

NEBRASKA TRACTOR TESTING LABORATORY DEPARTMENT OF BIOLOGICAL SYSTEMS ENGINEERING INSTITUTE OF AGRICULTURAL AND NATURAL RESOURCES UNIVERSITY OF NEBRASKA - EAST CAMPUS LINCOLN, NEBRASKA 68583-0832, USA

OECD APPROVAL NUMBERS: 4/1 960 APPROVAL DATE: 14 January 2020

REPORT IN ACCORDANCE WITH OECD STANDARD CODE 4

__

JOHN DEERE CAB MODEL CG131

STATIC TEST



FOR TRACTOR MODELS:

JOHN DEERE 8R 230, 8R 250, 8R 280, 8R 310, 8R 340, 8R 370, 8R 410, 8R-3904, 8R-3704, 8R-3504, 8R-3404, 8R-3204, 8R-3004, 8R-2704, 8R-2504, and 8R-2304 AGRICULTURAL TRACTORS

Manufactured by:	Deere & Co. 3500 East Donald Street, Waterloo, IA, USA
Test Date:	06 Aug 2019
Test Location:	John Deere Product Engineering Center
	6725 Cedar Heights Dr., Waterloo, Iowa, USA.
Nebraska Test No.:	1903
Supervised by:	Mr. Justin Geyer – Nebraska Tractor Testing Laboratory
	Lincoln, Nebraska, USA

This test report provides the results of tests conducted in accordance with the OECD Standard Test Codes for the official Testing of Roll-Over Protective Structures mounted on Agricultural Tractors (STATIC TEST) - Code 4.

The CG131 protective structure will be used on the 8R 230, 8R 250, 8R 280, 8R 310, 8R 340, 8R 370, 8R 410, 8R-3904, 8R-3704, 8R-3504, 8R-3404, 8R-3204, 8R-3004, 8R-2704, 8R-2504, and 8R-2304 models for series production. The structure is identical for all tractor models. The mounting to the vehicle chassis frame is also identical for all models.

Rum. Hy

Dr. Roger M. Hoy, Director Nebraska Tractor Test Laboratory

netin

Justin Geyer, Test Engineer Nebraska Tractor Test Laboratory

Date: 31 January 2020

Name & address of manufacturer of the protective structure:	Deere & Co. John Deere Tractor and Cab Assembly Operations 3500 East Donald Street Waterloo, IA, 50704
Submitted for test by:	The manufacturer
Make / Model / Type of Protective Body Structure:	John Deere / CG131 /Cab with integrated frame
Make / Model / Type of Tractor to which is it fitted:	John Deere / 8R 230, 8R 250, 8R 280, 8R 310, 8R 340, 8R 370, 8R 410, 8R-3904, 8R-3704, 8R-3504, 8R-3404, 8R-3204, 8R-3004, 8R-2704, 8R-2504, and 8R-2304 Wheeled Tractors
Date and Location of tests and Code version:	06 Aug 2019 under Nebraska Tractor Test Laboratory supervision at John Deere Product Engineering Center, Waterloo Iowa, USA. OECD Code 4 – February 2019

1 SPECIFICATION OF TEST TRACTOR (CHASSIS)

1.1 Identification of tractor to which the protective structure is fitted for the test None. Test performed on tractor chassis

1.1.1	- Make of tractor:	John Deere
	- Models:	Test performed on tractor chassis identical for the tractor models listed
		in 3.4
	- Type	4WD
1.1.2	Numbers	prototype

1.2 Mass of unballasted tractor with protective structure and without driver:

		Front Rear Total	8,016 kg 8,842 kg 16,858 kg
-	Maximum permissible mass of tractor	es:	20,000 kg
-	Mass used for calculating energies and crushing force		16,900 kg
-	Mass Ratio Value		1.18

1.3 Minimum track and tire sizes

	Minimum track	Tire sizes	Tire Pressure
Front	1524 mm	290/90R38	4 bar
Rear	1524 mm	480/80R46	4 bar

1.4 Tractor seat

- Tractor does not have a reversible driver's position
- Make/Model/Type of Seat 1: SE06 Select Seat; This seat is manufactured by Faurecia with air suspension with the SIP located 520 mm forward and 1302 mm above the rear axle center line, in the median plane of the cab and tractor.
- Make/Model/Type of Seat 2: SE06 Premium Seat. This seat is manufactured by Faurecia air suspension with the SIP located 520 mm forward and 1302 mm above the rear axle center line, in the median plane of the cab and tractor.
- Make/Model/Type of Seat 3: SE06 Ultimate Seat; This seat is manufactured by Faurecia with air suspension with the SIP located 520 mm forward and 1309 mm above the rear axle center line, in the median plane of the cab and tractor.
- Make/Model/Type of Seat 4: SE07 Premium Seat; This seat is manufactured by Faurecia. The suspension is a suspension which incorporates an electric motor to adjust damping in response to the vehicle inputs. The SIP is located 520 mm forward and 1302 mm above the rear axle center line, in the median plane of the cab and tractor.
- Make/Model/Type of Seat 5: SE07 Ultimate Seat. This seat is manufactured by Faurecia. The suspension is a suspension which incorporates an electric motor to adjust damping in response to the vehicle inputs. The SIP is located 520 mm forward and 1309 mm above the rear axle center line, in the median plane of the cab and tractor.

-	Seat belt anchorage to seat by supplier:	M12 x 1.75 x 35mm – Class 10.9 hex flange screws
-	Seat mounting on the tractor:	M8 PC10.9 screws (Drawings in Figures on Pages 20-22)
-	Other seat components:	Command Arm control module
-	Seat position in the test:	adjusted full up & full aft, suspension at mid-travel of Seat (most severe position of SIP)
-	Horizontal adjustment	a _h =100 mm rearward, 90 mm forward of nominal
-	Vertical adjustment	av=90 mm upward and downward

ROPS tests were conducted using the SIP from the SE07 Ultimate Seat as this was the worst-case scenario. Anchorage tests were performed on Seat 1 and Seat 5 as these represent the 2 different anchorage load paths for the 5 seats.

Masses used for calculating the loads

Seat 1	Make/Model/Type: Faurecia /SE06 Select Seat
COMPONENTS	MASS (kg)
Driver Seat	68.6
Seat Belt Assembly	0.9
Other Seat Components	10.8
Total	80.3

Seat 2	Make/Model/Type: Faurecia /SE06 Premium Seat
COMPONENTS	MASS (kg)
Driver Seat	68.6
Seat Belt Assembly	0.9
Other Seat Components	10.8
Total	80.3

Seat 3	Make/Model/Type: Faurecia/SE06 Ultimate Seat
COMPONENTS	MASS (kg)
Driver Seat	68.6
Seat Belt Assembly	0.9
Other Seat Components	10.8
Total	80.3

Seat 4 Make/Model/Type: Faurecia /SE07 Premium Seat	
COMPONENTS	MASS (kg)
Driver Seat	76.5
Seat Belt Assembly	0.9
Other Seat Components	10.8
Total	88.2

Seat 5	Make/Model/Type: Faurecia /SE07 Ultimate Seat
COMPONENTS	MASS (kg)
Driver Seat	76.5
Seat Belt Assembly	0.9
Other Seat Components	10.8
Total	88.2

2 SPECIFICATIONS OF PROTECTIVE STRUCTURE

2.1 **Photographs from side and rear** showing mounting details including mudguards



Fig. 1 – Photograph from front/side showing mudguards



Fig. 2 Photographs showing front mountings



Fig. 3 Photographs showing rear mounting

2.2 General arrangement drawing of the side and rear with main interior dimensions



Fig. 4 - Side View of Structure



Fig. 5 - Rear View of Structure



Fig. 6 Showing details of front mounting



Fig. 7 Showing details of rear mounting



Fig. 8 Showing dimensions of mounting



Fig. 9 Rear Mounting Left Hand Dimensions



Fig. 11 Rear Mounting Right Hand Dimensions

2.3 Brief description

The cab/ROPS frame is of welded construction using primarily high-strength low-alloy steels with suitable Charpy V-notch low temperature impact properties. The main upper horizontal members, lower floor supports, and front and rear posts are hollow structural section tubing connected by formed steel plates.

The cab is resiliently mounted to chassis by rubber isolators & property class 10.9 cap screws. Mounting steps are located directly below and forward of the entry doorway on the left side.

There is a full height door on the left-hand side of the cab. The windshield is tempered glass that extends for the full height & width of the cab. The rear window is openable & can also serve as an emergency exit. The cab floor is made of formed steel, the inner roof is polypropylene structural foam and the outer roof is thermal-formed ABS plastic. The portion of the cab interior that isn't glass is trimmed with fabric-covered acoustical foam, and the floor is covered with a rubber floormat.

There is no additional frame.

2.4 Tiltable or not tiltable/Folding or not folding structure

Cab is neither tiltable nor foldable.

2.5	DIMENSIONS	mm
2.5.1	Height of roof members above SIP 1: SIP 2:	968 961
2.5.2	Height of roof members above tractor footplate	1527
2.5.3	Interior width of protective structure $(810 + A_v)$ mm above SIP $(A_v = 90mm)$ SIP 1: SIP 2:	1525 1524
2.5.4	Interior width of protective structure above the SIP at the level of the center of the steering wheel	1525
2.5.5	Distance from the center of the steering wheel to the right side of the protective structure	763
2.5.6	Distance from the center of the steering wheel to the left side of the protective structure	763
2.5.7	Minimum distance from the steering wheel rim to the protective structure Basic Steering Wheel ACS Steering Sheel	693 718
2.5.8	Horizontal distance from the SIP to the rear of the protective structure at a height of 810 + 90 mm above SIP 1: SIP 2:	443 442
2.5.9	Front part of tractor capable of supporting	N.A.

SIP 1 – Select Passive Seat, Premium Passive Seat and Premium Active Seat

SIP 2 – Ultimate Passive Seat and Ultimate Active Seat

2.6 DETAILS OF MATERIALS USED IN THE CONSTRUCTION OF THE PROTECTIVE STRUCTURE AND SPECIFICATION OF STEELS USED – Steel specifications are in

conformity with ISO630:1995; Amd1:2003. All materials tested at -30 C

2.6.1 Main frame

	Bill of Material for Cab Structure (see Main Frame Figure Above)							
					Material Notes			
Pos.	No.	Material Standard	Material	Dimensions (mm)	(Charpy Impact Energy)			
1	1	EN 10027	S345	Sheet 2	17.5J min			
2	1	EN 10027	S345	Sheet 2	17.5J min			
3	1	EN 10027	S345	Sheet 3	17.5J min			
4	1	EN 10027	S345	Sheet 3	17.5J min			
5	1	EN 10027	S355	Sheet 3	17.5J min			
6	1	EN 10027	S690	Plate 8	17.5J min			
7	1	EN 10027	S690	Plate 8	17.5J min			
8	2	EN 10027	S600	Regular Tube 75 x 75 x 6	27J min			
9	1	EN 10027	S345	Sheet 6.3	17.5J min			
10	1	EN 10027	S345	Sheet 6.3	17.5J min			
11	2	EN 10027	S690	Sheet 8	17.5J min			
12	2	EN 10027	S600	Regular Tube 75 x 75 x 6	27J min			
13	1	EN 10027	S345	Sheet 6.3	17.5J min			
14	4	EN 10027	S345	Sheet 6.3	17.5J min			
15	1	EN 10027	S345	Sheet 6.3	17.5J min			
16	2	EN 10027	S600	Regular Tube 75 x 75 x 6	27J min			
17	1	EN 10027	S345	Sheet 6.3	9.5J min			
18	1	EN 10027	S345	Sheet 6.3	27J min			
19	1	EN 10027	S600	Regular Tube 75 x 75 x 6	27J min			
20	1	EN 10027	S600	Regular Tube 75 x 75 x 6	27J min			
21	1	EN 10027	S345	Plate 8	27J min			
22	1	EN 10027	S345	Plate 8	27J min			
23	2	EN 10027	S345	Plate 8	27J min			
24	1	EN 10027	S345	Sheet 3	27J min			
25	1	EN 10027	S345	Sheet 3	27J min			
26	2	EN 10027	S345	Regular Tube 75 x 125 x 6	27J min			
27	1	EN 10027	S345	Regular Tube 75 x 125 x 6	27J min			
28	1	EN 10027	S160	Sheet 3	11J min			
29	1	EN 10027	S160	Sheet 3	11J min			
30	1	EN 10027	S690	Plate 8	17.5J min			
31	2	EN 10027	S690	Plate 8	17.5J min			
32	2	EN 10027	S345	Plate 35.2	27J min			
33	2	EN 10027	S345	Plate 35.2	27J min			
Char	bv V-N	Notch Impact Strend	oth at -30 (C per ASTM A370 on a longitud	inal Specimen			

2.6.2 Mountings

	Bill of Material for Cab Structure (see Main Frame Figure Above)							
					Material Notes			
Pos.	No.	Material Standard	Material	Dimensions (mm)	(Charpy Impact Energy)			
32	2	EN 10027	S345	Plate 35.2	27J min			
33	2	EN 10027	S345	Plate 35.2	27J min			
35	2	ISO 4162	10.9	Bolt M30x140				
				Steel Bushing Over Molded with				
				Elastomer for Noise and				
36	4	ASTM D2000		Vibration Isolation				
37	4	EN 10027	S355	Plate 9	17.5J min			
38	2	EN 10027	S355	Sheet 12.7	17.5J min			
39	8	ISO 4162	10.9	Bolt M20 x 55				
40	8	EN 10027	S355	Sheet 5	17.5J min			
41	1	EN 10027	S355	Plate 14.27	27J min			
42	1	EN 10027	S355	Sheet 9.53	27J min			
43	2	EN 10027	S355	Plate 32	27J min			
54	2	ISO 4162	10.9	Bolt M30x140				
Char	py V-N	Notch Impact Streng	gth at -30 C	C per ASTM A370 on a longitudina	I Specimen			

- 2.6.3 Assembly and mounting bolts: M30-3.5 ISO property class 10.9, anti-corrosion coated, 140mm long at both the front and rear mounts. These bolts thread directly into the plates welded to the bottom of the cab, items 32 and 33 in the BOM. The ROPS-retention washers that carry the ROPS forces to the rear cab support and front chassis frame are 9mm thick steel of EN 10027 Grade S355, except with more restrictive chemistry, is killed, exceeds its requirements for low-temperature notch toughness, and is somewhat lower in % elongation. The screws that fasten the rear cab support to the chassis are M20 x 55, ISO property class 10.9, anti-corrosion coated. These screws thread directly into the cast axle housings. There are no nuts in the cab mounting system.
- 2.6.4 Roof: 3.3mm thick thermoformed Sheet Molding Compound (SMC) with glass reinforcement.
- 2.6.5 Cladding: Inner fender panels 3mm CR sheet steel, with guaranteed 27J. Charpy V-notch energy @ -30 C.
- 2.6.6 Glass: Doors & windows are 6mm tinted tempered safety float glass; windshield is 5mm tinted/tempered

2.7 DETAILS OF TRACTOR MANUFACTURER'S REINFORCEMENTS ON ORIGINAL PARTS – No reinforcement was done.

3 TEST RESULTS

3.1 Static loading and crushing tests

3.1.1 Condition of tests – Static loading tests were made to the right rear corner & left hand side of the cab. The reference mass used for loading energies & crushing forces was 16,900 kg.

Energies and forces applied:

	Required	<u>Applied</u>
Loading from right-rear:	23.7 kJ	24.76 kJ
Side loading from left:	29.6 kJ	32.23 kJ
Crushing force at front:	338.0 kN	338.47 kN
Crushing force at rear:	338.0 kN	338.49 kN

3.1.2 Permanent deflections measured after the tests

3.1.2.1 Permanent deflections of the extremities of the protective structure measured after the series of tests:

- Rear forward	Left side: Right side:	51 mm 76 mm
- Front forward	Left side: Right side:	55 mm 76 mm
- Sideways to the right	Front: Rear:	76 mm 85 mm
-Top	Rear left side: Rear right side: Front left side: Front right side:	19 mm upward 27 mm downward 2 mm upward 8 mm downward

3.1.2.2 Difference between total instantaneous deflection and residual Deflection during sideways loading test (elastic deflection): 200.3 mm

Statement: The acceptance conditions of these tests relative to the protection of the zone of clearance are fulfilled. The structure is a roll-over protective structure in accordance with the Code.

3.2 Cold weather performance (resistance to brittle fracture)

The method used to identify resistance to brittle fracture is to test every heat of steel used. Reference Section 2.6.1.

3.3 Anchorage performance

3.3.1 Loading in the forward and upward direction

Seat 1	Make/Model/Type: Faurecia/SE06 Select Seat				
GRAVITY FORCE	REQUIRED FORCE	APPLIED FORCE (N)			
(Fg = Seat Mass x 9.81) (N)	(4450 + 4Fg) (N)				
787.7	7601.0	7738.2			

Seat 5	Make/Model/Type: Faurecia/SE07 Ultimate Seat			
GRAVITY FORCE	REQUIRED FORCE	APPLIED FORCE (N)		
(Fg = Seat Mass x 9.81) (N)	(4450 + 4Fg) (N)			
865.2	7911.0	8173.3		

3.3.2 Loading in the rearward and upward direction

Seat 1	Make/Model/Type: Faurecia/ SE06 Select Seat				
GRAVITY FORCE	REQUIRED FORCE	APPLIED FORCE (N)			
(Fg = Seat Mass x 9.81) (N)	(2225 + 2Fg) (N)				
787.7	3800.5	4361.1			

Seat 5	Make/Model/Type: Faurecia/SE07 Ultimate Seat				
GRAVITY FORCE	REQUIRED FORCE	APPLIED FORCE (N)			
(Fg = Seat Mass x 9.81) (N)	(2225 + 2Fg) (N)				
865.2	3955.5	4308.4			

3.3.3 Curves and photos

Seat 1 Forward Seatbelt Anchorage Pull

Seat 2 Forward Seatbelt Anchorage Pull

Photograph showing one of the forward pull tests

Seat 1 Rearward Seatbelt Anchorage Pull

Seat 5 Rearward Seatbelt Anchorage Pull

Photograph showing one of the rearward pull tests

Seat in ROPS Frame

Hardware Details (see	table)
-----------------------	--------

	Bill Of Material for Cab Structure (see Main Frame Figure Above)							
Pos.	No.	Material Standard	Material	Dimensions (mm)	Notes			
1	4	ISO 898-1	10.9	Bolt M8 x 25				
21	1	EN 10027	S355	Sheet 4				
2 ²	1	Aluminum	115	Casting 7				
3	1	EN 10027	S355	Sheet 3				
4	1	ISO 898-2	10.9	M8 Steel Clip Nut				
5	5	ISO 898-1	10.9	Bolt M8 x 25				
6	1	EN 10027	S355	Sheet 2.55				
7	1	ISO 898-2	10.9	M8 Nut				

Notes: 1 – Seat 1, 2 – Seat 5

Seat Support Mounting Locations

The tests were carried out in the most severe condition for each representative seat.

Statement:

During the test, no structural failure or release of seat, seat adjuster mechanism or other locking service occurred. The seat and safety belt anchorage tested fulfill the requirement of the OECD procedure.

3.4 Tractors to which protective structure is fitted:

OECD Approval Number: 4/1 960									
Make	Model	Туре	Mass (kg)			Tiltable	Wheel-base	Minimum Track	
			Front	Rear	Total			Front	Rear
			kg	kg	kg	Yes / No	mm	mm	mm
John Deere	8R 230	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 230	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 250	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 250	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 280	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 280	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 310	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 310	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 340	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 340	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 370	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 370	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R 410	4WD	8016	8842	16858	No	3050 ¹	1524	1524
John Deere	8R 410	4WD	8016	8842	16858	No	3080 ²	1524	1524
John Deere	8R-3904	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-3704	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-3504	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-3404	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-3204	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-3004	4WD	6268	7140	13408	No	3050	1524	1524
John Deere	8R-2704	4WD	6290	7058	13348	No	3050	1524	1524
John Deere	8R-2504	4WD	5228	7654	12882	No	3080	1524	1524
John Deere	8R-2304	4WD	5228	7654	12882	No	3080	1524	1524

¹ with Independent Link Suspension or Heavy-duty MFWD

² with standard MFWD