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| IALA Guideline |

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Commissioning

Edition 1.0

December 2016

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

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| Date | Page / Section Revised | Requirement for Revision |
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|  |  |  |
|  |  |  |

1. INTRODUCTION 4

2. SCOPE 4

3. CONCEPT OF COMMISSIONING 4

4. THE IDENTIFICaTION OF CRITICAL FACTORS 5

4.1. What needs to be captured? 5

4.2. Measurement and visual Checks 5

5. MEASUREMENTS AND RECORDS OF PARAMETERS 5

6. FUNCTIONALITY 6

7. LINK TO FUTURE MAINTENANCE 6

8. VALIDATION 6

9. MONITORING 7

10. ACRONYMS 7

11. REFERENCES 7

ANNEX A EXAMPLES OF TYPICAL SYSTEMS REQUIRING COMMISSIONING 8

ANNEX B AN EXAMPLE OF A TEST SHEET 14

List of Figures

Figure 1 Light distribution curve showing tolerances 6

Figure 2 Monitored Buoy – Initial Request Stage 9

Figure 3 Pre Build Configuration 10

Figure 4 Pre Build Configuration 11

Figure 5 Assembly 12

Figure 6 Commission & Soak Test 13

Figure 7 Deployment, Servicing & Fault Finding 14

# INTRODUCTION

In very general terms, the process to manufacture and/or supply a product/system is based upon the following sequence of activities, with commissioning generally taking place in a number of forms across the final three activities:

Requirements and specification development;

Design (preliminary and detailed);

Manufacture/assembly;

Testing;

Delivery;

Integration/installation.

It is fundamental in providing effective Aids to Navigation (AtoN) that their performance and reliability meet the operational needs. To ensure this is achieved, it is important that components, equipment and systems are checked before implementation, fitment and use. The impact of ineffectively AtoN equipment verification can extend far beyond the inconvenience of have to undertake an unplanned repair. The delivery of these important services could have a direct impact to safe navigation.

# SCOPE

The concept of commissioning can be applied to a wide range of systems, such as the fit of mooring components, to the commissioning of remote monitoring and control systems. Often the phases of commissioning develop from the smaller discrete items, built up to complete assemblies and systems.

This can extend to the complete supply and checking of parts, equipment, tools and instruction to ensure efficient and effective implementation of AtoN installation. This is critical at remote and difficult to access locations.

Commissioning can be considered a key part of any quality system in ensuring no defective parts or systems are employed on operational AtoN.

The extent or scale of these tasks need to reflect the size, complexity or criticality of the equipment or system being deployed. Additionally, the scope of these tasks maybe be applied to a first of type production solution, but significantly reduced to the production product.

# CONCEPT OF COMMISSIONING

Commissioning is often thought of as the act of getting something working and confirming its correct operation in service. It can range in complexity from a simple visual verification e.g. AtoN character, to an elaborate process dependant on measurement and / or historical data. This being essential for the ever more complex systems required for AtoN and e-navigation.

Commissioning especially needs to be focused on those aspects that impact on the effective performance on the AtoN and as such, every component that contributes to this, needs to be identified and commissioned.

Given something like a buoy, this can include the dimension of the key mooring components, the material that these are made from, the colour of the buoy, and the character and operation of the lantern, to name but a few.

The key purpose of commissioning is to ensure that the correctly specified components are used. These may then be built up to form assemblies, which assemble and function as designed. Records of any measurements and functions need to be recorded to allow the process to be repeated if necessary and to inform others of what is correct.

The extent of testing that should be done needs to be reflective of the importance and size of the product or system that is being replaced. The examples given in the appendix is for a complex monitored buoy.

# THE IDENTIFICaTION OF CRITICAL FACTORS

## What needs to be captured?

Throughout the design phase, the design engineer would be able to identify the critical factors that need to be measured, checked or function tested. Some of this information may be supplied by manufacturers of equipment or materials and may be presented in the form of certification of performance.

In addition to the requirement for final operational performance, there can also be critical limits for transporting hazardous goods or equipment such as batteries in order to comply with statutory regulations. The early identification of such constraints is important to avoid unplanned difficulties in the delivery of AtoN equipment.

## Measurement and visual Checks

The identification of critical factors will also determine the manner in which such factors are to be checked. This is usually in the form of either measurement or visual. Examples of each of these could be:

* lantern optical performance – measurement within tolerance (see Figure 1);
* battery connectivity – visual;
* battery state of charge – operational measurement;

1. Light distribution curve showing tolerances

# MEASUREMENTS AND RECORDS OF PARAMETERS

It is important that throughout the commissioning or during each commissioning phase, that records of any measurements and tests are captured. This provides a historical record for the future and confirmation of performance, leading to a level of confidence to proceed to the next stage.

One of the most essential measurements is the verification of performance, usually against a reference or standard. An example could be the material of chain to a Lloyds standard or the measurement of a lantern range or sectors to an IALA Recommendation.

Alternatively, it could be confirmation of the correct operation of a diesel generator set following a mains failure. Either way, it is important that the steps taken are recorded to allow this operation to be repeated in the future.

Such records allow a baseline of operation to be captured for future comparison and assessment. A repeat of these tests through a product life will inform of any degradation and hence allow a prediction of end of service life.

# FUNCTIONALITY

The functionality of individual items need to be proven in isolation and then slowly built up into more complete and complex systems. Proving at each stage, the predicted operation is achieved. This process is always undertaken where full facilities are available to remedy any issues encountered.

Such testing, allows confirmation of correct software programming, operating levels and functionality, both during correct and adverse operating conditions. This highlights the importance of both positive and negative testing. That is testing and simulating fault as in line with the designed operation, but also the importance of needing to do negative testing. That is creating unexpected situations and confirming that the unit or system is able to function correctly without adverse impact to the AtoN.

# LINK TO FUTURE MAINTENANCE

The measurements taken at the time of commissioning allow comparison to the original baseline giving the opportunity to evaluate performance and assess or predict service life. Such information is useful in planning for replacement without having to react to a failure.

Occasionally, for critical factors, these points are monitored remotely to ensure a failure or deviation of such a point against the baseline, can be responded to. An example of such a point could be the system battery voltage.

Naturally, a record of functional checks and how these were achieved, allows conformation of correct operation of a system throughout its life. In order to avoid maintenance induced failures, such a test should be non-intrusive, otherwise the frequency of such a test should be balanced against the benefit they bring.

It is also important to capture setting, configuration and measurements during commissioning as such information provides a useful reference when replacing equipment. It ensures that any replacement equipment is configured the same as the original and allows a repeat of identical tests to confirm correct operations.

Consistent configuration, setup and testing of common equipment can aid in the early identification of common faults, aiding in the adoption of a proactive approach to rectification before unplanned failure.

# VALIDATION

Although it is important to capture, measure and record all factors that can influence the effective performance of an AtoN, it should also not be overlooked that validation by the customer or key stakeholders is also a critical factor in concluding commissioning.

Such validation maybe achieved through observation by the customer or stakeholder, but could also be achieved through evidence of how the mariner uses the new AtoN.

# MONITORING

As part of assessing effective unattended operation in line with the expected functionality, a period of normal operation ‘soak test[[1]](#footnote-1)’ should be monitored and recorded.

To determine the longer term effectiveness of the systems, user feedback can be captured and used as evidence to support any further changes or as further validation to the design.

Over the long term, monitoring of the performance of systems and equipment is important and useful information. Such information informs designers, engineers and organisations alike as to optimisation of future design. This leads to the elimination of common failures connected to historical design solution and returns a cost saving to organisations.

# ACRONYMS

AIS Automatic Identification System

AP Appointed Position

AtoN Aid(s) to Navigation

BOM Bill of Material

BSL Buoy Shipping List

BY Buoy Yard

CMCS Centralised Monitoring and Control System

Doc Document

F.Ops Field Operations

IALA International Association of Marine Aids to Navigation and Lighthouse Authorities - AISM

I/O Input / Output

OPC Operational Planning Centre

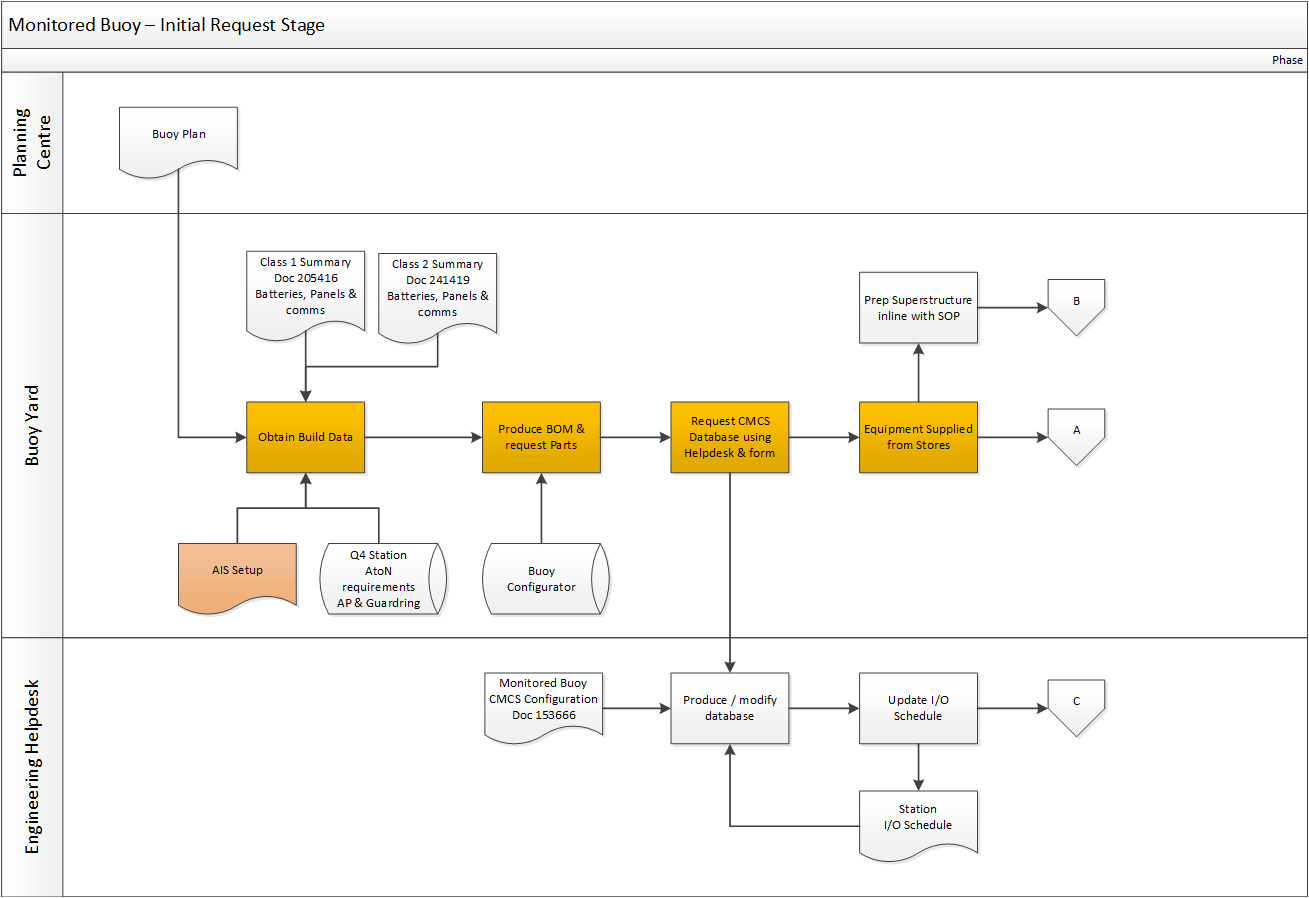
PIC Programmable Integrated Controller

SOP Standard Operating Procedure(s)

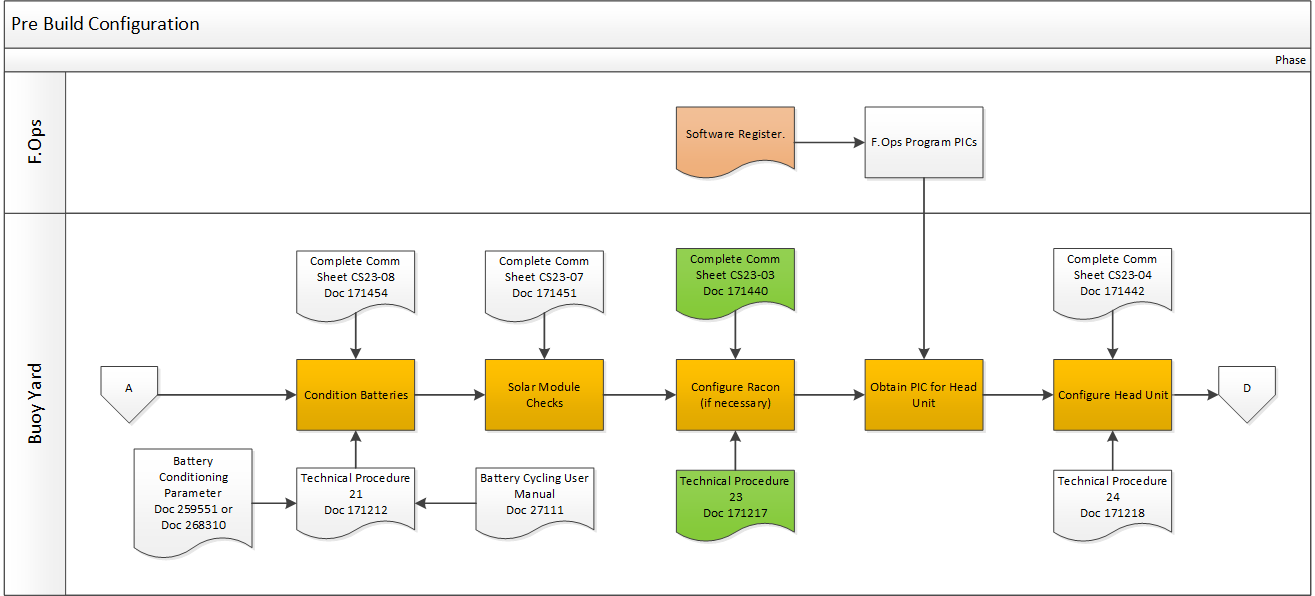
UTC Co-ordinated Universal Time (Universal Time Co-ordinated)

# REFERENCES

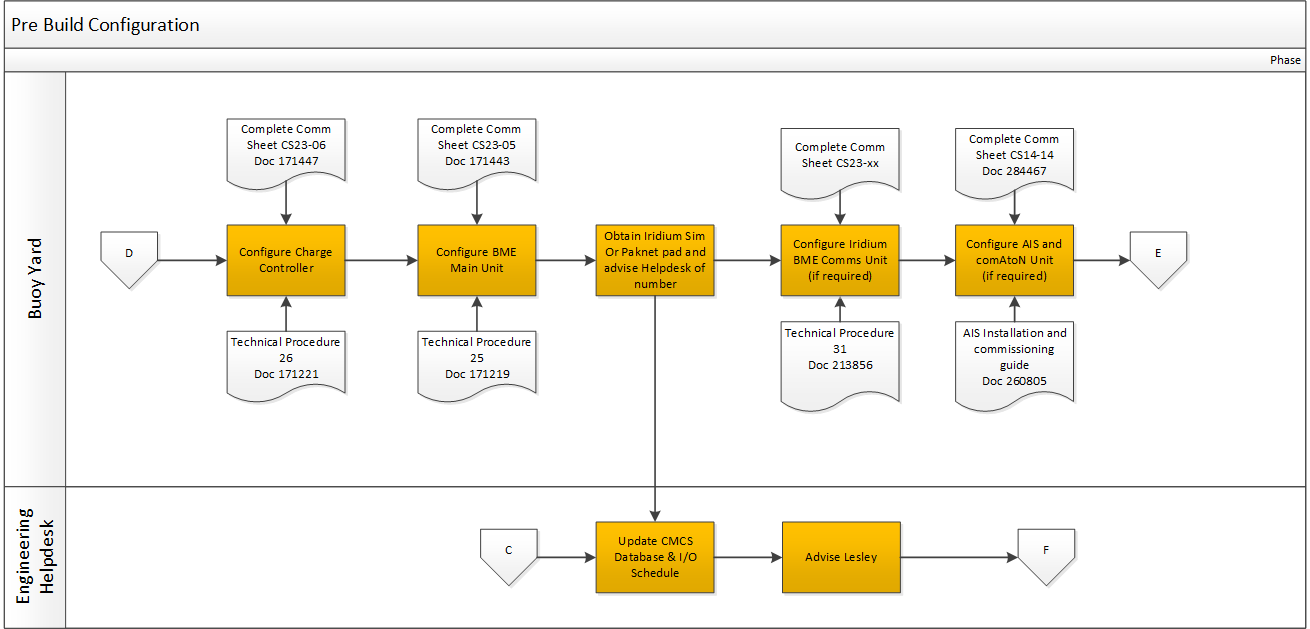
1. IALA Guideline 1008 on Remote Control & Monitoring.
2. IALA Guideline 1077 on Maintenance of Aids to Navigation.
4. EXAMPLES OF TYPICAL SYSTEMS REQUIRING COMMISSIONING



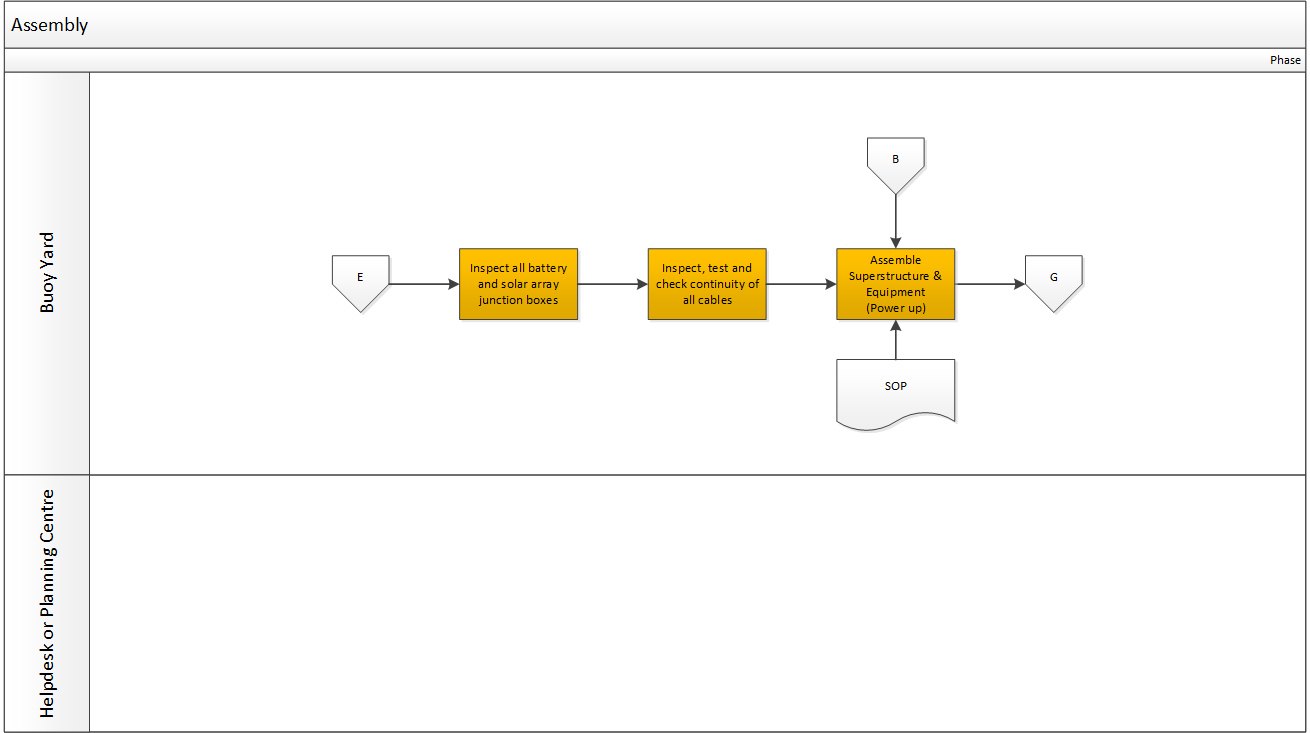
1. Monitored Buoy – Initial Request Stage



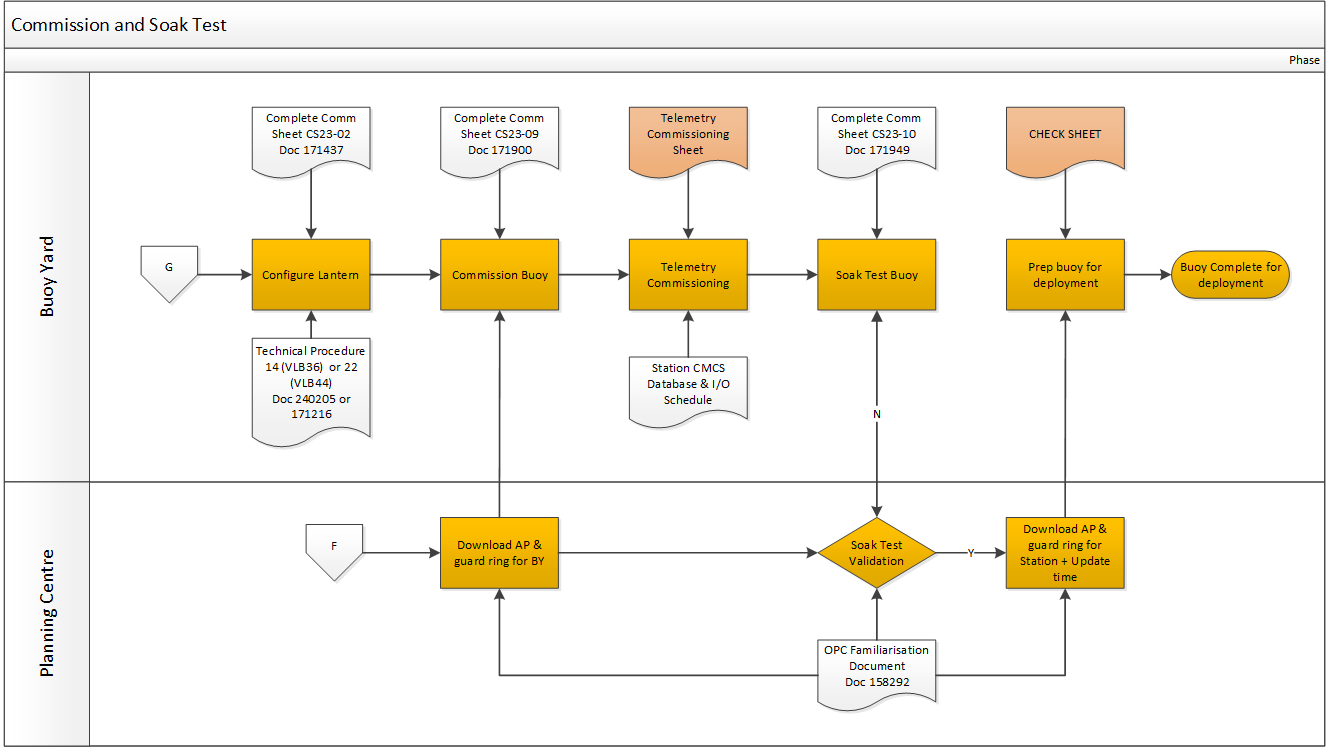
1. Pre Build Configuration



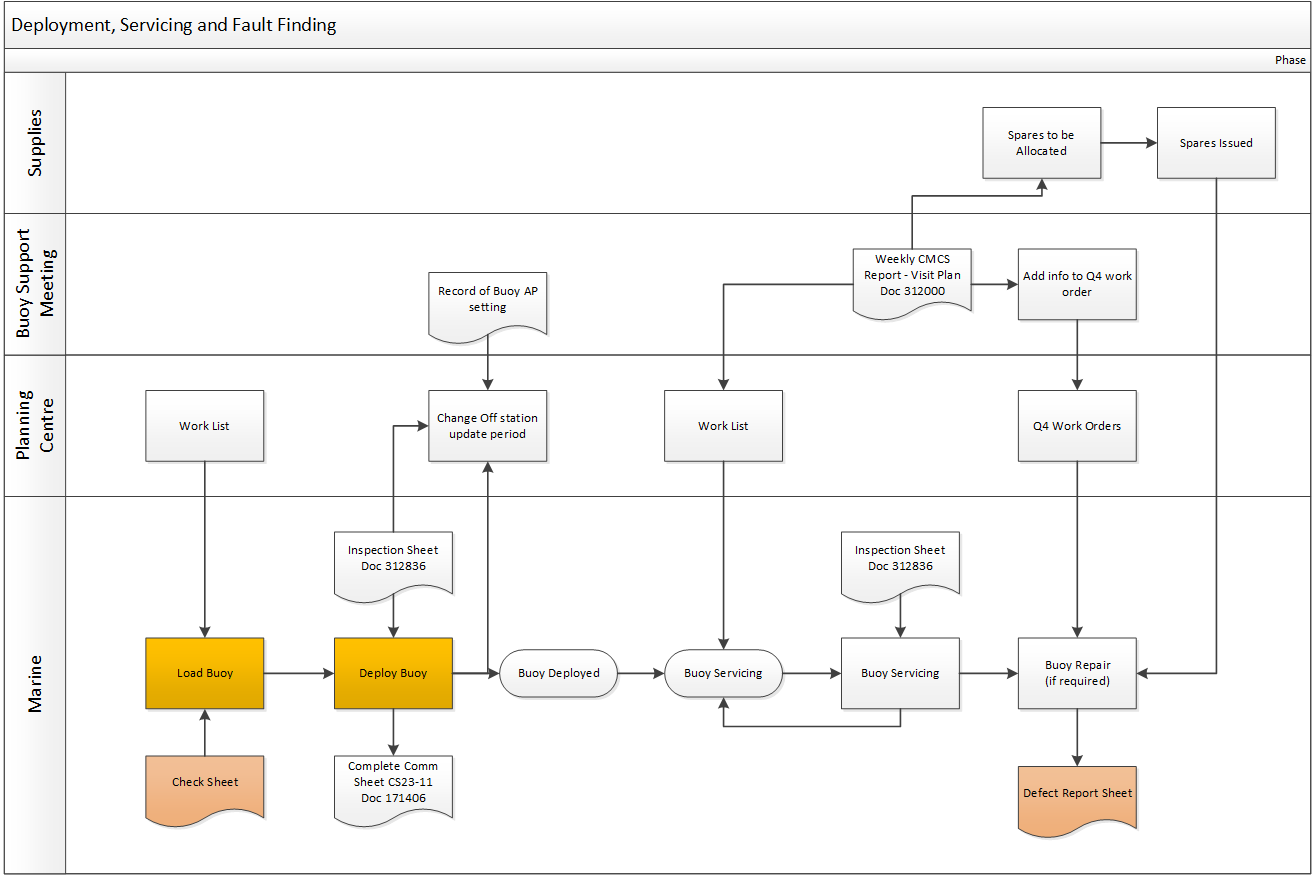
1. Pre Build Configuration Continued



1. Assembly



1. Commission & Soak Test



1. Deployment, Servicing & Fault Finding
2. AN EXAMPLE OF A TEST SHEET

**Checking, installation and Commissioning PROCEDURE RESULTS**

The following instructions shall be followed for the checking, installation and commissioning of SABIK ODSL-200 Sectored 6 and 12 tier LED lantern. Tests and checks show the outcome of the Commissioning of the equipment and peripherals.

Contact xxxx.

Completed document is to be forwarded to Project Manager.

**ANS: ……………………… Site Name : ……………………………………………………………………………………....**

**Checking AND SETUP OF LIGHT – IN THE DEPOTS**

**Date: ……………………… Completed by: …………………………………………………………………………………….**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item** | **Checking/ Setup step** | **Checking / Setup Procedure** | **Expected Results** | **Result** | **Comments** |
| **1** | Confirm all equipment has arrived safely and is clearly identified. | a. Identify and check all components of the light. | All components present. | Yes/No |  |
| b. Inspect for any physical damage. | No visible damage. | Yes/No |  |
| c. Confirm all units are clearly identified with Maximo numbers (where applicable). | All applicable equipment have Maximo labels. | Yes/No |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item** | **Checking/ Setup step** | **Checking / Setup Procedure** | **Expected Results** | **Result** | **Comments** |
| **2** | Check Current draw | a. Connect lantern and confirm current draw. | Current draw is available and polarity is correct. | Amps:  Day:  Night off:  Night on:  Amps  Pass/Fail |  |
| **3** | Confirm lantern photocell is operating | a. Power up lantern with adequate light on photocell. | Lantern does not come on. | Yes/No |  |
| b. Power up lantern and cover photocell. | Lantern comes on. | Yes/No |  |
| **4** | Confirm Character Setting | a. Confim character setting matches with ANS attached. (ANS may be draft copy only for new installations) | Character setting matches ANS. | Yes/No |  |
| **5a** | Confirm sector plate Cutouts | a. Setup light on flat level surface approximately 5m from clear wall space. Remove weather cover (if fitted) and affix sector bearing check plate with arrow and string line to top of LED lantern. | Lantern setup with sector bearing check plate and arrow affixed | Yes/No |  |
| **5b** |  | b. Sector Cutout 1 check bearing (from seaward)  Secure string line to wall, setup the first sector cut out and rotate the sector bearing plate to match the bearing as per ANS. Rotate the Lantern until the string line lines up with the other side of the sector, check angle on sector bearing plate. Do not adjust sector bearing plate | Sector cutout 1  1st bearing edge  Sector cutout 1  2nd bearing edge | Sector matches ANS  Yes/No |  |
| **Item** | **Checking/ Setup step** | **Checking / Setup Procedure** | **Expected Results** | **Result** | **Comments** |
| **5c** |  | c. Sector Cutout 2 check bearing (from seaward)  Check angles on sector bearing plate for the second sector cut out. Do not adjust sector bearing plate. | Sector cutout 2  1st bearing edge  Sector cutout 2  2nd bearing edge | Sector matches ANS |  |
| **5d** |  | d. Sector Cutout 3 check bearing (from seaward)  Check angles on sector bearing plate for the third sector cut out. Do not adjust sector bearing plate. | Sector cutout 3  1st bearing edge  Sector cutout 3  2nd bearing edge | Sector matches ANS |  |
| **5e** |  | b. Sector Cutout 4 check bearing (from seaward)  Check angles on sector bearing plate for the fourth sector cut out. Do not adjust sector bearing plate. | Sector cutout 4  1st bearing edge  Sector cutout 4  2nd bearing edge | Sector matches ANS |  |
| **6** | Confirmation Sectors match ANS | Check sector angles match ANS attached | Sector match ANS | Yes/No | If Yes – proceed to 7  If No – recheck sectors and if still wrong quarantine the light and contact supplier |
| **7** | Record Intensity Setting | Read and Record Intensity setting. (No setting available to confirm against for new installations) | Intensity setting recorded. | Intensity: |  |
| **8** | Prepare light for mobilisation | a. Secure sector bearing plate with tek screw to handle to stop from rotating. | Sector bearing plate secure | Yes/No |  |
| b. Roll up and leave string attached to sector bearing plate and affix weather cover. | String attached to sector bearing plate, weather cover affixed | Yes/No |  |
| c. Place light back into box, ensuring the name on the box matches the name on the light | Name on box matches light | Yes/No |  |
| d. This document to be completed and packed with the light | Completed document scanned and packed with light | Yes/No |  |

**installation of light – on site**

**Date: ……………………… Completed by: …………………………………………………………………………………….**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item** | **Installation step** | **Installation / Commissioning Procedure** | **Expected Results** | **Result** | **Comments** |
| **1** | Confirm all equipment has arrived safely and is clearly identified. | a. Identify all equipment by checking off against checklist. | All equipment present and labelled. | Yes/No |  |
| b. Inspect for any physical damage. | No visible damage. | Yes/No |  |
| c. Confirm all units are clearly identified with Maximo numbers (where applicable). | All applicable equipment have Maximo labels. | Yes/No |  |
| **2** | Inspection of existing lantern stand. | a. Identify the mounting position and confirm the mounting requirements for the new lantern as per the drawings. | All equipment can be installed as per drawings. | Yes/No |  |
| b. Identify the mounting position and confirm mounting requirements for the lantern junction box as per the drawings. | All equipment can be installed as per the drawings. | Yes/No |
| c. Inspect for any physical damage or corrosion to existing lantern stand | No visible damage. | Yes/No |
| **3** | At the regulator board, confirm input and output of circuit breaker and that the polarity is correct. | a. With the circuit breaker in the off position, measure the input voltage. | 12VDC is available and polarity is correct. | Volts  Pass/Fail |  |
| b. With the circuit breaker in the off position, measure the output voltage. | 0VDC is available. | Volts  Pass/Fail |
| **Item** | **Installation step** | **Installation / Commissioning Procedure** | **Expected Results** | **Result** | **Comments** |
| **4** | Confirm existing lantern is isolated from regulator board | a. Remove lantern cover/ existing junction box and test for voltage. | 0VDC (lantern is isolated). | Volts  Pass/Fail |  |
| **5** | Remove existing lantern | Disconnect cable from lantern and remove lantern and any other mounting equipment associated with the existing lantern. Existing cable to be re-used and connected to new junction box. | All equipment removed from lantern stand. | Yes/No |  |
| **6** | Bearing setup | a. Attach theodolite mounting stand to theodolite using the theodolite mounting bolt. Fix the mounting stand with theodolite to the existing lantern stand. Level Theodolite. | Theodolite mounted to lantern stand and level | Yes/No |  |
| b. Locate true north and mark on site for future reference (eg handrail) other positions can also be used as reference/check | True north and/or other positions marked on site for furture reference | Yes/No |  |
| c. Remove theodolite mounting stand from lantern stand | Theodolite stand removed. | Yes/No |  |
| **7** | Installation of new Sectored LED lantern. | a. Determine whether installed height of the lantern (base of the lens) is greater than 50mm above the horizontal plane of any obstructions. | Lantern lens base is installed greater than 50mm above the horizontal plane of any obstructions. | Yes / No | If no go to 7b  If yes go to 7c |
| b. Install extension stand as per the drawing to raise height of lantern to clear obstructions. | Extension stand installed. Lantern lens base is installed greater than 50mm above the horizontal plane of any obstructions. | Yes / No |  |
| c. Ensure all dissimilar metals are isolated with the use of nylon sleeves and washers as per the drawings. | Nylon sleeves and washers are installed and dissimilar metals are isolated. | Yes / No |  |
| d. Remove weather cover to expose sector bearing plate. Do not adjust sector bearing plate. Position light to align the sector bearing plate to the correct orientation. |  | Yes / No |  |
| e. Ensure Lantern is level | Lantern level | Yes / No |  |
| **8** | Install new lantern junction box. | a. Install junction box as per the drawing ensuring that the LED lantern cable can be installed. If there is an existing junction box, and the cables are not sufficient in length, the new junction box is to be installed between the existing junction box and new LED lantern | Junction box installed as per drawing and cable can be terminated. | Yes / No |  |
| b. Ensure all dissimilar metals are isolated with the use of nylon sleeves and washers as per the drawings. | Nylon sleeves and washers are installed and dissimilar metals are isolated. | Yes / No |
| c. Remove all sharp burrs and edges from junction box mounting rails. | No sharp burrs or edges exist. | Yes / No |
| **9** | Installation Complete | a. Asbuilt dimensions taken of lantern installation, including wiring diagram/s. | Asbuilt comments completed | Yes / No | To be sent to PM |
| b. Take photos of the complete site including cabling and terminations. | Photos of site taken | Yes / No |  |

**commissioning of light – on site**

**Date: ……………………… Completed by: …………………………………………………………………………………….**

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| --- | --- | --- | --- | --- | --- |
| **Item** | **Commissioning step** | **Installation / Commissioning Procedure** | **Expected Results** | **Result** | **Comments** |
| **1** | Connect cable from lantern to junction box. | a. Connect cable from LED lantern to new junction box via cable glands and ensure correct polarity | Cable connected to junction Box via cable glands and polarity correct. | Yes / No |  |
| **2** | Connect existing cable into the new junction box. | a. Inspect existing cable to ascertain it is in good working condition and can be utilised for the new LED lantern. | Existing cable can be utilised for the new LED lantern. | Yes / No |  |
| b. Connect existing cable into new junction box via cable gland reducing the length as required and ensure correct polarity | Cable connected to junction Box via cable glands and polarity correct.. | Yes / No |
| c. Cable is to be secured with stainless steel insulated cable ties to lantern stand and affixed along the existing path to the regulator board . | Cable is secured by insulated cable ties. | Yes / No |
| d. Remove disconnect pin from junction box. | Disconect pin removed. | Yes / No |  |

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| --- | --- | --- | --- | --- | --- |
| **Item** | **Commissioning step** | **Installation / Commissioning Procedure** | **Expected Results** | **Result** | **Comments** |
| **3** | Confirm that the LED Lantern powers up. | a. Enable circuit breaker at the regulator board and apply power to the terminal connections. | Circuit breaker enabled. | Yes / No |  |
| b. Confirm 12VDC power is available and the polarity is correct. | 12VDC is available and polarity is correct. | Volts  Pass/Fail |
| c. Insert disconnect pin back into junction box. | Disconnect pin reinstalled | Yes / No |
| **4** | Check LED lantern operation. | a. Cover photocell to confirm lantern comes on. | Lantern comes on when photocell covered. | Yes / No |  |
| b. Check character setting is correct as per Draft ANS | Character setting confirmed as per Draft ANS | Yes / No |  |
| c. Compare character setting on the Draft ANS to the current ANS. | Both settings are the same | Yes/No | YES – no further action required  NO – contact and advise differences to the  RCC 1800 641 792 Advise Hydrographer reference if available |
| **5** | Commissioning Complete | a. Site clear of tools and spare parts. No rubbish left behind. | Site clean and clear of hazards | Yes / No |  |
| b. Confirm sector check from vessel. - Confirm and record angle of visibility of auxiliary light as per AMSA sector check procedure AtoN6-3 and AMSA1524 Sector check form; | Sectors confirmed and correct | Yes / No | To be sent to PM |

1. Soak testing involves testing a system with a typical production load, over a continuous availability period, to validate system behaviour under typical use [↑](#footnote-ref-1)