Ente Nazionale Meccanizzazione Agricola

ENTAM
European Network for Testing of Agricultural Machines

AGRICULTURAL MACHINERY FUNCTIONAL AND SAFETY TESTING SERVICE

TEST REPORT No. 41 - 004

TRACTOR TYRES:
BKT AGRIMAX RT 657

MANUFACTURER: BALKRISHNA TYRES (BKT)
421/422, "Creative", 72 N. M. Joshi Marg, Mumbai 400011, India

Rome, November 2006

This report has been made by ENAMA under its responsibility

TESTS CARRIED OUT IN COMPLIANCE WITH ENAMA SPECIFICATIONS NO. 41 AT THE CRA-ISMA, EXPERIMENTAL INSTITUTE FOR FARM MECHANISATION, TREVIGLIO SECTION (BG):

Supervisor	Dr. Carlo Bisaglia	(CRA-ISMA - Treviglio)
Test engineers	Dr. Elio Romano	(CRA-ISMA - Treviglio)
	p.a. Gianluigi Rozzoni	(CRA-ISMA - Treviglio)

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TO FACILITATE THE INTERPRETATION OF THE RESULTS, IT SHOULD BE REMEMBERED THAT:

- MPa = 1000 kPa = 10 bar ≈ 10 kg_{force}/cm^2
- 1 daN ≈ 1.02 kg_{force}
- kW = 1.36 HP
- 1 m/s = 3.6 km/h

Manufacturer: BKT Europe S.r.l.

Tel+39 039330031 – Fax. +39 0393300328
email: info@bkt-tires.com – internet: www.bkt-tires.com

TECHNICAL DATA

MODEL	BKT Agrimax RT 657
axle position	rear
PROPERTIES	
	for tractors
	for traction wheels
	radial
	open centre
MEASUREMENTS	
tyre size designation	540/65 R28
rim	DW 16 L
diameter (mm)	711.2
actual width of rim (mm)	406.4
service characteristic	
load index	152
speed category symbol	D
identification dimensional data	
loaded radius (mm)	651
section width (mm)	550
section height (mm)	365.4
actual aspect ratio (%)	66.0
overall diameter (mm)	1442
keying diameters (mm)	711.2
TREAD BARS	
number	19
height at tread centre (mm)	53
tread angle (°) (with respect to the longitudinal vertical axis of the tyre)	42
thickness halfway up (mm)	46
thickness at top (mm) (25 mm from top)	45
HARDENING OF CARCASS	
on sides	no
between lugs	no

DESCRIPTION OF TYRES

The BKT Agrimax RT 657 tyres are radial and tubeless, and are designed for medium- to high-powered tractors. The tyre tread has been designed to meet traction and weight distribution needs in the field and to ensure comfort and safety on the road even at high speeds. They can be used on both axles of the tractor.

TEST CONDITIONS

The pairs of tyres under review underwent testing at the Istituto Sperimentale per la Meccanizzazione Agricola of Treviglio in October and November 2006. The pair of tyres being tested came from normal production, and appropriate controls showed a manufacturing tolerance not exceeding design tolerance. The tyres were mounted on the type of standard rim recommended by the manufacturer. The same pair of tyres was used for all tests. The results obtained on the tested tyres are deemed to be valid for models having the same service characteristic.

The pair of tyres underwent the necessary tests according to a precise sequential order.

After each test the state of the two tyres was observed and recorded, paying special attention to permanent deformations, cuts, scratches and loss of pressure.

No maintenance was performed during testing.

The air temperature at which tests were performed was between 8° and 13°C.

Dimensional measurements were taken after a period of 24 hours in which the tyres were kept in a room at normal air temperature, with the tyre unloaded, mounted on a standard rim, after having checked and, if necessary, adjusted pressure to the value recommended by the manufacturer.

TEST PROCEDURES

Laboratory and field tests were carried out in accordance with the order, procedures and conditions indicated below.

The results of tests are given in the test report.

Laboratory tests

Load-displacement curves and contact areas on rigid surface

Three different tyre pressure values were considered:

- a reference value recommended by the manufacturer (240 kPa);
- two values, lower than the reference value (80 kPa and 160 kPa), representing different working conditions.

The following measurements were effected using equipment for testing hydraulic lifts, with the tyres mounted on a standard rim, for each of the above pressure values, on a flat concrete surface:

• the load-displacement curves for the side of the tyre, starting from a minimum load up to a maximum value prescribed by the manufacturer (Figures 1÷3);

• conventional contact areas, also calculating the surface area as load is varied (Fig. 4÷6).

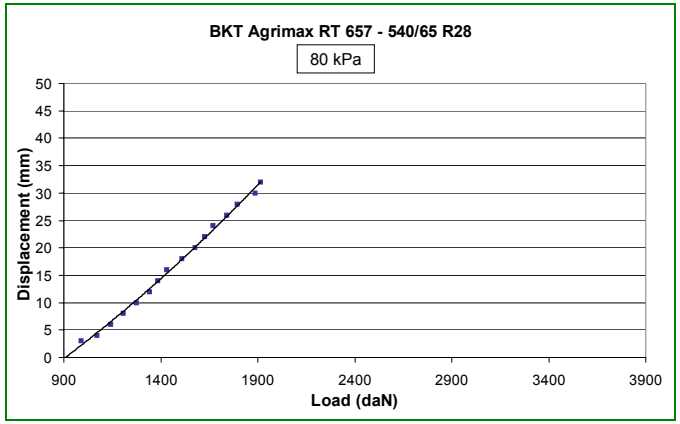

Fig. 1: Ratio between exerted load and displacement of the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 80 kPa.

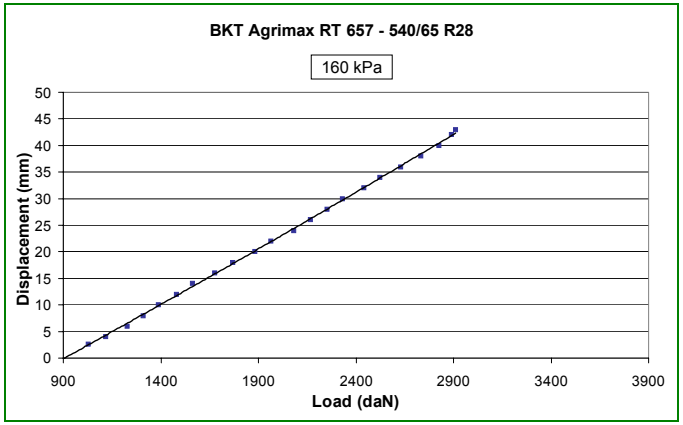

Fig. 2: Ratio between exerted load and displacement of the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 160 kPa.

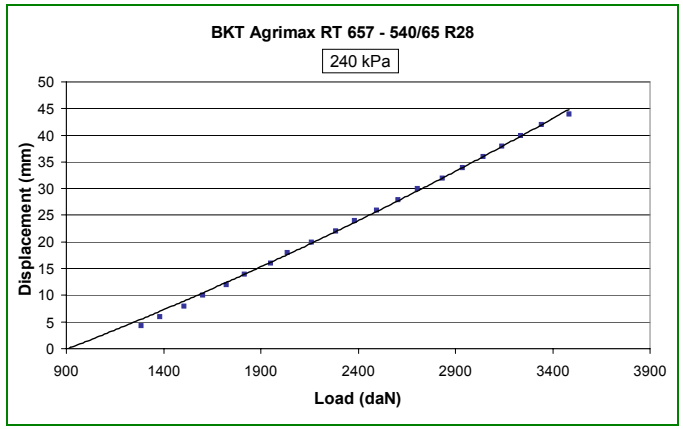

Fig. 3: Ratio between exerted load and displacement of the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 240 kPa.

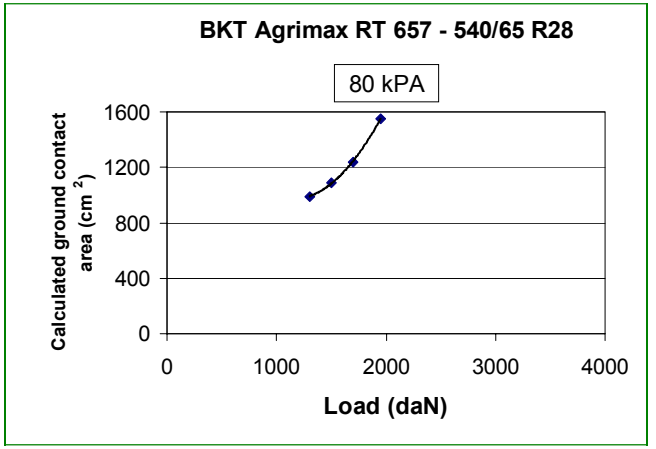

Fig. 4: Ratio between exerted load and calculated area of ground contact for the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 80 kPa.

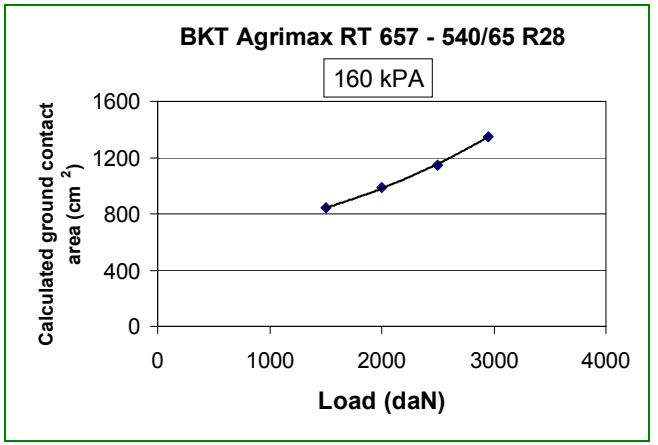

Fig. 5: Ratio between exerted load and calculated area of ground contact for the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 160 kPa.

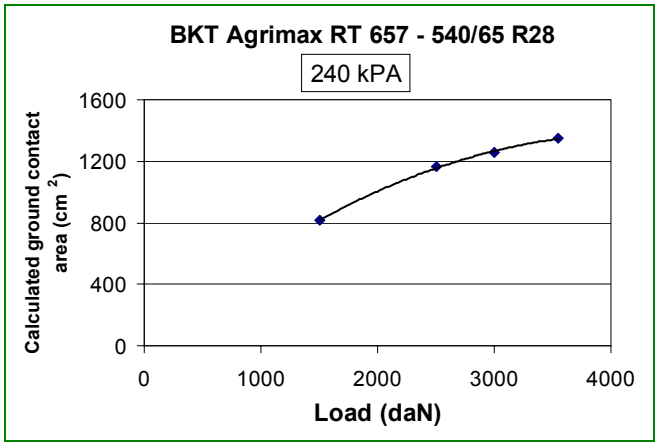

Fig. 6: Ratio between exerted load and calculated area of ground contact for the BKT Agrimax RT 657 tyre, size 540/65 R28 having an inflation pressure of 240 kPa.

Field testing
Testing of tyres for drive wheels on farmland: traction.

Characteristics of terrain

The chosen plot of land was grass covered (natural grass), flat and sufficiently level, alluvial in origin, having the physical and mechanical properties given in Tab. 1. The average moisture content of the worked layer was measured for a depth of about 300 mm.

Table 1 – Physical-mechanical properties of test ground.

cobbles (%)	30
sand (%)	68
silt (%)	24
clay (%)	8
av. moisture content (%)	16
average resistance to penetration (MPa)	0,98

Test procedures

The pairs of tyres mounted on two rims with the standard diameter recommended by the manufacturer were mounted and tested on the rear axle of a 4-wheel-drive tractor, with front-wheel traction disengaged (simple traction) and the differential locking mechanism inserted.
The tractor had a power of 63.2 kW and total mass, including 6 ballast rings having a total weight of 260 kg fixed to the rear rims, of 3,605 kg (rear axle 2,090 kg, front axle 1,515 kg), suitable for the dimensions and service characteristics of the tyres.

The tractor used for the test was chosen from among those officially allowing the mounting of the tyres being tested.
The tyres were tested at an inflation pressure of 160 kPa.

The tractor with the tyres being tested towed a vehicle dynamometer that can vary the tractive effort exerted by the tractor on which the tested tyres are mounted, being careful to ensure that the boom linking the tractor to the brake-van was set horizontally (height of hook from ground: 555 mm).
The test on farmland was repeated by selecting, in sequence, the gears that allowed a nominal forward speed closest to 3, 6 and 9 km/h, for an engine RPM corresponding to that of maximum power (2,350 rpm).

For each of the operating situations thus defined, tractive effort and consequent wheel slip were measured, respecting the following conditions:
- calculation of the average tractive effort (daN) for each measurement, based on straight lines of 50 m, travelled in a reasonably stable traction situation;
- measurements repeated with different wheel slip and tractive effort values, so as to cover the 0-40% wheel slip interval; each repetition showed differences not below 2% and not above 10% of the previous and the next measurement.
Results are given in a graph, with the tractive effort (y axis) related to wheel slip (x axis). (Fig. 7).

Track testing
Testing of tyres for drive wheels on

track: traction.

Simple traction performance was measured on a concrete surface under the same ballasting, tyre pressure and tractor regulation conditions as those described in the paragraph above.

Properties of the track

The pairs of tyres under review underwent traction tests on one of the tracks present at the Istituto Sperimentale per la Meccanizzazione Agricola of Treviglio. The track is made of concrete, is flat and rigid, with an adhesion coefficient close to 1. The track was dry when tests were performed, and had been cleaned of dust, sand and gravel, using a suitable turbo blower.

The track tests were repeated by selecting, in sequence, the gear that allowed a nominal forward speed closest to 5 and 10 km/h, for an engine RPM corresponding to that of maximum power.
The results are given in Fig. 8.
Figures 9 and 10 illustrate the conditions under which the above traction tests on grass and on track were performed.

COMPLIANCE

The manufacturer declared that the characteristics and working parameters of the tyres it produces belonging to the model being tested for certification conform to those of the tested models.

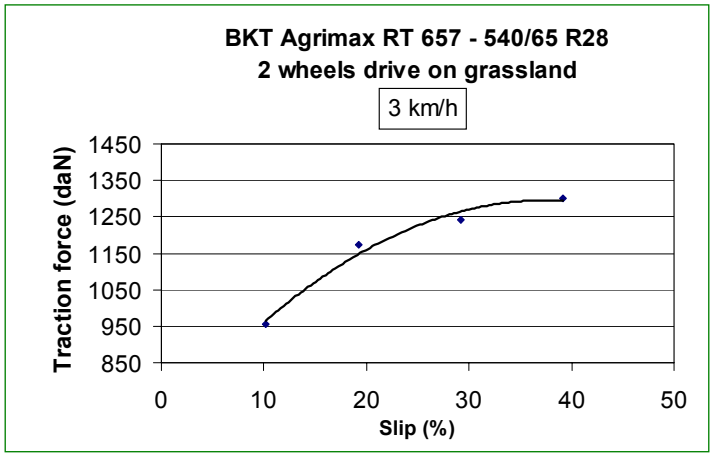

Fig. 7: Simple traction tests on grass with the BKT Agrimax RT 657 tyres mounted on the rear axle of a tractor.

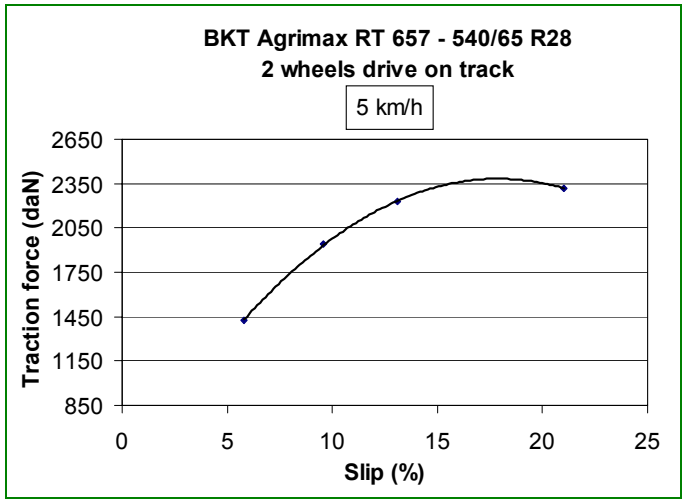

Fig. 8: Simple traction tests on a concrete track with the BKT Agrimax RT 657 tyres mounted on the rear axle of a tractor.

Fig. 9: Tractor equipped with BKT Agrimax RT 657 tyres during traction tests on grassland.

Fig. 10: Tractor equipped with BKT Agrimax RT 657 tyres during traction tests on a concrete track.

THE PRESENT TEST REPORT IS VALID UNTIL REFERENCE REGULATIONS CHANGE FOR THE AGRIMAX RT 657 TYRES, MANUFACTURER: BKT.

THE PRESENT TEST REPORT IS OFFICIALLY RECOGNISED BY THE FOLLOWING ENTAM MEMBERS WITH THEIR RELATIVE RECOGNITION NUMBERS:

ENTAM is the European Network for Testing of Agricultural Machines and its purpose is to promote a cooperation among testing stations in order to optimize activities and give a better service to farmers, dealers and manufacturers.

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ENAMA
ENTE NAZIONALE PER LA MECCANIZZAZIONE AGRICOLA
(Italian Agricultural Mechanisation Body)
VIA VENAFRO, 5 – 00159 – ROMA
TEL. 06/40860030-40860027 FAX: 06/4076264
email: info@enama.it **http://**www.enama.it

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