Window requirements for forestry machines

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Basic requirements for machine

- Machine directive 2006/42/EC
- ISO 11850 Machinery for forestry – Self-propelled machinery – Safety requirements (EN 14861)
- ISO 8083 Machinery for forestry – Falling-object protective structures
- ISO 8084 Machinery for forestry – Operator protective structures
- ISO 10263-5 Earth moving machinery – Operator enclosure environment – Part 5: Windscreens defrosting system test method
- Forest machines are not under Tractor directive
  => Road requirements for windows varies

=> PROBLEMS
Why Road requirements is needed?

- Some countries forest machines are driven on road to transfer different working sites
- Specially done in Germany, Sweden, Austria, France and Finland
- Long distance transports are done with trailer
- Sometimes registration is needed for insurance reasons or for bank loan

- Current approvals for 12 mm clear polycarbonate:
  - ANSI 26.1 Z (AS 4)
  - Germany national approval (~D –number)
TOTAL: 345 mill. m³

North America: 56,9
Norway: 7,7
Netherlands: 0,7
Belgium: 3,6
UK: 7,4
Ire: 2,4
France: 36,3
Spain: 13,3
Portugal: 10,7
Sweden: 56,9
Finland: 47,7

EUROPE:

Germany: 36,5
Czech: 13,3
Slovakia: 5,0
Hungary: 3,5
Romania: 9,8
Bulgaria: 2,3
Greece: 0,8

Croatia: 2,7
Serbia and Montenegro: 1,2
Bosnia and Herzegovina: 3,0
Slovenia: 2,0

Estonia: 8,3
Latvia: 11,3
Lithuania: 4,1
Belarus: 5,3
Poland: 23,6
Ukraine: 5,8
Forestry Products

Manufactured in Joensuu, Finland

- 643K Wheeled Feller Buncher
  - 141 kW (189 net hp)

- 843K Wheeled Feller Buncher
  - 181 kW (243 net hp)

- 540G-III Cable Skidder
  - 96 kW (129 SAE gross hp)

- 640H Cable Skidder
  - 128 kW (172 SAE gross hp)

- 548G-III Grapple Skidder
  - 96 kW (129 SAE gross hp)

- 648H Grapple Skidder
  - 128 kW (172 SAE gross hp)

- 748H Grapple Skidder
  - 141 kW (193 SAE gross hp)

- 848H Grapple Skidder
  - 149 kW (200 SAE gross hp)

- 335D Knuckleboom
  - 129 kW (173 hp)

- 437D Knuckleboom
  - 129 kW (173 hp)

- 703JH Tracked Harvester
  - 135 kW (181 hp)

- 753JH Tracked Harvester
  - 180 kW (241 hp)

- 759JH Tracked Harvester
  - 180 kW (241 hp)

- 903K Tracked Harvester
  - 224 kW (300 hp)

- 909K Tracked Harvester
  - 224 kW (300 hp)

- 903K Tracked Harvester
  - 224 kW (300 net peak power)

- 909K Tracked Harvester
  - 224 kW (300 net peak power)

- 953K Tracked Feller Buncher
  - 246 kW (330 net peak power)

- 959K Tracked Feller Buncher
  - 246 kW (330 net peak power)

- 1070E Wheeled Harvester
  - 136 kW (182 hp)

- 1170E Wheeled Harvester
  - 145 kW (194 hp)

- 1270E Wheeled Harvester
  - 170 kW (228 hp)

- 1470E Wheeled Harvester
  - 190 kW (225 hp)

- 810E Forwarder
  - 95 kW (127 hp)

- 1010E Forwarder
  - 115.5 kW (155 hp)

- 1110E Forwarder
  - 136 kW (183 hp)

- 1210E Forwarder
  - 136 kW (183 hp)

- 1510E Forwarder
  - 145 kW (195 hp)

- 1910E Forwarder
  - 186 kW (249 SAE hp)

- 1490D ECO III Energy Wood Harvester
  - 136 kW (182 hp)

- 2154D Swing Machine/Road Builder
  - 125 kW (168 hp)

- 2454D Swing Machine/Road Builder
  - 145 kW (194 hp)

- 2954D Swing Machine/Road Builder
  - 145 kW (194 hp)

- 3754D Swing Machine/Road Builder
  - 220 kW (296 hp)

- 2154D Swing Machine/Processor
  - 125 kW (168 net hp)

- 2454D Swing Machine/Processor
  - 145 kW (194 net hp)

- 2954D Swing Machine/Processor
  - 145 kW (194 net hp)

- 2154D Swing Machine/Delimber
  - 125 kW (168 SAE net hp)

- 2454D Swing Machine/Delimber
  - 145 kW (194 SAE net hp)

- 2154D Swing Machine/Log Loader
  - 125 kW (168 hp)

- 2454D Swing Machine/Log Loader
  - 145 kW (194 hp)

- 2954D Swing Machine/Log Loader
  - 145 kW (194 hp)

- 3754D Swing Machine/Log Loader
  - 220 kW (296 hp)

- 753J Tracked Feller Buncher
  - 180 kW (241 hp)

- 759J Tracked Feller Buncher
  - 180 kW (241 hp)
Wheeled Harvesters

770D
1070E
1170E
1270E
1470E
LET’S TAKE A LOOK…
Forwarders

810E
1010E
1110E
1210E
1510E
1910E
SOME VIDEO...
4.3 Procedure

4.3.1 Slowly apply the force (5 mm/s max., to approximate static loading) from the test object normal to the exterior surface under test until this applied force attains a value of 17 800 N. Sustain the force at this value for 1 min before releasing it.

4.3.2 In the case of open-mesh material, apply the loading such that the projection of the line of force passes through the centre of the mesh opening.

5.1 Test acceptance

When the test is performed anywhere on the OPS, the DLV, in accordance with ISO 3164, shall not be entered by any part of the OPS or the test object, and the major diameter of the test object shall not pass through the surface under test.

Frontscheibe (front window)

Belastung der Scheibenmitte bei Testende (loading of the centre at end of test)
Window protection against logs #1
Window protection against logs #2

Curve is following the wiper metal body scratch
Window protection against logs #3
Window protection against logs #4
4.3 Test procedure

4.3.3 Raise the drop test object vertically to a height above the position indicated in 4.3.1 and 4.3.2 to develop an energy of 5,800 J or 11,600 J based on the mass of an object shaped as shown in figure 1. Two energy levels are given: national authorities may choose the level of requirement according to local conditions such as log size, etc. The drop test object shall be aimed to impact at a location on the FOPS to produce the maximum deflection.

5.1 Protective properties

The protective properties of the FOPS system shall be estimated by the ability of the cabin or protective structure to retain its safety zone intact after the impact. The DLV as defined in 3.2 and specified in 4.2.1 shall not be entered by any part of the protective structure under the first or subsequent impact of the drop test object. If the drop test object penetrates the DLV, the FOPS shall be deemed to have failed.

Nach dem Auftreffen des Fallkörpers auf das FOPS-Gitter- Ansicht von der Unterseite
(After the drop of the falling object on the FOPS-grid – view from down side)
Riffle bullet?

It is a deere, for sure?
Other risks like broken chain

What is chain shot

Chain does break during sawing
1-3 chain links loose and fly
Even 450 m/s speed measured
Link/object rotation speed even 400.000 rpm,
one piece
58 000 – 200 000 rpm if more than one chain
98 % of chain shots do not hit cabin
Risk for operator and other persons outside
cabin
Piece of chain, no full penetration (12 mm)
Old 12 mm polycarbonate

4 + 4 mm laminated standard, preferred optics
Problems with polycarbonate (12 mm)

- All broken glasses have had different structure than OPS tests
- Scratches from metal wipers parts
- Deeper scratches than hard coating => certain washing liquids have been harmful for carbonate (currently not recognized as a problem)
- Stone impacts not really but … other hard particles
- Polishing is not acceptable (hair type scratches)
- Earlier some problems with gluing and coating
- Optics
- Noise?
- Direct sun heat (IR-radiation)
- Poor heat transfer (de-frosting time)
- Secondary exit is needed (carbonate won’t break)!
- Cabin fire, increased burning material in case of cabin fire

BUT

=> ONLY MATERIAL WHICH IS ACCEPTED FOR FOREST APPLICATIONS