and other a.c. power source leads, but if present the owner should be invited to, providing they first make the system safe to do so. If the condition of a shore-power, battery charging, and other a.c. power source lead and connectors cannot be determined mark the BSS Checklist 'not verified' and note the reason why in your records.</u></p> <p><u>Applicability – if an obvious risk of electrocution is determined take the actions described in Appendix A.</u></p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • New check introduces a check of condition of shore-power, battery charging, and other a.c. power source leads and connectors as per the outcome of the a.c. risk review. The impact assessment is that, as an 'advice' check, it is for the owner to decide to take remedial action and so there is no imposed cost. It is estimated that between 10 - 20 boats will be affected. The risk assessment is the change is necessary to address the accepted potential for leads and connectors in poor condition to present a risk of electrocution to persons on or around the vessel 		

- New 1st applicability – provides safety advice for examiners (neutral impact change)
- New 2nd applicability – guides examiners to class the vessel as immediately hazardous, in the event an electrocution risk is identified (neutral impact change)

3.9 Alternating current systems – multiple power sources and consumer units

3.9.1	Is it impossible to connect simultaneously more than one power source to the alternating current distribution system?	A
<p><u>Check for the presence of one or more shore-power inlet connections.</u></p> <p><u>Check for the presence of additional power sources (e.g. generators and inverters).</u></p> <p><u>Check for the presence of one or more means of selection between all the identified power sources.</u></p> <p><u>Check that the selection facilities prevent more than one power source being connected to the alternating current distribution system at any one time, and that they prevent the male pins on shore-power inlet connections being 'live' when an alternative power source is selected.</u></p>		<p><u>Only one power source may be connected to the alternating current distribution system at any one time.</u></p> <p><u>The male pins on shore-power inlet connections must not be 'live' when an alternative power source is connected to the alternating current distribution system.</u></p>
<p><u>Applicability – the requirement for one power source to be connected does not apply to synchronised multiple power sources. In cases where the boat owner claims that multiple power sources are synchronised but this cannot be verified, the examiner should contact the BSS Office.</u></p> <p><u>Applicability – power source selectors may comprise of a multi-position manual switch, an electronic switch, or a single (male type) plug connector on the alternating current distribution system and a range of leads with corresponding (female) sockets attached to the individual power sources (see Check 3.8.2). It is also possible there may be more than one selection facility.</u></p> <p><u>Applicability – do not operate selection facilities, but the owner if present, should be invited to do so in order to verify compliance. If the presence of appropriate power source selection cannot be determined mark the BSS Checklist 'not verified' and note the reason why in your records.</u></p> <p><u>Applicability – in the event a fault is determined take the actions described in Appendix A.</u></p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • New check introduces a check addressing the fire/electrocution risks associated with using unsynchronised a.c. supplies simultaneously as per the outcome of the a.c. risk review. The impact assessment is that, as an 'advice' check, it is for the owner to decide to take remedial action and so there is no imposed cost. It is estimated that between 10 - 20 boats will be affected. The risk assessment is the change is necessary to address the accepted potential for unsynchronised multiple connected a.c. inputs to present a risk of fire and electrocution to persons on or around the vessel. • New 1st applicability – makes allowance for 'synchronised' systems (neutral impact change) • New 2nd applicability – provides guidance as to the 'selection' facilities between power sources (neutral impact change) • New 3rd applicability – provides safety advice for examiners (neutral impact change) • New 4th applicability – guides examiners to class the vessel as immediately hazardous, in the event an electrocution/fire risk is identified (neutral impact change). 		

3.9.2	<u>Do all a.c. electrical circuits pass through a consumer unit?</u>	<u>A</u>
<u>Check that all a.c. electrical circuits pass through a consumer unit (also known as fuse/circuit-breaker box or distribution board).</u>		<u>All a.c. circuits must pass through a consumer unit.</u>
<p><u>Applicability - examiners are encouraged to confirm during prior dealings with the owner, the location of the consumer unit.</u></p> <p><u>Advice for owners – it is strongly advised that a Residual Current Device (RCD) is installed to provide appropriate electric shock protection on a.c. systems.</u></p> <p><u>Applicability – in cases where the only power source is via a shore-power lead then a MCB may be incorporated within the lead.</u></p> <p><u>Applicability – for the purpose of this check residual current breakers with overcurrent protection (RCBOs) may be considered as MCBs.</u></p>		
<p>Rationale –</p> <ul style="list-style-type: none"> • New check introduces a check for the presence of a consumer unit on all a.c. supplies as per the outcome of the a.c. risk review. It should be seen as the first stage of a requirement for a.c. to have circuit protection. The impact assessment is that, as an ‘advice’ check, it is for the owner to decide to take remedial action and so there is no imposed cost. It is estimated that between 10 - 20 boats will be affected. This is because consumer units reflect boat building practice. The benefit of the approach to check for consumer units is that this aligns with the ISO 13297 requirements, aligns with planned BSS awareness advice pointing to the consumer units as the likely source of main switch, fuses or circuit-breakers, RCD and reverse polarity indicator (if fitted). For examiners the check is checkable and does not introduce potential liabilities for examiners. The risk assessment is the change is necessary to address the accepted potential for unprotected a.c. circuits to present a risk of fire and electrocution to persons on or around the vessel. • New 1st applicability – guides examiners to establish the location of the consumer unit in advance of the examination (neutral impact change). • the ‘advice for owners’ emphasises to need for RCD personal protection on a.c. systems (neutral impact change) • New 2nd applicability – emphasises that an MCB in the shoreline can be acceptable (neutral impact change). • New 3rd applicability – emphasises that RCBOs incorporate MCBs (neutral impact change). 		