



## Non-Destructive Testing

ALLMI Guidance Note 012

BS7121 Parts 2 and 4 recommend that eight years after first being put into service a “non-destructive test” of the loader structure is made in conjunction with a thorough examination. ALLMI totally endorses these recommendations.

Non-destructive testing (NDT) is employed to assist in the detection of any material cracks or defects that may lead to a structural failure.

The competent person making the examination must either be qualified in the techniques of NDT or employ a suitably qualified specialist. BS EN 473 *Non - Destructive Testing Qualification and Certification NDT Personnel – General Principles*, details the qualification and certification of NDT personnel. This standard can be obtained from [www.bsi-global.com](http://www.bsi-global.com)

The crane should be thoroughly cleaned to remove grease or grime that would hinder a visual inspection. In the case of a more in-depth analysis the crane may require dismantling and/or removal of paint. The extent of this preparation depends greatly on the NDT method adopted. Before making the inspection, carry out a risk assessment. Give consideration to the means of access to all parts of the loader crane and take fall prevention measures as appropriate. Use suitable tools and protective equipment.

Blistered, flaking or cracked paint must be removed.

### Common methods of NDT used to investigate structural failure.

#### **Visual Inspection**

Look for paint cracks. Steel exposed by a paint crack will start to rust in contact with rainwater or salt air. Telltale reddish-brown signs are easy markers of places to start looking for cracks. Be aware that visual signs of failure may not always be apparent. E.G. rust/cracks painted over.

#### **Dye Penetrant Testing**

Employs a penetrating dye which is applied over the surface of the component and enters clean, dry and open defects. The inspection is carried out by first cleaning the surface to remove foreign material in the crack.

The penetrant is then applied to the surface and allowed to soak into the cracks.

Excess penetrant is then removed and a developer applied which draws penetrant from cracks out onto the surface.

This method only detects surface defects in non-porous materials but can be used on a wide variety including metals, plastics and ceramics. Further guidance is given in BS EN 571-1:1997 and prEN 10228 - 2

#### **Ultrasonic**

Uses high frequency pulse waves to detect flaws in materials and can also measure an object's thickness (e.g. the degree of corrosion inside a pipe).

The pulse waves are transmitted through the material and defects in the material cause reflections of the sound. By measuring the time difference between the transmission and the reflected sound an estimate of the defect's depth can be made.

*Ultrasonic testing can detect flaws at a superior depth in a wide variety of materials.*

Further guidance is given in BS EN 583-3: 1997.

#### **Electromagnetic Testing**

Detects cracks on and below the surface by inducing electric currents or magnetic fields upon a conductive test object and observing the electromagnetic response.

This method is very accurate and has the ability to test complex shapes, but is limited by the depth of inspection.

#### **Magnetic Particle**

Very fine dyed magnetic particles are suspended in a liquid and painted onto the test surface. Cracks on and below the surface are indicated by a gathering of the dyed particles caused by distortion of the magnetic field caused by the crack. It is necessary to grind the surface at suspect crack locations to ensure against false positives / negatives. This grinding can help prevent fatigue cracks by removing weld toes, for example, without compromising the structure.

*Not suitable for non-magnetic materials.*

*Possible to test through undamaged paint.*

*Not suited to complex objects.*

Further guidance is given in BS 6072 :1981, PD 6513 and prEN 10228 – 1

#### **Radiographic Testing**

Uses short wavelength electromagnetic radiation (e.g. X-ray) to detect hidden flaws in various materials by measuring the intensity of radiation through the test object. Surface defects may require grinding to smooth the surface before analysis to ensure a clear image of a crack can be seen on the radiograph, which may otherwise be obstructed. Penetrants can be used to make surface cracks more visible.

### **Notes**

A suspected crack found by visual inspection should be further checked with one of the other techniques.

Areas where paint has been removed for inspection must be made good to prevent corrosion.

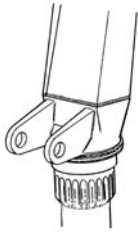
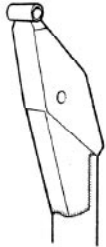
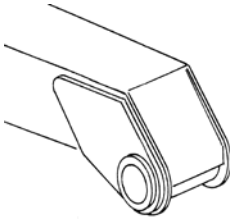

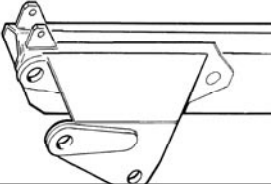
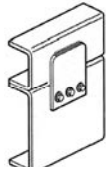
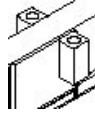
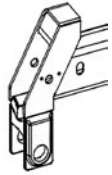
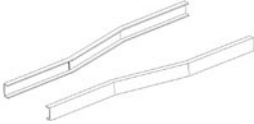
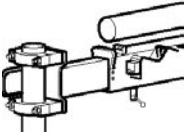
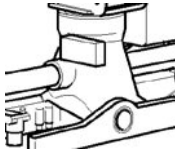
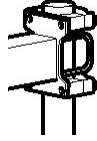
**Areas to be checked**

Please reference ALLMI Guidance Note 011 - In-service structural inspections

Plate intersections  
 Changes in section  
 The hook  
 Around pin locations  
 Plate edges with stress points  
 Around holes

Repairs  
 Welding  
 Fastenings  
 Complex fabrication areas  
 Pins  
 Helper Frame

**Example areas to be checked**

|   |   |  |   |
|---|---|--|---|
|    |    |    |    |
| 1. Between cast and fabricated Column Components.                                   | 2. Changes of Section on Column   | 3. Fabrications  | 4. Links & Linkages   |
|    |    |     |    |
| 5. Complex Fabrications   | 6. Helper frame Cleat Plates  | 7. Holding Down Blocks   | 8. Hook Attachment  |
|  |  |  |  |
| 9. Helper Frame Waisting  | 10. Stabilizer Extension Beams  | 11. Cast Components  | 12. Stabilizer Anchorages   |

For points 1 and 2, It would be prudent to use Ultrasonic or Magnetic Particle testing due to the critical nature of the welds.

Any certificates and / or reports of NDT, should be appended to the Report of Thorough Examination.

**Reference Information**

- BS EN 12999 Cranes – Loader Cranes
- LOLER Lifting Operations and Lifting Equipment Regulations
- PUWER The Provisions and Use of Work Equipment Regulations
- ALLMI Code of Practice for Installation Application and Operation
- BS 7121 Safe use of cranes, Parts 2 and 4
- BS EN 473 Non Destructive Testing Qualification and Certification NDT Personnel

**Disclaimer**

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