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Test specification for pallets

Abstract

The main goals when designing pallets are to make them durable, but also lightweight. Pallets must withstand the strain from rough handling and still protect the products that it carries, therefore testing is needed.

Application

This test specification can be used when testing the durability of stand-alone pallets. These tests also help the pallet designer to balance cost against performance of the pallet. Decision to perform these tests is taken by the VEM.

Test standards

This test specification is mainly based on the international ISO-8611 standards regarding test methods, performance, and durability requirements.

Not all test methods specified in ISO 8611 are used. The methods chosen are based on the damages seen in Ericsson distribution flows today. Modifications have been made to the ISO-standard test to suit Ericsson's needs.

ASTM D 1185-98a is used to set test speed value to 1,27m/s for impact tests since the ISO 8611 standard does not specify any impact speed. This speed is considered normal speed for a forklift.

- SS-ISO 8611-1:2011, Flat pallets - test methods
- SS-ISO 8611-2:2011, Flat pallets - performance requirements and selection of tests
- SS-ISO 8611-3:2011, Maximum working loads
- ASTM D 1185-98a, Standard Test Methods for Pallets

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1 Terms and definitions

1.1 Maximum work load

Maximum work load is the heaviest load, excluding the safety factor, that the pallet is permitted to carry.

The maximum work load equals the measured load in kilograms at which the stated maximum bending limit is reached.

1.2 Safety factor

In ISO 8611 the safety factor for pallets is at least 2.0. The safety factor is verified for the following selected tests, bending test (racking and forklift) and bottom deck bending test, by performing ultimate bending limit tests.

Safety factor tests are not performed for shear impact and block impact tests.

- Example of safety factor test and verification in bending test (racking):

Pallet achieves a result of 200 kg at maximum bending limit 2% of L1. 200 kg is then the intended maximum work load for the pallet as described in 1.1.

Calculating with safety factor $2.0 = 200 \times 2 = 400$ kg.

400 kg shall be verified by performing ultimate bending test to the test limit of 6% of L1.

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2 Test preparation

2.1 Pallets in test

Pallets selected for test shall be new and unused. Before testing begins the pallets shall also be verified so they are manufactured according to the 1301-specification.

2.2 Reference document

The pallet Design Guideline, 5/102 60-CSX 101 58 can be used as a reference document when verifying the manufacturing of the pallets.

2.3 Test result documentation

To make the test procedure easy and smooth it is recommended to use the pallet test performance template attached below. All measures and performance results for each test method can be recorded in the template. Test results shall be included in verification protocol 102 67-.



Pallet test
guide.xlsx

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3 Chosen Test methods

3.1 Bending test (racking)

This test is performed to verify the pallets strength when placed in racks.

3.1.1 Test preparation and procedure

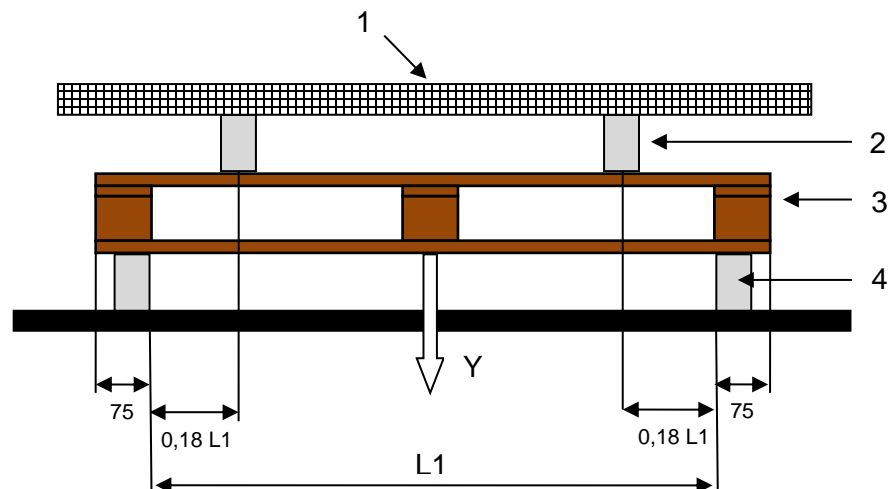
Place the pallet on the test equipment according to fig 1 below. Use the Pallet test performance template to calculate value for $0.18 L1$ / maximum / relaxation / ultimate bending limits.

1. Start by applying load until maximum bending limit 2% of $L1$ is reached at deflection point Y. Result in kg shall be noted in the performance template.
2. Release the load and measure the maximum bending limit after relaxation which is set to 0,7% of $L1$. Result in millimeters shall be noted in the performance template.

Fig. 1

1. Test load equipment
2. Load bars 50mmx min 50mm
3. Pallet
4. Support bars 50mmx min 50mm

Y Deflection of $L1$



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3.2 Bending test (forklift)

This test is performed to verify that the pallet does not bend too much during forklift handling.

3.2.1 Test preparation and procedure

Place the pallet in the test equipment according to fig 2 measuring deflection Y at point A to I according to fig 3.

1. Apply load until the maximum bending limit 20mm is reached at any of the measuring points A to I. This result in kg is the maximum workload for the pallet in the Forklift test method.
Note the result in load (kg) in the performance template.
2. Release the load and measure the maximum bending limit after relaxation which is set to max 7mm. Result in millimeters shall be noted in the performance template.

Fig. 2

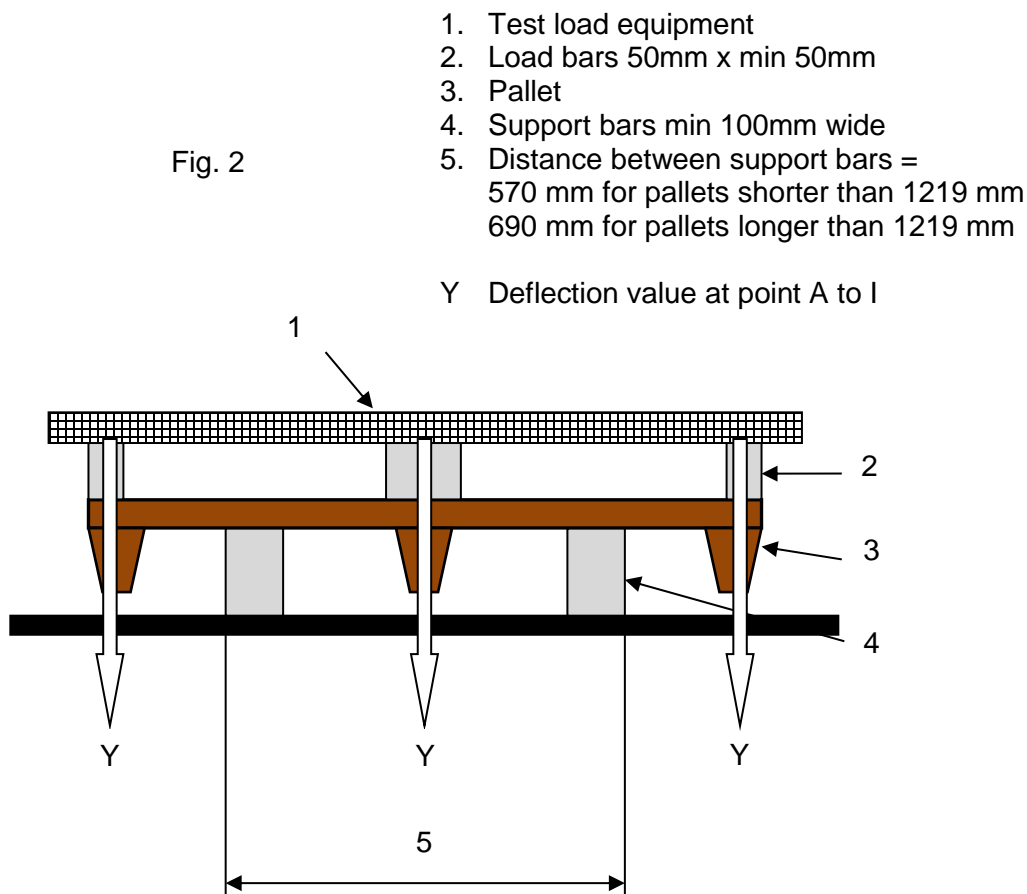
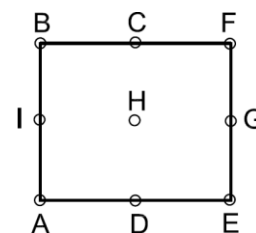


Fig. 3



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3.3 Bottom Deck Bending test

This test is to determine that the bottom deck boards are strong enough to manage conveyor belts or narrow beam rack supports.

3.3.1 Test preparation and procedure

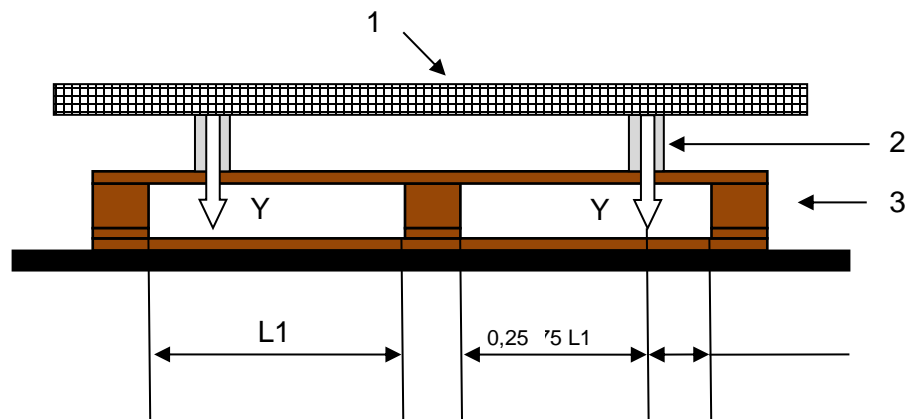
The pallet is placed upside down and load is applied over the bottom deck boards according to fig 4.

1. Apply load until the maximum bending limit 15mm deflection at Y is reached.
Result in kg shall be noted in the performance template.
2. Release the load and measure the maximum bending limit after relaxation which is set to max 7mm. Result in millimeters shall be noted in the performance template

Fig 4

1. Test load equipment
2. Load bars 50mm x min 50mm
3. Pallet

Y Deflection



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3.4 Pass/Fail criteria for bending test in sections 3.1 to 3.3.

- The described performance limits in section 3.X.1 shall be reached.
- After completion of testing, the pallet must be intact and capable of being used for further transportation, storage, and handling.
- Some pallet material degradation is acceptable.

Unacceptable degradation of the pallet material can be defined as:

- Severe damage to the pallet is not acceptable.
- Any change in pallet condition, including fractured or deformed components, that affects the wanted performance is not acceptable.
- Separation between runners, blocks, stringer, or deck boards are not ok.

*

3.5 Shear Impact test

The purpose of this test is to determine the resistance to side horizontal impact of the assembly between top deck, blocks, stringers, and bottom deck.

This could occur when driving the forklift and holding the pallet too low. An edge can then impact the bottom deck runner board risking shearing off the whole runner.

3.5.1 Test 10 – Shear impact test

Secure a steel or high-density hardwood beam 90 x 90 ±10mm or similar beam to the backstop of the test rig. This beam shall be longer than the pallets longest side.

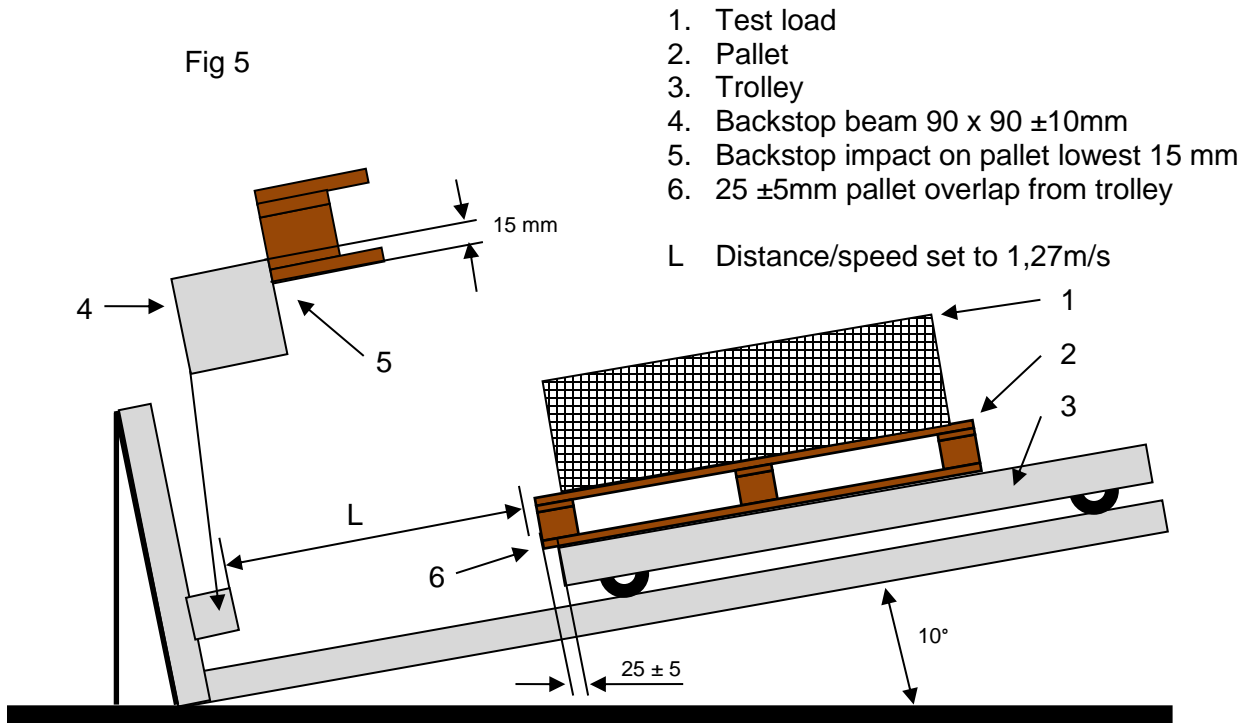
The test is performed by impacting the pallets lowest 15 mm into the backstop beam.

Impact speed is set to 1,27m/s.

Test is performed two times on both long and short side of the pallet. Deformation and/or displacement or other damages shall be noted in test report. Visual inspection shall determine if pallet passed or failed the test.

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Fig 5



3.6 Block Impact test

This test is to determine the blocks resistance to impact from a forklift arms.

3.6.1 Test 12 – Block impact test

Same test procedure as for Shear impact test, but the backstop beam is replaced by two impact stop shanks simulating forklift arms according to figs 6 and 7.

These shanks shall be positioned so that the top of the shank blade impact the pallet blocks approximately 75mm from the bottom of the pallet.

Impact should not be centered on the blocks but offset so 30mm of the block width is impacted, according to fig 7.

Test is performed once on both long and short sides of the pallet. Deformation and/or displacement or other damages shall be noted in test report. Pass or fail is determined by visual inspection.

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Fig 6

1. Test load
2. Pallet
3. Trolley
4. Backstop impact shank
5. Backstop impact shank top surface impacts pallet 75 mm from pallet bottom
6. 25 ± 5 mm pallet overlap from trolley

L Distance is to set to achieve 1,27m/s

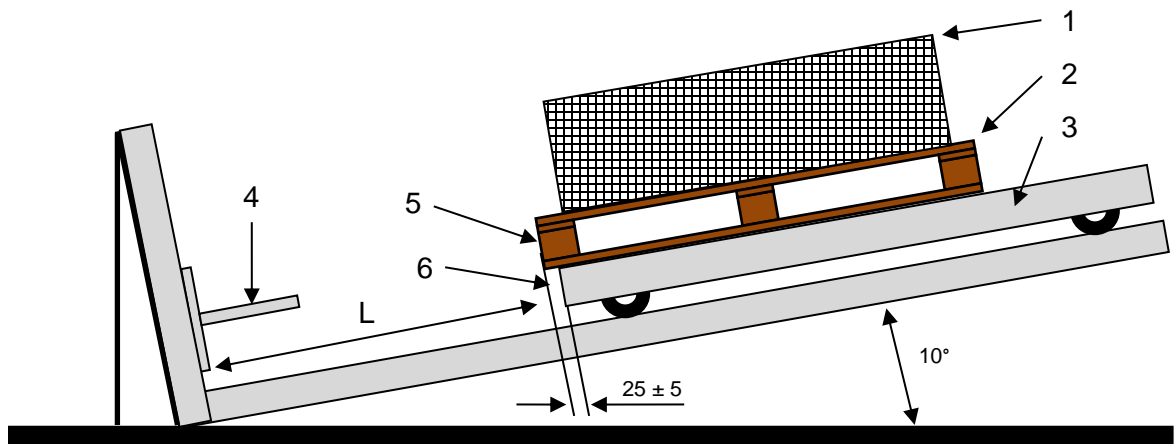


Fig 7: Showing offset impact between shank and pallet blocks.

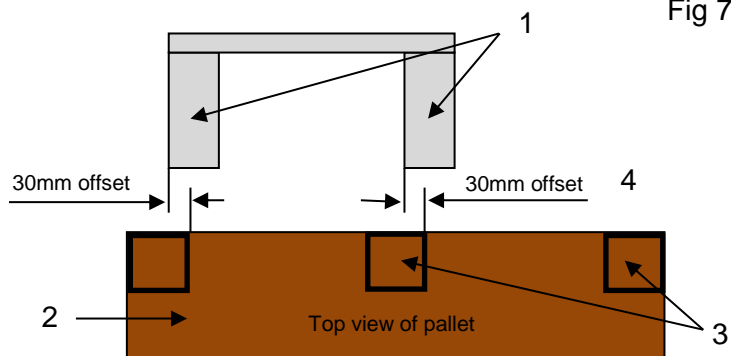


Fig 7

1. Shanks
2. Pallet
3. Pallet blocks
4. Impact offset 30mm on pallet blocks
5. Distance

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3.7 Pass/Fail criteria for Impact tests in sections 3.5 and 3.6.

- The pallet must be intact and capable of being used for further transportation, storage and handling.
- Some pallet material degradation is acceptable. Severe damage is not acceptable.

Unacceptable degradation of the pallet or pallet material can be defined as:

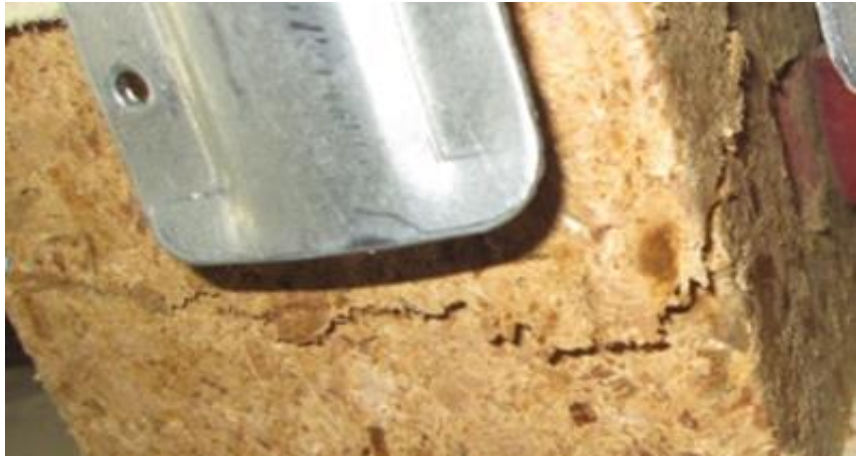
- Severe change in pallet condition, including fractured or deformed components, that affects the wanted performance is not acceptable.
- Blocks or runners shall not be displaced or turned more than 10 mm in any direction, see example picture 5.1. on page 12.
- Plywood blocks shall not be twisted more than 15 mm measured between top to bottom, see example picture 5.4. on page 12.
- Cracked blocks not ok, see example picture. 5.2. on page 12.
- Blocks that have been separated are not ok, see example picture 5.3. on page 12.
- Separation between runners, blocks, stringer or deck boards are not ok.
- Protruding nail heads are not ok.

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Pic. 5.1



Pic. 5.2



Pic. 5.3



Pic. 5.4



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4 Revision history

Revision	Date	Author	Comments
A	Oct 2014	Thomas Arneberth	First version
B	Feb 2017	Sanna Severinsson	Ultimate test has been removed affecting chapter 1 and test sequence 3.1, 3.2, 3.3; Excel-file Pallet test guide updated; 2.1, text updated; 2.2 added info regarding Pallet Design Guideline; 2.3, performance template moved from chapter 4 to 2.3; Performance template updated with Pass/Fail criteria for all chapters.
C	Jun 2020	Piers Byford	Added that safety factor 2 also applies to forklift test
D	Dec 2020	Piers Byford	Updated revision history; minor text changes; changed number of impacts in block test from 2 to 1