

# **ENGINEERING TEST REPORT**

REPORT REFERENCE: BTK22-03-38  
ADR TEST FACILITY APPROVAL NUMBER: TFA-002348

Testing Of

## **Cotton Bale Load Restraint System to suit Conventional 45' Flat Deck Semi Trailer**

To Nominated Sections Of  
NTC Load Restraint Guide (2018)

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## 1 Introduction

- 1.1 – Collier & Miller Pty Ltd have requested physical testing be conducted on their cotton bale load restraint system.
- 1.2 – The load restraint system includes the following items:
- 1.2.1 – Primary strap – Ancra Australia double J-hook w/ keeper, 5,000kg rated, 100mm webbing x 20.0m length.
  - 1.2.2 – Primary winch – Collier & Miller 100mm Cotton Winch.
  - 1.2.3 – Secondary strap – AustLift double J-hook w/ keeper, 2,500kg rated, 50mm webbing x 9.0m length.
  - 1.2.4 – Secondary winch – AustLift 205205 Slide On Ratchet Winch.
- 1.3 – The primary strap, primary winch, secondary strap and secondary winch must be attached to substantial members of the trailer capable of supporting the imposed loads of the load restraint system, all welding must comply with Appendix A of this report.
- 1.4 – This load restraint system must be used on a flat-deck trailer with a combing rail depth of no less than 20mm.
- 1.5 – This load restrain system must be used on a trailer with a headboard capable of supporting a minimum 16,800kg load at 0.8g forward longitudinal acceleration.
- 1.6 – The test trailer supplied by Collier & Miller was a 1965 Fruehauf flat-deck semi-trailer with a deck length of 45 feet.
- 1.6.1 – Refer Section 4 for a summary of trailer specifications.
- 1.7 – The test mass included six (6) typical cotton bales weighing approximately 2,800kg positioned in accordance with image 1.1 below.



*Image 1.1 – Loaded Test Trailer*

1.8 – In accordance with the NTC Load Restraint Guide 2018, the following tests have been conducted:

- 1.8.1 – Test – Forward Longitudinal Acceleration  
Requirement – 0.8g  
Method – Physical tilt test
- 1.8.2 – Test – Rearward Longitudinal Acceleration  
Requirement – 0.5g  
Method – Physical tilt test
- 1.8.3 – Test – Lateral Acceleration  
Requirement – 0.5g  
Method – Physical tilt test

## 2 **Summary**

2.1 – Testing demonstrated that the load restraint system can support six (6) cotton bales for the lateral acceleration and rearward acceleration requirements of the NTC Load Restraint Guide 2018.

2.2 – A forward longitudinal tilt test was conducted; however, the trailer headboard began to fail at a tilt angle commensurate of 0.6g acceleration.

- 2.2.1 – This load restrain system must be used with a trailer headboard capable of supporting a minimum 16,800kg load at 0.8g forward longitudinal acceleration.

### **3 Load Restraint System Description**

3.1 – The load restraint system consists of a primary strap tensioned by the primary winch (see Image 3.1) and a secondary strap tensioned by the secondary winch (see Image 3.2).



*Image 3.1 – Primary winch*



*Image 3.2 – Secondary winch*

3.2 – The primary winch may be located at either the front or the rear of the trailer.

3.2.1 – For the purpose of this test, the primary winch was fitted to the rear of the trailer.

3.3 – The load restraint system must be pre-tensioned in the following sequence:

Step 1 – Tension primary strap to 11.3kN.

*Note: this pre-tension can be achieved by applying a torque of 500N.m at the primary winch handle.*

Step 2 – Tension secondary strap until the minimum angles shown in figure 3.3 below have been obtained.

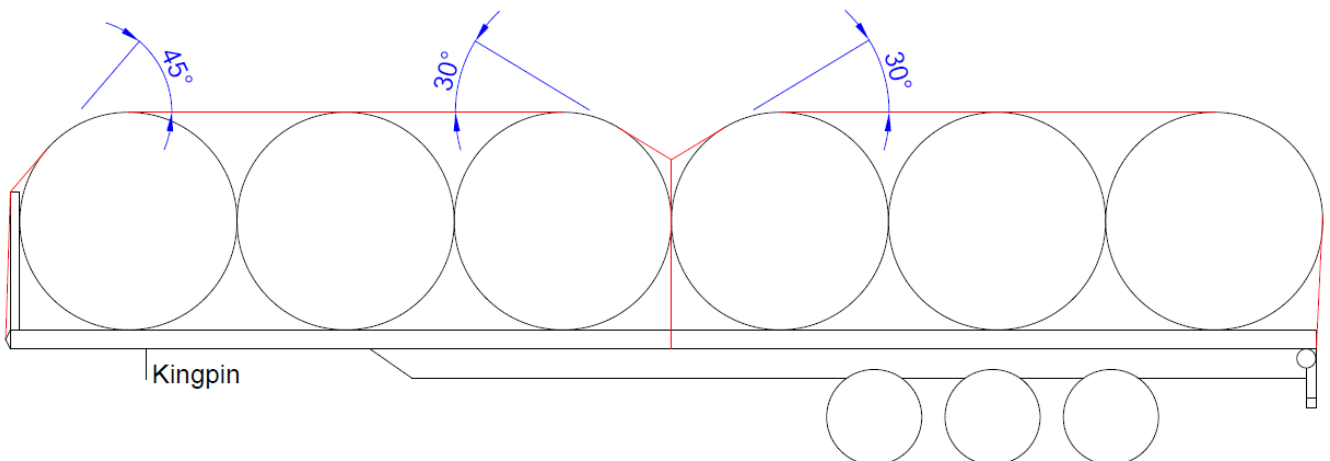


Figure 3.3 – Required minimum tension angles

#### 4 Test Trailer Specifications

4.1 – The test trailer used was a 1965 Fruehauf flat deck triaxle semi trailer supplied by Collier & Miller, see details below:

VIN/Chassis No.: TR4664045  
 Make: Fruehauf  
 Model: PH37L2AW

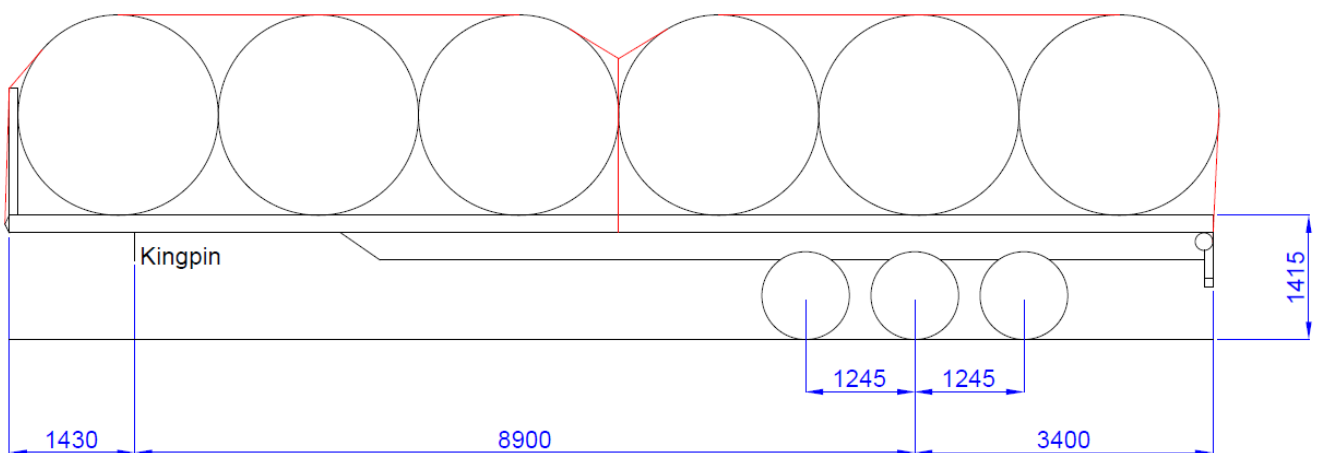


Figure 4.1 – Trailer dimensions

## 5 Results



*Image 5.1 – Longitudinal Forward; Note: test abandoned as headboard began to deform.*



*Image 5.2 – Longitudinal Rearward.*



*Image 5.3 – Lateral Simulation.*

## Appendix A - Structural Steel Welding

1.1 – While strict attention must be given to the requirements of AS1554 – Structural Steel Welding, the following points should be followed to ensure the integrity of the structure, to minimise the chance of fatigue failure, and to ensure the weld itself does not contribute to any failure of the joined components.

1.1.1 – No start/stopping of the weld in an area of high stress – this can lead to crater cracks in the weld pool which may propagate through the weld and into the parent material.

1.1.2 – No porosity – this will reduce the strength of the weld.

1.1.3 – No undercutting of the parent material (see diagram 2 below). Undercutting reduces the thickness and therefore strength, it also acts as a stress concentrator where cracking and failures tend to initiate.

1.1.4 – Full penetration into parent material required. There should be no beading of the weld on the surface, this leads to potential stress concentrators at the weld pool edge. Poor weld penetration may also lead to cold laps and gaps in the weld which can lower the strength of the weld and lead to stress raisers.

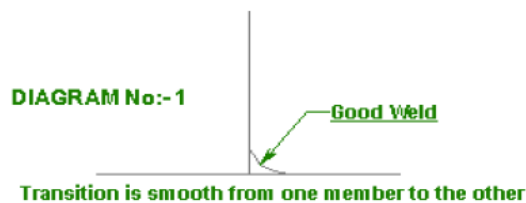


Diagram A – Shows an example of an ideal concave profile weld that will help dissipate any stresses present into the parent material.

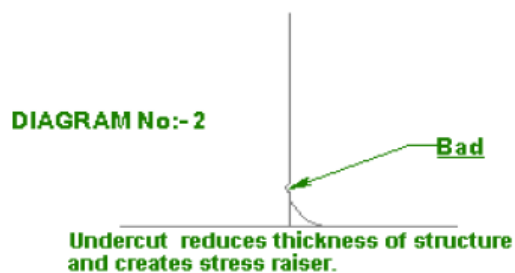


Diagram B – Shows a correct concave profile weld but with undercutting at the weld's edge, causing a reduction in material thickness and a potential failure point where stress will be concentrated.

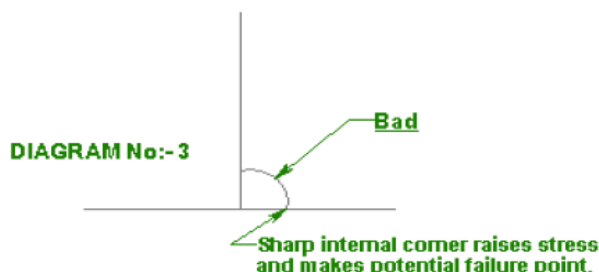


Diagram C – Shows a weld with a poor profile (high bead/build up) and likely poor penetration. The sharp edges of the weld are potential failure points.