

## **Nautilus ROV & Subsea Hooks™ Recommended Maintenance Schedule & Inspection Guidelines.**

These maintenance recommendations and tolerance specifications are the manufacturers guidelines for ensuring your Nautilus ROV Hooks remain fit for purpose. Nautilus ROV Hooks must conform to manufacturer's specifications and tolerances for annual re-certification.

All lifting equipment, including Nautilus ROV Hooks, should be visually inspected prior to use. Any lifting equipment found with signs of excessive general wear or tear, visual fatigue cracks or damage due to misuse, should be removed from service and replaced.

### **Annual Thorough Examination**

- In accordance with current legislation the manufacturers recommend that Nautilus ROV and Subsea Hooks are subjected to an Annual Thorough Examination by a competent testing and inspection service. Thorough Examination should encompass these manufacturers recommended guidelines and tolerance specifications for annual re-certification.

### **General Maintenance Guidelines**

- All lifting equipment, including Nautilus ROV Hooks, should be visually inspected for signs of cracks, nicks, excessive wear, gouges or deformation prior to use.
- To maintain the operating functionality of Nautilus ROV Hooks it is essential to apply a general purpose, waterproof, lubricant to the main load bearing pins and sliding surfaces as well as the lock slide/spring areas at frequent intervals.
- In order to ensure your Nautilus ROV or Subsea Hooks remain in a serviceable condition, and to counter the corrosive effects of the subsea marine environment, the manufacturer recommends that an appropriate waterproof lubrication is applied to the component parts both prior to, and upon conclusion, of each subsea lifting operational exercise/day such that the critical moving components always remain well lubricated and free to operate as designed.  
**Regular lubrication is the key element to maintaining your Nautilus ROV hook in good working order.**
- The primary activation wires/studs are manufactured from 316 marine grade stainless steel, the threaded stud (M6) screws into the lock shaft. The primary wire has a max. load rating of 1200kg.  
Should the primary wire need replacing first pull the lock piece all the way open to expose the lock shaft, then unscrew the M6 stud using a 6mm spanner on the flats located on the stud.  
New primary activation wires/stud threads should be well greased with waterproof lubricant prior to installation/fitting or alternatively fitted with a medium strength thread lock.
- The 3mm 316 SS secondary/backup activation wire is fitted directly through the hole in the lock piece and forms a loose loop (crimped together with a ferule) which should sit above the primary wire where it passes through the handle. The 3mm secondary wire is a backup and disposable wire which can be cut free if/when not required.



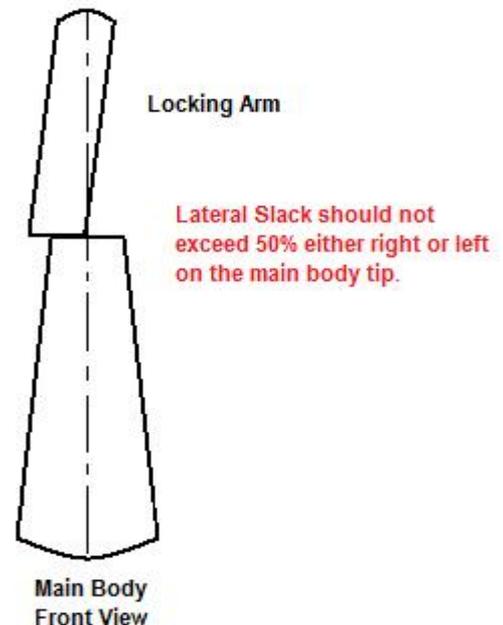
## General Checks and Tolerance Specifications

- **Deformation Check** - Two strategically placed marks are located either side of the hook opening which allows for onsite “spec check” measurement to determine if the throat opening of the hook has changed, thus indicating abuse or overload. On both models NH-ROV22E and NH-SS22E the throat measurement between the spec check nib centres is **115mm**. If the throat measurement, centre to centre is **+/- 3mm** from the specification it is recommended that the hook is removed from service as this indicates damage or overstressing of the hooks load bearing main body component.

**Note:** Nautilus ROV and Subsea hooks should not be subjected to side loading or back loading (when fully opened) which places loading on the hook components in any manner other than intended, excessive side or back loading forces will damage or reduce the service life of the hook. Side loading may induce lateral slack in the locking arm.

## Nautilus Hooks Lateral Slack

- Lateral slack refers to the horizontal (sideways) movement of the locking arm in relation to the main body of the hook at the point where the tips come together. (as shown in diagram).
- If lateral slack on the locking arm exceeds **50%** this indicates damage or side loading abuse has induced excessive lateral wear in the hook.
- Nautilus ROV Hooks which exceed this tolerance for lateral wear should be removed from service and replaced with new units.



## Fatigue Rating

- All Nautilus Hooks including the ROV and Subsea Hooks are fatigue rated to 20,000 cycles at 1.5 times the stated WLL as per BS/EN 1677 requirements.

## Gap Tolerance

- The manufactured “gap” between the main body and locking arm where the tips come together is specified as  $\leq 2\text{mm}$ . An increased gap can indicate either the hook has been overstressed or general wear and tear of the main load bearing pin or lock piece. Measuring across the spec check deformation nibs will indicate overstressing if greater than the 115mm spec, If the nibs are within tolerance and the gap has become excessive this will indicate general wear on the main load bearing pin or lock piece. The hook should be removed from service and replaced
- **Note:** The maximum allowable “gap” should not exceed **6mm** when tips are pressured apart with the hook in the locked position, Hooks outside this tolerance should be removed from service and replaced with new units as they have passed their service life.

### Additional Guidance Notes for Inspection of Nautilus ROV/Subsea Hooks

- All Nautilus Hooks are manufactured under BS/EN standard 1677. In addition to this international safety hook manufacturing standard Nautilus Hooks are DNV type approved under regulation 2.22. An independent QA procedure that includes verification of the manufacturing processes, assembly, materials and component testing which are common to all Nautilus Hook models.
- All Nautilus Hooks are assembled from 5 basic components, the main load bearing body, the load bearing locking arm, the load bearing main pin, together with the non-load bearing handle portion and lock piece.
- During assembly the non-load bearing handle portion is welded to the main load bearing portion at three points as shown in the diagram at right. These welds are non-structural and do not contribute to the rated WLL of the Hooks.
  1. The 2 top handle welds are both “L” shaped welds, starting from each side of the top of lock opening in an “L shape to the locking arm slot.
  2. The centre weld runs underneath/across the bottom of the lock space.
  3. The bottom weld runs right around the base of the handle.
- The weld material is a Nickel/Stainless Steel alloy (non-corrosive) and the load bearing components are carbon steel. These metals have contrasting magnetic permeability values, the weld material is <003% magnetic and the carbon steel is 100% magnetic. This magnetic differentiation affects MPI test methods as the induced magnetic field is disrupted along either side of the weld line (see right) concentrating the particles at the weld lines and giving a false impression of potential cracking. The MPI test procedure is not suitable for Nautilus Hooks



**\*\*\* LPI or Dye Penetration is the recommended test for all Nautilus Hooks.**

- The manufacturing standard for lifting hooks calls for fatigue testing/rating of 20,000 cycles at 1.5 x WLL of the hook. (20,000 cycles is the BS/EN 1677 rated hook life)  
All batches of Nautilus Hooks exceed this requirement with no indication of metal fatigue. Extended factory fatigue testing has been conducted to determine the expected fatigue life of Nautilus Hooks. All test samples achieved 120,000+ fatigue cycles (6 x the rated hook life) before hairline cracks became evident, initially propagating from a welded handle joint corner as expected, following this extended test all samples passed a proof load test with no deformation.
- **Should any minor damage become apparent to the non-load bearing handle, including any slight imperfections of the non-structural welded handle joints, the load bearing integrity of the hook (rated 4:1 safety factor) will not be compromised.**  
**Note : The welded joints serve only to fix the handle in place.**
- **Should minor imperfections develop in a welded joint, for whatever reason, they will not propagate into the main body load bearing portion of the hook. Any Nautilus Hook indicating slight deficiencies in a handle weld joint when LPI/Dye tested may be re-certified at the users discretion, subject to a 2.5 x WLL proof load test.**
- **In the unlikely event, and for whatever reason, a handle weld should develop clear visual cracks across the full welded joint, then, as a precaution the hook should be removed from service and replaced.**