Thruster Lifting Jig
Team StrongHeart
Scope

• Objective
• Project Background
• Current Method
• Cause & Effect
  ▪ Ishikawa Diagram
• New Method
• Tangible Benefits
• Intangible Benefits
• Conclusion
Objective

To eliminate or reduce the risks of **Hand-Finger and Bodily Injury** through reduction in **material handling** encountered during the **thruster transportation process**
Project Background

• What is a Thruster?
  ▪ Propulsion system of ships
  ▪ Comes in various sizes
  ▪ Generally used for dynamic positioning of vessel
Current Method

- Step 1: Thruster is protected and lifting wires are lashed followed by removal of thruster
Current Method

• Step 2: Crane to lift thruster to be placed on trailers to be sent to workshop
Current Method

- Step 3: Thruster is supported by concrete blocks and wooden wedges during overhauling
Current Method

- Step 4: Thruster is lifted back to be installed in reverse order
Safety Statistics

• Highest accident rate recorded by Struck by object & Caught in Between category.
• Thruster Lifting Jig aims to reduce this percentage.

KSL – ACCIDENT ANALYSIS – 2012
Type of accident

- Struck by or against object: 45%
- Caught in between objects: 24%
- Fall from height: 6% (less than 2m)
- Fall on same level: 10%
- Contact with Heat: 5%
- Contact with Chemical: 1%
- Foreign Body in the eye: 3%
- Sprain/Strain: 6%
Engineering Design

- Standardization for modification and any further fabrication works in the future
- Technically certified by the engineering department of Keppel
## Thruster Jig Strength Check

1. **Design Load**
   - SWL
     - Design Load = \(200 \times 1.50\)
   - SWL
     - Design Load = \(30 \times 1.50\)

2. **Material**
   - Mild Steel
     - Yield Stress
       - Allowable Bending Stress = \(24 \times 0.6\)
       - Allowable Compressive Stress = \(24 \times 0.6\)
       - Allowable Shear Stress = \(24 \times 0.4\)

3. **Check Bottom Beam**
   - Total 2 Beams
     - Beam 310 x 250 x 9 / 16
     - "Z" (Ref Appendix 1A)
     - \(L = 1.95\ m\)
     - Moment Max. = \(PL / 4\)
       - \(= (25 \times 1.95 / 4) / 2\)
       - \(= 6.09\ t\ \cdot\ m\)
     - "Z" require
       - \(= 6.09 \times 10^3 / 14.4\)
       - \(< 1220.4\ cm^3\ \text{ok}\)
**Final Design**

**Lifting Lugs**
- For securing thruster

**Thruster Neck Support**
- To support ‘neck’ of thruster
- Adjustable

**Securing Lugs**
- For securing thruster

**Semi Circular Plate**
- To rest base of thruster up to diameter of 1.1m
The Jig has been load tested with a certified counter weight of 30 Ton and is safe for operational works.
Improved Method

• Step 1: Thruster is protected and lifting wires are lashed followed by removal of thruster to be rested on the Thruster Lifting Jig
Improved Method

• Step 2: Crane to lift thruster with jig to be placed on trailer and secured before being transported to the workshop
Improved Method

• Step 3: Thruster is overhauled while rested on jig and sent back to be installed in the reverse order
Tangible Benefits

**Reduced Contact**  
(Between Hand & Load)  
50%  
(Certain activities does not require contact anymore)

**Better Stability**  
(During transportation)  
2.3X  
(Holding strength from 80Tons to 180Tons)

**Manpower**  
(From 10 man to 5 man)

**Productivity**  
(Reduction in Time needed to complete thruster transportation operation)  
46%  
(From 6.5 hrs to 3.5 hrs)
Intangible Benefits

• **Enhance Corporate Image**
  - Implementation of a safe and innovative device

• **Improve in workers’ morale and confidence**
  - Usage of a safe and simple innovation
## Thruster Lifting Jig Maintenance Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Frequency</th>
<th>Maintenance Procedure</th>
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<th>Date</th>
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<td>1</td>
<td>Annually</td>
<td><strong>Load Test</strong>&lt;br&gt;i) Load test report&lt;br&gt;ii) Witness by PE</td>
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<td><strong>MPI (Lifting Lugs)</strong>&lt;br&gt;i) Removal Of Paint&lt;br&gt;ii) MPI report&lt;br&gt;iii) Submission of report to PE</td>
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<td>Annually</td>
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<td>4</td>
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<td><strong>MPI (Foundation Seam)</strong>&lt;br&gt;i) Removal Of Paint&lt;br&gt;ii) MPI report&lt;br&gt;iii) Submission of report to PE</td>
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<td>Quarterly</td>
<td>Eye Lug Check and Colour Coding</td>
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<td>Prior to Usage</td>
<td>Pre-lifting Visual Check</td>
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Review and Sustenance

• Addition of C channels on to Jig
  ▪ To lift empty jig into position

• Addition of Retractable Stand Structure
  ▪ Improves ergonomics as worker can reach and adjust thruster neck support easily
Conclusion

- Practical, innovative way of transporting thrusters to workshop for overhaul.
- Improves safety
- Reduces manpower and costs
- Additionally, 2 units of this Jig has been sold to customers during the month of January 2013