

The machines in the test:

- Bobcat E85
- CAT 308E2 CR SB
- ECM ES85 SB4
- JCB 90Z-1
- Komatsu PC80MR-5
- Kubota KX080-4a
- Takeuchi TB280FR
- Wacker Neuson EZ80

The test operators: Juha Arminen, Hannu Jantunen, Camilla Kuivalainen, Tuomo Nurminen, Mikael Sammatti, Arto Turpeinen

Technical support: Jyrki Karkinen, Timo Rintakoski

Images: Jussi Laukkanen, Arto Turpeinen

Graphic: Jukka-Pekka Lindbäck

Comparison of tracked excavators below 10 tonnes weight

EIGHT EIGHT-TONNERS

Urbanisation and underground cabling have increased the need for compact and powerful machines. For example, reduced tail excavators weighing eight tonnes are suitable for many different application areas. Koneviesti has tested eight machines of this size class.

■ Arto Turpeinen

This year, the machines of the Finnish construction machinery class KKH 08 were selected for the traditional construction machinery comparison, that is, all tracked excavators weighing less than 9 tonnes. These are also called eight-tonners on construction sites in Finland.

Construction machines of this class are generally used in earth cabling or landscaping. Modern 8-tonne machines not only offer practicality but also power and range for work that used to require the use of heavier construction machines.

All importers in Finland were invited. In the test invitation, we asked for all construction machines to be fitted with a reduced tail and rubber tracks. There were eight construction machines in the comparison; this represents a comprehensive sample of the models sold in Finland. Unfortunately, not all potential candidates could participate in the comparison this time. Reasons for this included the lack of a suitable demonstration machine and the recent release of a new model.

The healthy business situation in civil engineering as well as the tightening of sales figures for construction machines meant that, surprisingly, some brands had no new demonstration machine.

Nevertheless, the importers of CAT, ECM and JCB showed great enthusiasm as they brought rented construction machines to the test almost directly from the construction site. The construction machines had the following operating hours: CAT - 762, ECM - 300 and JCB - 1063.

Differences in outfitting

There were some differences in the outfitting of the construction machines tested. Instead of rubber tracks, the Caterpillar and ECM machines had rubber-padded steel tracks and the Komatsu machine had so-called Roadliner pads, where the rubber base plates are attached directly to the track conveyor. The boom of the ECM machine was fixed (the model fixed next to the cab), while the other machines had a swivel joint on the boom that could be tilted forward from the revolving superstructure.

Today, there are hardly any machines with standard outfitting, rather, machines are adjusted to the customer's wishes in the purchase order. Of course, this poses a challenge when it comes to making comparisons.

If the outfitting of a machine affects the test operator points or the measurement results, this is indicated in the presentation of the results.

Koneviesti carried out its last comparison in the eight-tonner category in 2008. For example, ten years ago, tilt rotators were not as common as they are today, so some machines only had swivelling buckets. The level of outfitting and working comfort have also improved significantly in this decade.

Measurements and assessments

This time, the test took a good week, during which we performed a wide range of different performance efficiency measurements. After diligently acquainting themselves with the machines, the test operators and Koneviesti employees evaluated the operating characteristics of the machines. Among other things, the subject of analysis was the factors which have an impact on user-friendliness, working comfort and performance efficiency.

The test operators filled in a 37-point assessment sheet based on their findings during the test; the different characteristics were evaluated on a scale of 1-5. When calculating the total point score, the different areas of the questionnaire were multiplied by factors of 1-3, depending on the weighting of the area.

For example, the hydraulic control system, working ergonomics and serviceability of the machine were given a weighting factor of 3. In contrast, less important features such as the storage space in the operator's cab, the ease of keeping the cabin clean and the appearance of the machine were given a weighting factor of 1.

We also used weighting factors in the technical measurements, among which fuel consumption, power values and sound level were tested, among others. A completely new element of the comparison was the testing of air-conditioning system performance.

Weighted properties included the accuracy of the hydraulics, the external dimensions and the stability of the machine. The theoretical maximum score was 1,000 points, 600 of which were test operator points and 400 of which were technical points.

The test operators, **Juha Arminen, Hannu Jantunen, Camilla Kuivalainen** and **Tuomo Nurminen** evaluated the machines in practical work assignment and awarded points based on their own experience. By using multiple test operators, we have ensured that the result is as unbiased as possible.

In the course of the comparison, the differences between the machines, both positive and negative, became clear. The work could be carried out with all test machines, but some clear differences were visible, for example, in terms of serviceability and working comfort. ■

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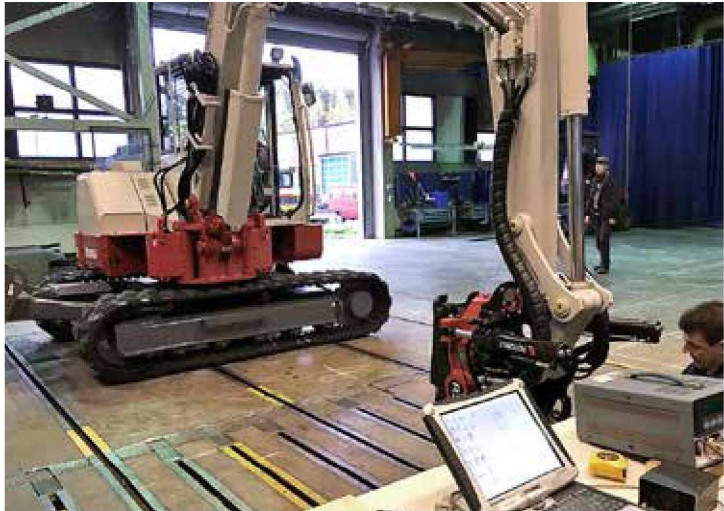
Dimensions and measurements

■ Arto Turpeinen

A whole series of performance efficiency measurements was carried out on the test machines. Eurofins Expert Services Oy (formerly ATT Expert Services Oy), which performs various certification and audit services, measured the lift capacities and tipping loads. In addition, Eurofins measured the size of the lines-of-sight and the performance of the air-conditioning systems of the machines. With our own machines from Konevlehti, for example, we measured the dipper stick power and swing power of the revolving superstructure. We also performed the sound level and fuel consumption measurements ourselves.

Scattering at operating weight

All machines that took part in the test are in the KKH 08 class of the Finnish classification system, which means that the weight in this group should have been less than nine tonnes. When completely fitted out and ready for operation, however, only three of the machines remained below this weight limit when weighed.



↑ The tipping loads and lift capacities were measured by Eurofins Expert Services Oy. The measuring distance was 4.5 metres. There was even a difference of one metre in the range of the machines. The measurements were carried out without a bucket.

The tail swing was also taken into account in the awarding of points, because the test invitation expressly asked for reduced tail excavators. From the edge of the chain to the side, two machines had a genuine "zero tail" - only the ECM and the JCB could turn without protruding beyond the track width. The tail swing of the Caterpillar was as much as 41 cm due to the additional counterweight and that of the Kubota was 36 cm. The differences were pretty big.

In a small space, it is important to be able to turn forward as well. Due to the original lateral displaceability of the boom, you can fold the excavator arm into a small size next to the operator's cab. The outermost point of the excavator arm protruded just 68 cm beyond the track width in the turn. The result for the ECM, which has a conventional boom attachment, was 81 cm. Together with the zero tail, this ensures that the ECM can even turn in very small spaces.

The differences were also remarkable in this measurement, since the CAT needs as much as 213 cm of room.

This, however, was affected by how the dipper stick was attached to the cylinder, as the bolt can be attached to two different brackets. On the test machine, the cylinder was attached in the rear position, meaning that it was not possible to move the dipper stick very close to the machine, for example, the bucket did not approach the dozer blade. With a change in the bolt position, the situation would have been different.

Lift capacities and tipping loads

Eurofins Expert Services was responsible for measuring the lift capacities and tipping loads. Due to differences in reach and dipper stick, the measuring distance was measured at 4.5 metres both laterally and longitudinally from the centre of the machine. The ECM had the best lift capacity with a result of 28.7 kN, which corresponds to a result of approximately 2,927 kg. The Kubota came second with a result of 27.4 and the Wacker Neuson came third with 26.6 kN. The weakest machine was the Takeuchi, which, with a lift capacity of 17.8 kN, was the only one under the 20 kN mark. The difference between the best and the worst result was as much as 10.9 kN, about 1,111.50 kilos.

The ECM proved to be the machine with the best stability, as its tipping load was the best in both lateral and longitudinal direction. In addition to the high operating weight, the steel tracks and the traditional fixed boom also had an impact. With a raised plate, the longitudinal tipping load was 22.2 kN, which was 1.5 kN more than the second-placed CAT. The weakest result by far was achieved by the lightest machine in the test, namely the Komatsu, whose track edge lifted off at a force of just 12.4 kN.

The ECM began to tilt laterally at a force of 21.8 kN. The CAT, with its very long tail swing, and the Bobcat took second and third respectively. The most tipping-prone was the Wacker Neuson, which was beaten by the most stable machines by 10 kN, or about 1,020 kilos, which is a significant difference.

Shovel arm and turn

The tractive force of the dipper stick was measured by placing the boom upright and lifting the tilt rotator bolt to a height of 60 cm from the ground. The two machines with the shortest reach, the ECM and the Komatsu, took the top positions in the measurements. However, the comparatively short working range of the ECM can be explained by the fact that the boom is fixed next to the cab in a conventional manner. The values of the top duo were 5,740 and 5,630 kg. The Kubota also achieved a force of over five tonnes. The weakest was the Takeuchi, whose power was measured at 4,180 kilos.

Lift capacity and tipping load 4.5m, kN

	Bobcat	CAT	ECM	JCB	Komatsu	Kubota	Takeuchi	Wacker Neuson
Lift capacity	21.3	24.2	28.7	22.5	24.1	27.4	17.8	26.6
Tipping load		20.7	22.2	18.5	12.35	20.1	17.5	15
Lateral tipping load		17.9	21.8	12.9	14.1	14	15.2	11.8
	Smallest		Largest					

Fuel consumption l/h

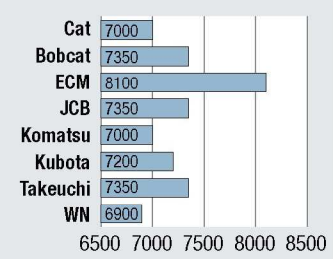
	Bobcat	CAT	ECM	JCB	Komatsu	Kubota	Takeuchi	Wacker Neuson
Ditch excavation	9.5	9	8.6	8.8	9	8.8	8.6	8.4

Sound level, dB (A)

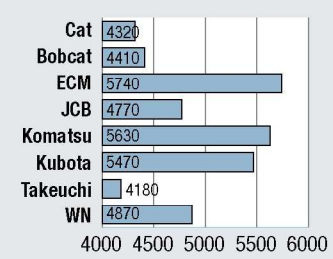
	Bobcat	CAT	ECM	JCB	Komatsu	Kubota	Takeuchi	Wacker Neuson
Idling	63	66	66	61	60.5	68	64	61
Idling*	77	68	77	74	69	71	78	75
Work noise	72	73	70	73	70	87	74	67
Drive noise	74	74	77	75	77	76	75	73
Work noise**	82	79	76	81	75	84	80	73
Mean value	73.6	72	73.2	72.8	70.3	77.2	74.2	69.8

* Fan at maximum power **outside, distance 5 m

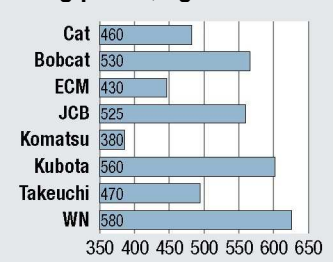
Undercarriage tractive force, kg



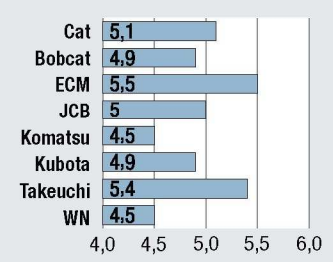
Dipper stick power, kg



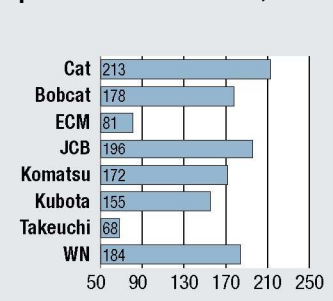
Swing power, kg



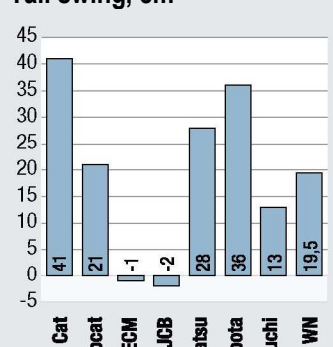
Travel speed, km/h



Space for forward turn, cm



Tail swing, cm



The swivel powers of the revolving superstructure are comparatively modest in this size category. Even the largest value, achieved by the Wacker Neuson, was only 580 kilos. Second was the Kubota with just 20 kilos less. The ECM was 30 kilos weaker than this. The top trio were therefore within a range of 50 kilos.

When considering hydraulic force measurements, however, it must always be borne in mind that several movements are always carried out simultaneously during smooth digging work. However, measuring the forces of simultaneous movements with the test methods available is extremely difficult, if not impossible. Nevertheless, the measurement of individual movements gives a general indication of the performance efficiency of a machine.

Tractive forces and speed

The highest speeds were measured with a VBox Sport unit, which can measure speeds to a tenth of a second. The fastest was the ECM, which can cover a distance of 5.5 kilometres in one hour. The second-placed Takeuchi was only one tenth slower. The differences were quite large, as the slowest two, the Wacker Neuson and the Komatsu, only had a measured speed of 4.5 kilometres per hour.

In the tractive force measurements, three machines, the Bobcat, the JCB and the Takeuchi, achieved the same result of 7,350 kilos. The ECM proved to be the machine with the highest tractive force, with a result of 8,100 kilos. Somewhat surprisingly, the Wacker Neuson also came last in the tractive force category, as the scale showed only 6,900 kilos.

Big differences in noise

The machine sound levels were measured with a Rion NL-52 sound level meter. Overall, the Wacker Neuson was the quietest machine by some distance, its average measured values were below 70 decibels. The Komatsu was only 0.5 decibels behind in its averaged values.

There were amazing differences in the sound levels. The sound level of the loudest engine by far, the Kubota, at 87 decibels when idling, was similar to that of the quietest machine, the Wacker Neuson, while working. Overall, the Wacker Neuson was clearly the quietest machine, even though the sound levels were no longer peak values when the fan was at maximum power.

The values of the third-placed Komatsu were slightly affected by the very high volume carried to the outside. All in all, however, it can be said that, with the exception of the Kubota, the operator's cab of modern machines is slowly becoming quieter, even in this size category.

Fuel consumption

Fuel consumption was measured using the traditional "full tank" method. After careful ventilation, the tank was topped up to the top, and the machine was used to dig an 80 cm-deep cable trench in a loamy field. All machines worked with the same bucket. After digging, the venting process was performed again. To ensure reliability, this section was repeated twice. However, the differences between the individual test runs were very small. The consumption measurement was carried out at full throttle but without power mode. The measurement was carried out at full throttle to ensure the most productive work possible.

↑ The highest speeds were measured with a VBox Sport unit, which can display speeds to a tenth of a second. There are surprisingly large differences in travel speed.

↗ We drew the visual field graphics in a dark hall, where we set up a light at the eye level of the operator and painted the resulting shadows on the ground.

Equipped with the smallest engine in the test, the Wacker Neuson came out on top in this comparison, with fuel consumption of about 8.4 litres per hour during work.

The Wacker Neuson was followed closely by the ECM and the Takeuchi, which consumed only 2 decilitres more. The CAT, with the most powerful engine, was last; it consumed 1.1 litres more fuel than the least thirsty engine.

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The size and weight of the machine are important

The measured operating weights of the machines were quite different from the official figures. Only the Komatsu and the Kubota remained below nine tonnes in operating weight. The operating weight of the ECM with steel tracks was more than 10 tonnes.

The size of the machine is a deciding factor when considering transport costs. Of course, the most common solution for transporting small and medium-sized machines is a removable loader. When it comes to eight-tonne machines, the key question is: is a two-axle truck sufficient? It is not worth driving an unnecessarily large truck.

For small projects, you can also use a removable loader for several purposes, so the same vehicle that brings the machine to the construction site can also assume other transport tasks. In garden work, for example, transport requirements are usually quite low, and a two-axle vehicle is a sensible choice.

With rubber tracks, the machines in this test can accommodate a two-axle removable loader, which has a gross vehicle weight of at least 16 tonnes. The dead weight of a two-axle removable loader of this class is usually 7-9 tonnes, to which a normal open container adds at least 1.5 tonnes. If you have additional permissible total weight which is one to two tonnes higher, you can load an eight-tonne machine with accessories. Transporting the ECM with steel chains with a two-axle vehicle is probably difficult.

The weight limits for new trucks provide a gross vehicle weight of 20 tonnes for two-axle vehicles - the load capacity is of course sufficient. There are virtually no second-hand vehicles approved for 20 tonnes, which means that a realistic alternative would be to purchase a three-axle truck. Then you could fit out the vehicle with a sufficiently powerful crane.

Some vehicle manufacturers have made undercarriage models with a low dead weight, where the payload is greater than that of the standard version. The Volvo FS7 is a good example of this type of vehicle. With a pull-rope dump truck, its dead weight remains under 7 tonnes and the maximum total weight is 19 tonnes. Unfortunately, the production of this vehicle was discontinued in 1996. Among the current models, the vehicles of the FE series have a corresponding gross vehicle weight.



Transport an excavator with a tractor incurs the lowest costs. In principle, you only need a trailer weighing about three tonnes for transport, making the total weight about 11 tonnes. The tractor must be in at least the 100-horse power performance category; the required minimum weight of the tractor is then complied with. With a trailer without brake, the tractor must have half of the mass to be towed.

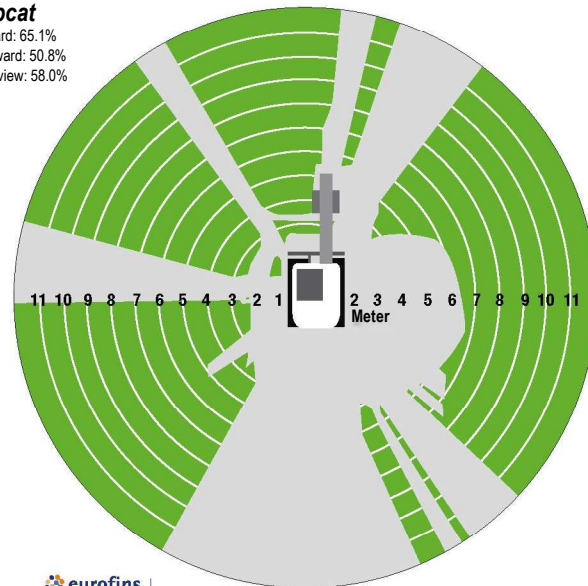
Jussi Laukkanen

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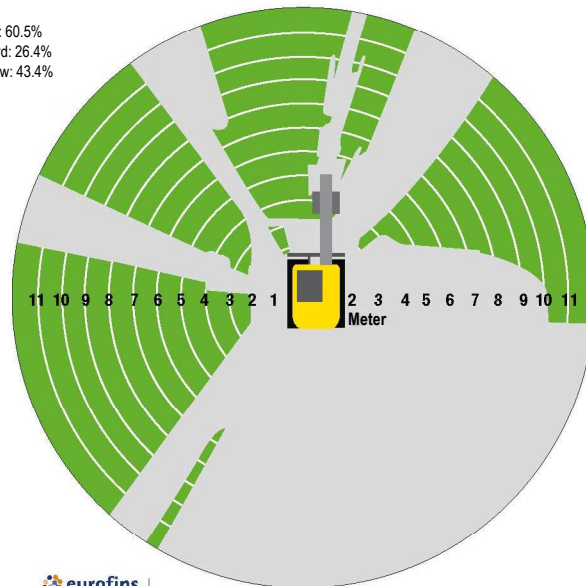
Bobcat

Forward: 65.1%
Backward: 50.8%
Total view: 58.0%



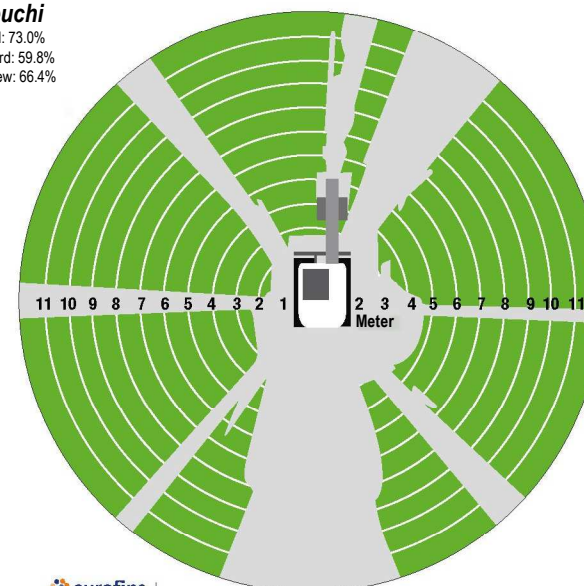
CAT

Forward: 60.5%
Backward: 26.4%
Total view: 43.4%



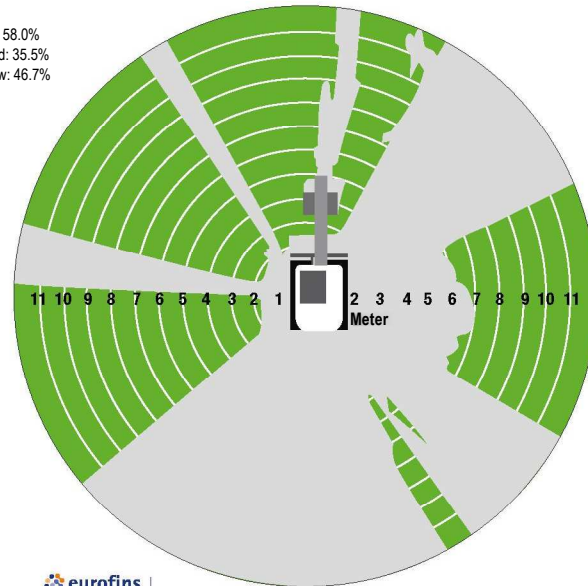
Takeuchi

Forward: 73.0%
Backward: 59.8%
Total view: 66.4%



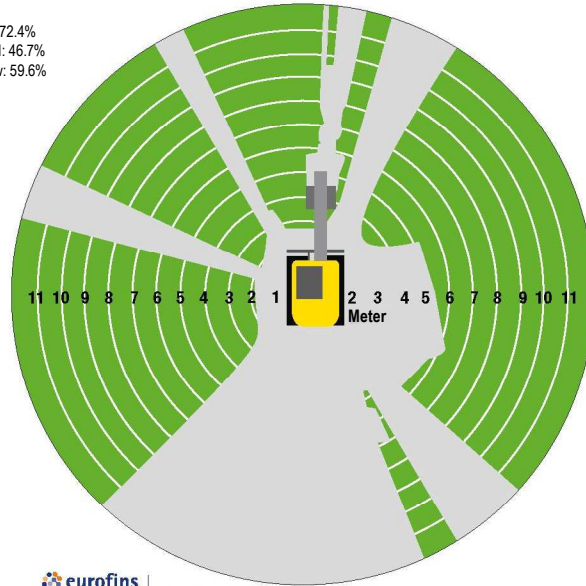
ECM

Forward: 58.0%
Backward: 35.5%
Total view: 46.7%



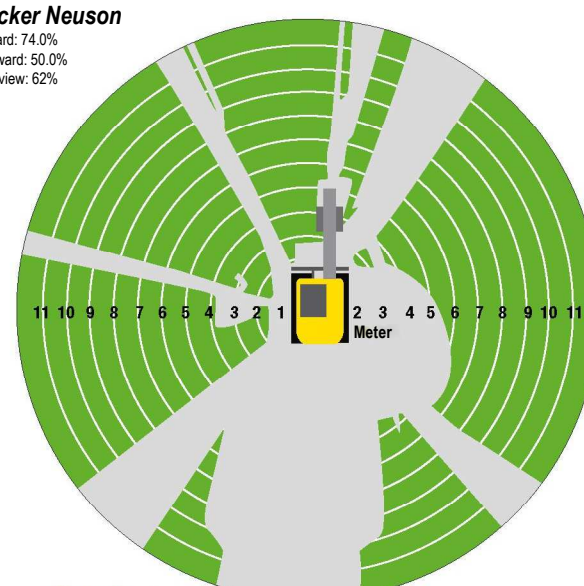
JCB

Forward: 72.4%
Backward: 46.7%
Total view: 59.6%



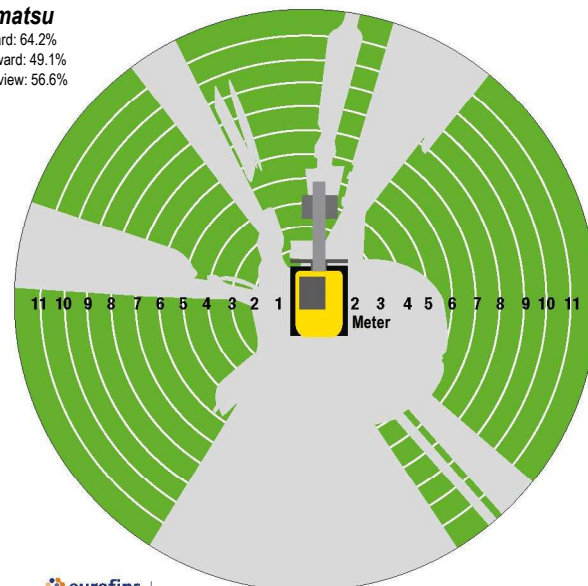
Wacker Neuson

Forward: 74.0%
Backward: 50.0%
Total view: 62%



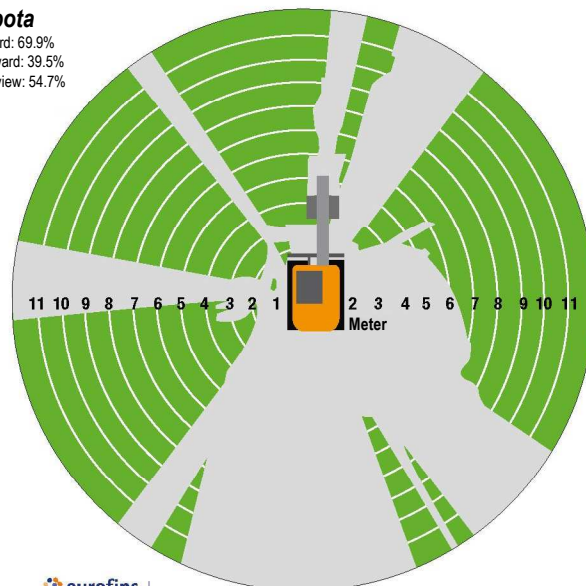
Komatsu

Forward: 64.2%
Backward: 49.1%
Total view: 56.6%



Kubota

Forward: 69.9%
Backward: 39.5%
Total view: 54.7%



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View to the front and to the back

The machines of the test group are often used in confined spaces. In addition to the compact external dimensions, the view from the operator's cab also plays a role in operational safety. The field of view measurements were performed by Eurofins Expert Services Oy (formerly VTT Expert Services Oy).

A light was set up at the eye level of the operator, and using the shadows cast, the line-of-sight was painted on the ground. The line-of-sight is expressed as a percentage, so the larger the number, the better the view. All machines worked with the same bucket. The laterally displaceable boom of the Takeuchi was in the same position as that of the other machines.

The best results were achieved by Takeuchi and Wacker Neuson, with visibility above 60%. For the former, however, the position of the boom has a major impact on visibility. The ECM and the CAT were uncoupled. The boom solution and the wide pillars of the operator's cab clearly influenced the results. Some machines were also equipped with reversing cameras, but their function was not taken into account in this measurement.

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Individual parts make the big picture



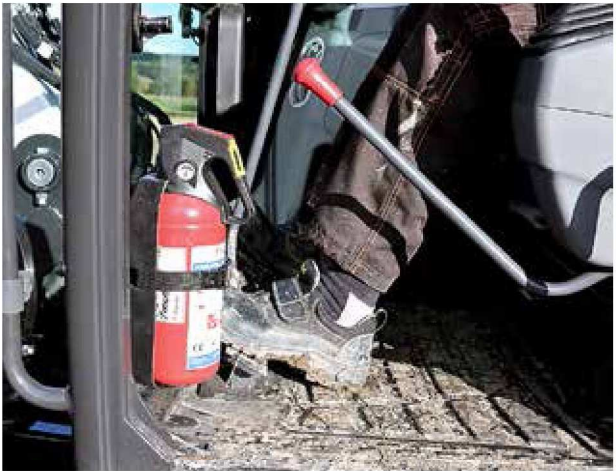
There were big differences in the display sizes. The largest is the colourful and easy-to-read display of the Wacker Neuson. The machine also comes with a reversing camera.



The CAT dipper stick cylinder can be attached to two different attachment points, influencing the boom trajectory. When the boom is attached to the top hole, movement in the direction of the machine is restricted and the bucket of the test machine cannot touch the dozer blade.

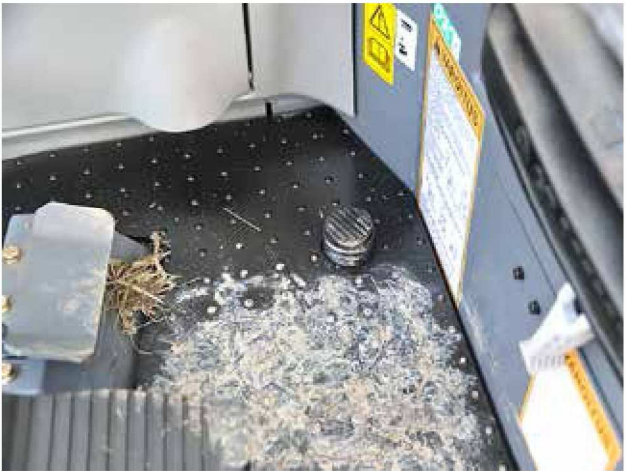


The Kubota display is at the smaller end of the scale. The small, black-and-white and outdated display is reminiscent of excavator displays twenty years ago.



The Bobcat fire extinguisher was fixed right at the entrance. This was not an issue when entering and exiting the Bobcat.

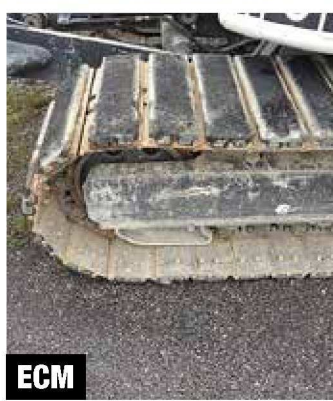
The Takeuchi rapid action couplings also require actuation of a pedal. Once you get used to it, it's a great solution.



Bobcat



Cat



ECM



JCB



Komatsu



Kubota



Takeuchi



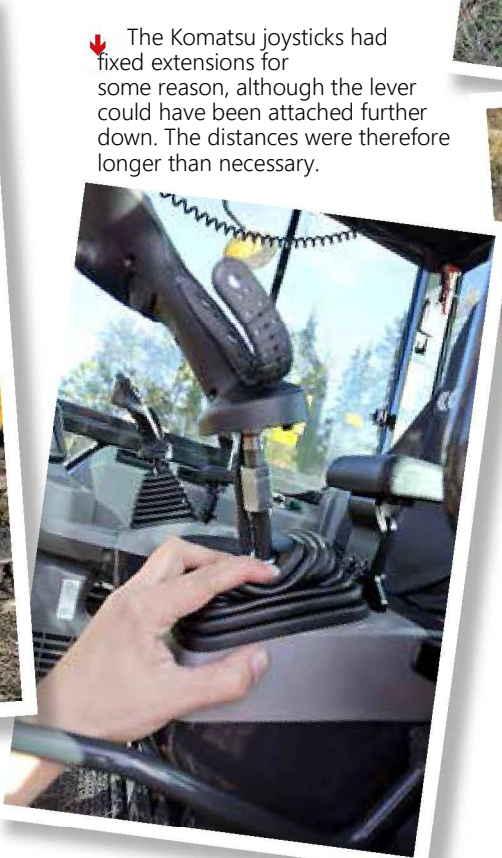
Wacker Neuson

All the normal excavator track options were represented among the tested vehicles: rubber tracks, track belts with rubber floor plates and track belts with steel floor plates. The CAT and ECM were equipped with the latter, even though both had rubber pads attached to the steel floor plates with bolts. The Komatsu had rubber base plates screwed directly onto the track belt. These are not particularly common on excavators - presumably because the adaptability of this type of track to different conditions is not as good as that of rubber pads attached with bolts. For the rubber tracks, the manufacturers preferred Bridgestone; the JCB (with the Tracmaster product brand) and the Kubota were equipped with Bridgestone rubber tracks. Also, the rubber base plates on the Komatsu were from Bridgestone. The Takeuchi and Bobcat tracks were provided with product labels of the machine manufacturers; the Bobcat chain had the product brand Doosan.

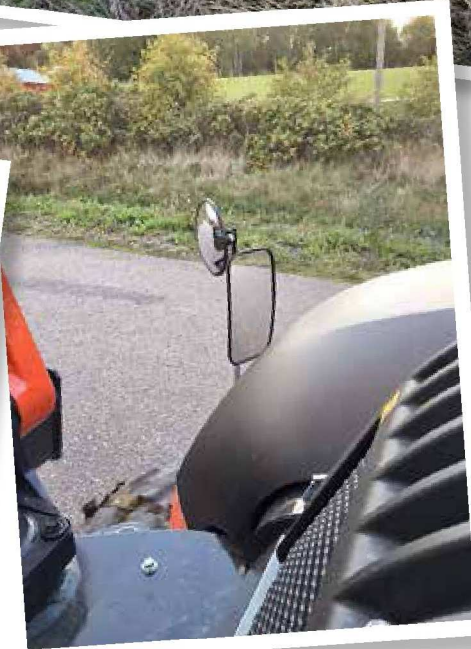
The CAT dozer blade is the only one to have a replaceable cutting blade.



The Komatsu door opening was by far the narrowest. Larger operators have to manoeuvre themselves awkwardly.



The Komatsu joysticks had fixed extensions for some reason, although the lever could have been attached further down. The distances were therefore longer than necessary.



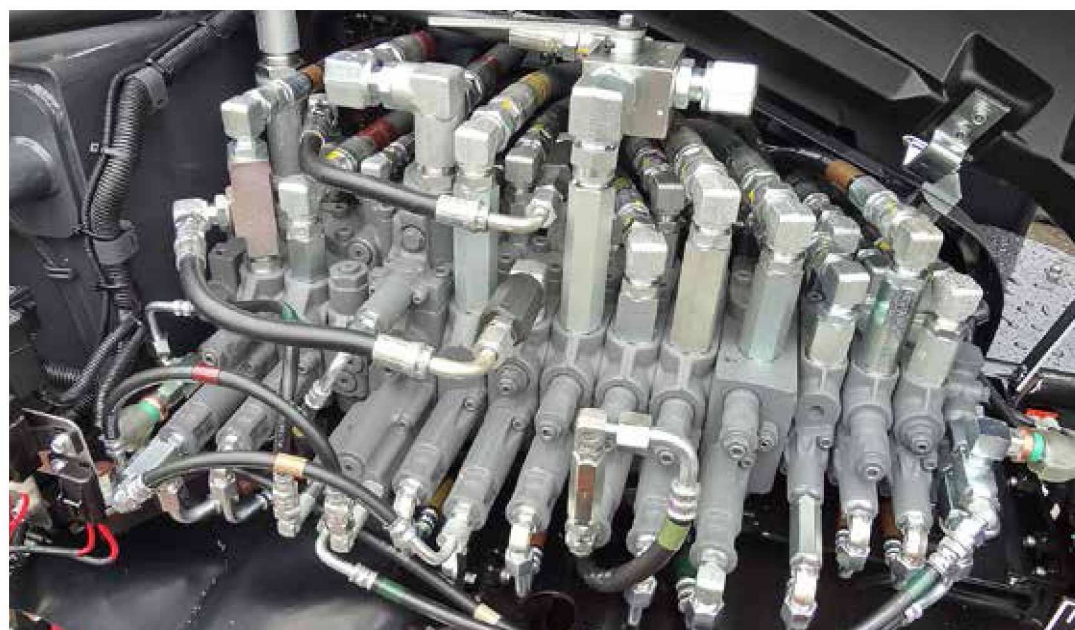
The Kubota is equipped with lots of mirrors, which are very cleverly placed.

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← The JCB hydraulics are controlled by Rexroth multiple way valves. The compact valve unit is beneficial to the manufacturer of the machine, but replacing a hose takes some time if the defect affects the bottom row.

→ The Wacker Neuson has a Rexroth LUDV valve unit that, despite its relatively simple build and small exterior dimensions, is capable of balancing the flows of multiple simultaneous working movements.

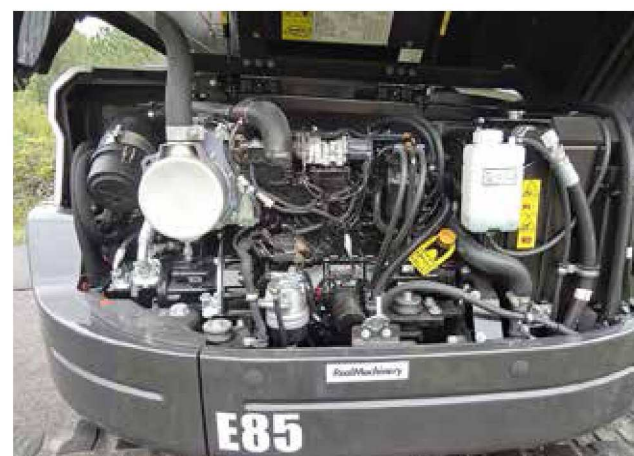


← The Kubota has a valve unit from Kyb. The large housings of the pilot valves make it appear large and complex. Nevertheless, the inside has completely normal hydraulic technology.

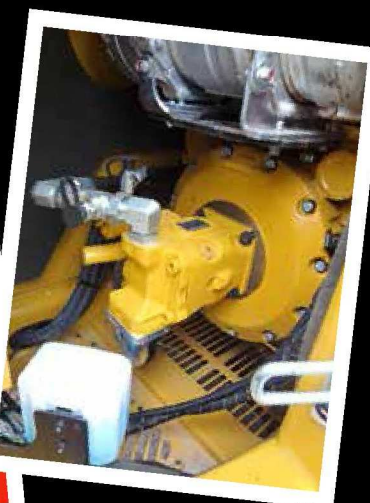
→ Yanmar is the most popular engine choice among the machines tested. The Bobcat (pictured), ECM and Takeuchi are all equipped with it. The Komatsu is also equipped with a Yanmar engine. The first three all have the same 4TNV98 base model, but the engines differ slightly from each other, which can be seen in the different levels of peak performance. The Komatsu has the 4D98E model.



← The Perkins 404D-22T engine from Wacker Neuson is the smallest of the test engines in terms of displacement: 2.2 litres. The same applies to the peak power, which is 36.3 kW.



→ → With the CAT, the main components of the machinery have been successfully arranged to allow a generous working area around the pump, the engine and the valve unit. It was the best in the test group in this regard. The assumption is that with the CAT, at least part of the hoses can be replaced with a moderate level of work. Hose changes are among the things that are likely to be needed on a machine which is just a few years old.



→ Digging stability with a zero tail excavator can be improved with an additional weight fixed in the engine compartment, as has been done with the JCB. Unfortunately, the steel lump almost covers the whole engine.

→ The dozer blade hose of the ECM was temporarily trapped between the cylinder bracket and the support beam.



← In addition to the extra weight in the engine compartment, the JCB's stability is also enhanced with chassis-mounted weights.



→ It is difficult to find space for all the components required for reduced tail excavators. Sometimes the end result looks like a stopgap solution. In the Takeuchi and the ECM, the battery is placed at the bottom of the revolving superstructure, meaning that its replacement requires a certain amount of disassembly.

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Big differences in air-conditioning system performance

■ Arto Turpeinen

The summer of 2018 put the air-conditioning systems of the machines to the test, as the temperatures were in the heat for weeks on end. From what could be heard from the construction sites, the temperatures could not be kept under control in all machines, because the performance of the air-conditioning systems simply was not sufficient.

Eurofins Expert Services Oy offered the opportunity to test the performance efficiency of the machines under extreme conditions. The temperature in the hall specially designed for the purpose can be set between -40 and +55 degrees Celsius. For Koneviesti, this hall has been used on previous occasions, for example in forest removal tests in operator's cabs and to test the performance efficiency of heaters. This time, the performance efficiency of the air-conditioning systems was tested.

For the test, we fixed eight temperature sensors to different parts of the operator's cab. From the temperatures recorded every minute, we calculated an average; on the basis of this average, we plotted a curve that shows the total temperature in the operator's cab. The heat generated by the sun was simulated with several halogen lights, which we directed from a fixed distance to the operator's cab, at an angle, from above.

Before the test, the temperature in the cabins was stabilised for two hours in the hall. After the lights were turned on, the temperature was raised for about 20 minutes, after which the engines were turned on and set at a speed of approx. 1,500 rpm.

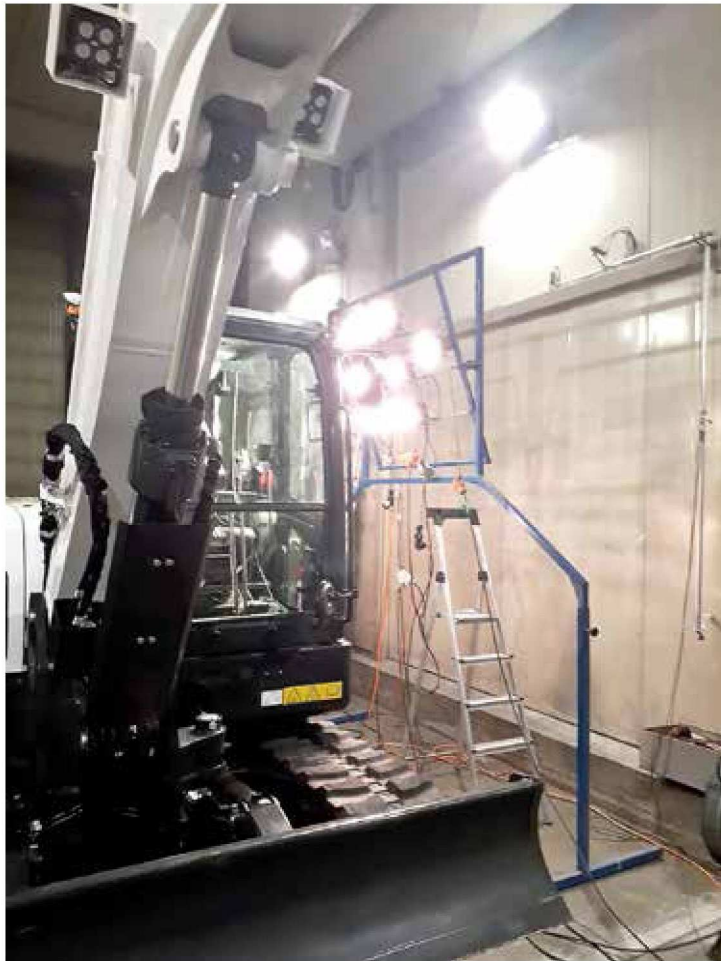
The air-conditioning systems were set to blow out as much cold air as possible. The entire test took 55 minutes, which was sufficient to separate the wheat from the chaff.

Big differences

At the beginning of the test, the temperatures in the operator's cabs were all within a range of 1.7 degrees, the average was 33.7 degrees. After the lights were turned on, the radiation caused the temperatures to rise to about 39 degrees. The speed of the temperature rise in the operator's cabs and the final temperature is influenced, for example, by the size of the glazed area of the operator's cab.

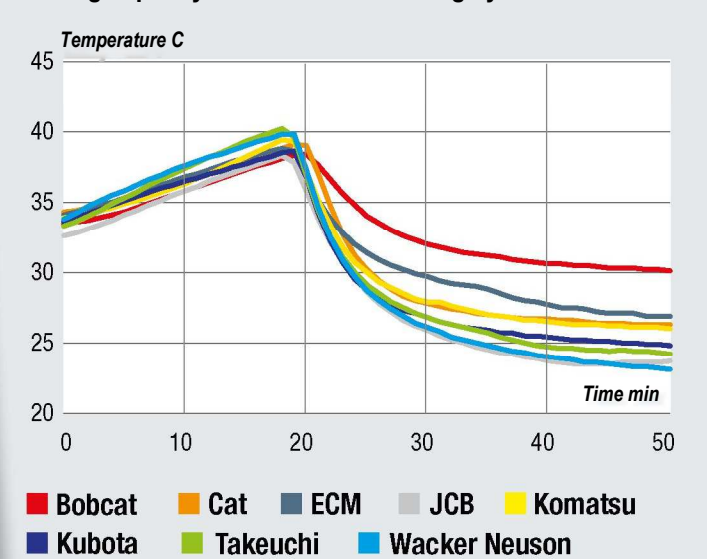
After the air-conditioning system was switched on, the temperature in the operator's cab dropped rapidly. The exception, however, was the Bobcat, in which the temperature dropped much more slowly than in the other machines, even though the air-conditioning system was maintained. The temperature in the Bobcat operator's cab was still above 30 degrees at the end of the test. At the top, the Wacker Neuson and the JCB achieved results of 23.1 and 23.7 degrees, meaning that the difference between the machines was surprisingly large.

Also, the ECM air-conditioning system was a little exhausted, because at the end, the temperature was almost 27 degrees. The temperatures of the Komatsu and the CAT did not fall below 26 degrees. ■



↑ In the hall of Eurofins Expert Service, where environmental conditions can be simulated, the performance efficiency of equipment can be tested in extreme situations. The heat caused by rays coming in from the outside was simulated with additional lighting. Before the air-conditioning system was turned on, the temperature in the cabins was about 39 degrees.

Cooling capacity of the air-conditioning systems



← The cooling of the operator's cab comes at a cost. The prices of refrigerants have been rising since last year. The largest price increase has been for R134a, which is often used for vehicles and machinery. Prices for newer refrigerants are high from the outset.

Big differences in spare parts prices

■ Arto Turpeinen

After-sales support and easy maintenance play an increasingly important role in purchasing decisions. Even a good machine can cause frustration if the normal maintenance parts are expensive or the spare part delivery times are long. The table opposite lists the prices of some parts for the test machines. For some parts, the price differences are surprisingly large.

For example, a JCB upper front window costs €431, while you only have to pay €182.20 for a Komatsu window. The price difference is €248.80. In addition to the price policies of the manufacturer and importers, the window size and the number of holes required, for example, also influence the price.

There are also price differences for basic maintenance parts. The price for the combined air filter package inside and outside the Bobcat is stated as just €36, while the price for the ECM package amounts to €158. The difference between the cheapest and most expensive alternator is €946.

For starter motors, there are price differences of up to €1,266.

The largest price difference in the shopping cart was for engines, where there was a difference as high as €8,279 between the two ends of the scale. For some machines, there were special-offer transmissions included, so the prices are not quite comparable.

There were also significant price fluctuations with engine control units. The CAT ECU costs €2,977.87, while you can get the Wacker Neuson for less than €800.

The assembly of the machine using commonly available components seems to have a price-reducing effect. The difference in price for the Bobcat Bosch Rexroth main pump is in the 20% range, depending on whether you buy the pump in Finland from the importer or in a hydraulic accessories store offering Rexroth components, where the price is within the normal range. The importer in Finland can often offer the parts at a shorter delivery time.

The fact that the gear pumps and engines are from one of the major component manufacturers means that broken parts can be repaired in a hydraulic workshop. For example, the basic repair of the above-mentioned pump with original parts will cost about €1,600 (VAT 0%) with Peimarin Hydraulikka Oy. This usually takes one working day, meaning that a repair often beats a new part in terms of time savings. ■



↑ The hydraulics of the machines are usually composed of parts from the major component manufacturers. This gives you more options if something is broken on the machine. The parts can usually be repaired at the nearest hydraulic workshop or, alternatively, the part can be purchased as an original part from the component manufacturer. The picture shows the main pump of the Bobcat, one of the widely used Bosch Rexroth pumps, Type A10VO71. The Bobcat pump is labelled as a Doosan spare part with the identification number 401-00327.

Continued on the next page ►

Spare parts prices, in € (VAT 0%)									
Brand	Bobcat E85	CAT 308E2 CR SB	ECM ES85 SB4	JCB 90Z-1	Komatsu PC80MR-5	Kubota KX080-4a	Takeuchi TB280FR	Wacker Neuson EZ80	Difference between the highest and lowest price
Front window	250	283.75	316	431	182.20	349	238	269.30	248.8
Lower front window	140	159.23	197	107	274.32	109	129	187.46	167.3
Engine oil filter	12	21.08	19	17	10.87	17	15.90	11.42	10.2
Hydraulic oil filter	28	78.12	142	99	78.96	21	93.75	92.88	121
Air filter package inside + outside	36	65.15	158	73	88.14	56	119.50	85.60	122
Support roller	85	195.75	117	82	90.47	207	165	144.32	125
Roller	115	243.65	142	164	189.70	255	230	198.15	140
Drive wheel	225	281.69	253	378	209.06	170	390	290.22	220
Starter motor	1,475 (Yanmar)	480.29	453	282	778.70	209	865	390.35	1,266
Alternator	1,265 (Yanmar, 80A)	514.39	510	368	1,099.80	319	777.50	591.22	946
Drive motor	2,800	6,841.52	5,100	4,457	11,069 (including special-offer transmission)	4,950	3,895	2,790 (including special-offer transmission, 1,980 without transmission)	8,279
Gear pump	3,000	3,379.36	3,900	2,281	6,660	5,990	4,725	2,590	4,379
Seal kit for lift cylinders	130	336.61	230	113	430.92	307	197	593.66	480.7
Engine control unit	2,180 (Yanmar, programmed)	2,977.87	1,949	2,754	834	2,400	1,055	789.89	2,188

For the ECM, the filter package price is €336. Incl. air filter, hydraulic and engine oil filter and fuel filter

Top trio stand out

■ Arto Turpeinen

In order to reach the top spots in the machine comparison, the machine must not only impress in the test operator assessment but also in measurements assessing technical performance efficiency.

There can be no doubt about the winner of this year's comparison, as Wacker Neuson impressed in both parts of the ranking. In addition, the properties have all been bundled at a very competitive purchase price. The machine was also first choice when the test operators were asked which machine they would choose to use in their own work. The point deductions for this quiet and modern machine were primarily due to the slight inertia of the hydraulics and the comparatively low performance efficiency of the undercarriage.

The sales figures of the brand, which is still somewhat unknown in Finland, have increased significantly in recent years in Germany and Europe, which is hardly surprising, given the comparison results.

Although the hydraulics of the engine are perfectly fine, it would be advisable for Kubota to update the operator's working area if the emission regulations become stricter. The Kubota took second place due to its extremely balanced performance efficiency. Points were deducted in the assessment for the otherwise high-quality overall package due to the surprisingly loud operator's cab.

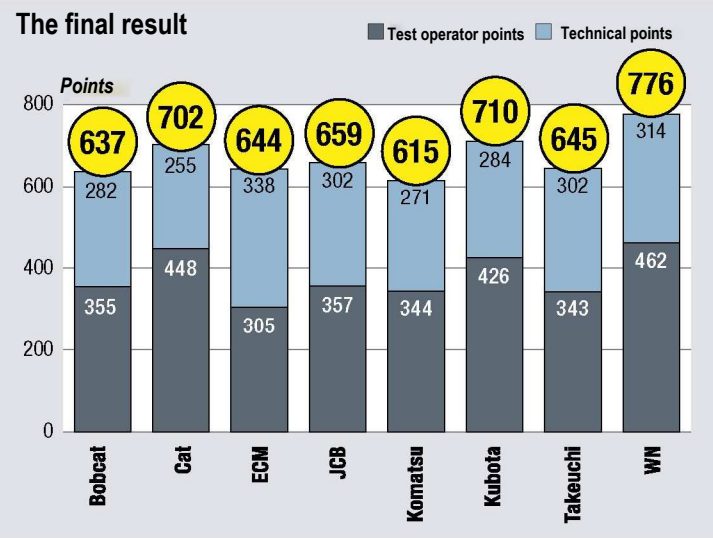
Third-placed Caterpillar is a safe choice for operators who are accustomed to the brand, as the hydraulics are consistently efficient.

As usual, serviceability is top notch, but the view from the operator's cab and the mediocre digging force brought about point deductions.

Fourth-ranked JCB performed steadily across the board, but did not stand out from the crowd. The special features on this machine are the reduced tail and the efficient air-conditioning system. The lubrication intervals are exceptionally long.

The Takeuchi was the slight disappointment in the comparison. The hydraulic control system of the test machine was not quite at the level of the previously tested machines and the power level is not exactly cause for celebration. However, the performance efficiency of the undercarriage was good. The low fuel consumption, the performance of the air-conditioning system and the small tail swing were also positives.

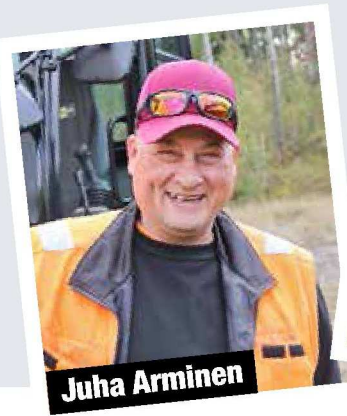
The ECM is extremely strong in terms of hydraulics and undercarriage, which is why the machine received the highest number of technical points.



The choice of the Koneviesti test operators

The test operators not only gave points for machine characteristics, but also chose the three machines they would most like to use themselves. The first choice was awarded three points, the second choice with two and the third place with one. From time to time, the machine coming on top according to the tested properties and the ratings in the assessment form and the emotionally justified test operator's choice of machine have not been the same. This time, the machine that won the most points, namely the Wacker Neuson with 10 points, was also chosen in this test section. The CAT and the Kubota both received 10 points. Again, this test section highlights the difference between the top trio and the rest of the field, with only the ECM and the JCB out of the other, machines scoring one point

Points



The machine with the zero tail can also turn forward in a small space because of the conventional boom. The poor test operator assessment, however, meant that the machine only came fifth in the overall standings. Negative points for the test operators were, for example, the narrow engine compartment and the somewhat complicated operation.

The Bobcat is a machine with a fairly good range, but with stiff movements, which affected the test operator assessment. Deductions in the technical points were made for things such as the weak air-conditioning system. The turning force of the revolving superstructure and the lateral tipping load, however, were good. The price for the Bobcat was not stated.

The Komatsu was the worst in both test areas, the overall package simply did not warrant more than an eighth-place finish. The machine had the best dipper stick, but the torque and lateral tipping load, for example, were weak. The operator's cab was relatively quiet. For example, in the test operator assessment, negative ratings were given for the fact that the boom movements do not work well while driving and that the joysticks are too long.

The overall impression is what counts

When looking at the overall scores, it becomes clear that the Wacker Neuson was the outright winner, as the difference in points to the second-placed Kubota is 66 points. The third-placed CAT also achieved over 700 points. The top trio had a whole 100-point range to themselves - the JCB was more than 40 points behind third place. The mid-table machines, the Takeuchi, the ECM and the Bobcat, all came within a point distance of seven points.

The Komatsu would have needed a bit more effort to catch up with the Bobcat, as the gap was more than 20 points.

Overall, however, one can say that the modern machines are suitable for most of the tasks with all the test comfort. The purchase prices are based on the purchasing decision. ■

In many cases, in Finland, machines are imported, which is why the price level of the machine to have slightly different characteristics - some value various outfitters and the nature of the construction sites. It was possible to perform the tasks with all the test comfort, as well as the skill of the seller influence machines, but there were big differences. The purchase prices are based on the purchasing decision. ■

Technical Data:

Brand	Bobcat E85	CAT 308E2 CR SB	ECM ES85 SB4	JCB 90Z-1	Komatsu PC80MR-5	Kubota KX080-4a	Takeuchi TB280FR	Wacker Neuson EZ80
Operating weight	8,540 kg	8,400 kg	8,300 kg	8,607 kg	8,000 kg	8,315 kg	8,650 kg	8,400 kg
Engine	Yanmar 4TNV98C-VDB8	CAT C3.3B	Yanmar 4TNV98CT	Kohler KDI 2504TCR	Komatsu 4D98E-5SFB	Kubota V3307-CR-TE4	Yanmar 4TNV98CT	Perkins 404D-22T
Performance	44.3 kW	48.5 kW	53.7 kW	55 kW	46.2 kW	46.5 kW	51.6 kW	36.3 kW
Displacement	3.31 l	3.33 l	3.31 l	2.5 l	3.31 l	3.33 l	3.3 l	2.21 l
Emission category	3B	3B	3B	3B	3B	3B	3B	3B
Flow rate	151 l/min	150 l/min	185 + 20 l/min	148 l/min	178 l/min	84.6 x 2 l/min	198 l/min	160 l/min
Max. operating pressure	250 bar	280 bar	200 bar	300 bar	204 bar	270 bar	275 bar	300 bar
Travel speed	2.7/4.7 km/h	2.8/5.1 km/h	2.6/5.2 km/h	2.5/4.6 km/h	2.9/4.9 km/h	2.7/4.8 km/h	4.0 km/h	4.4 km/h
Max. revolving superstructure	9.5 rpm	11 rpm	10 rpm	-	10 rpm	10.2 rpm	9.9 rpm	9.1 rpm
Turning angle	70/55 Degrees	60/50 Degrees		55/60 Degrees		70/60 Degrees	15/30 Degrees	67/63 Degrees
Fuel tank size	110 l	125 l	105 l	112 l	110 l		128 l	85 l
Cooling system	10 l	14 l	25 l	12.1 l	11.6 l			
Engine oil	10.2 l	11.2 l	10 l	11.2 l	9 l		10.2 l	
Hydraulic system	148 l	94 l	120 l	118 l	-		120 l	
Made in	South Korea	USA	Italy	England	Italy	Japan	Japan	Austria
Importer	Daetek Oy	Wihuri Oy Tekninen Kauppa	Minikone Oy	Mateko Oy	Suomen Rakennuskone Oy	Konesilta Oy	Honka Trading Oy	Edeco Tools Oy

Wacker Neuson EZ80

Modern quality package

The Wacker Neuson was the clear winner in the end, as the machine was number one in the test operator assessment and number two in the technical assessment. The

Wacker Neuson EZ80 was only brought onto the market about two years ago, while the competitor models, aside from minor innovations, have remained more or less the same for several years.

This is evident, for example, in the operator's cab, which is particularly modern and quiet. The noise level of the fan was not excessive. The air-conditioning system was one of the strongest of the test group. Also the display is large, in line with current requirements, and offers good readability. The seat is covered with a comfortable fabric and can be moved in the longitudinal direction together with the joysticks. Nevertheless, the pedal for the swivel joint was found to be too small and difficult to operate by the test operators.

The engine of the machine was the smallest in the test. The kilowatt count is 36.3, while the strongest engines in the test had more than 50 kilowatts. The fuel consumption when digging the cable trench was the smallest, but the Wacker Neuson was still able to keep up with the force measurements quite well. The swing power of the revolving superstructure was the best in the test. The tipping load, especially the lateral tipping load, was low.

The undercarriage of the EZ80, on the other hand, was surprisingly weak, as the machine came last in the tractive force and travel speed measurements.

Although the Wacker Neuson LUDV hydraulic valve unit, with a pump, is very accurate, some test operators would have wished for a bit more speed on the spot. A more detailed description of the valve unit can be found in Koneviesti Issue 13/2016. The Wacker Neuson has many small and interesting details, such as the headlights fixed on the edge of the revolving superstructure. The overall package is of very high quality - for example, the working comfort is at the level of larger machines.

Praise & criticism

+ Quiet and modern operator's cab
Low fuel consumption
price/performance ratio

- Low travel speed and low tractive force
Tipping loads
Battery difficult to access



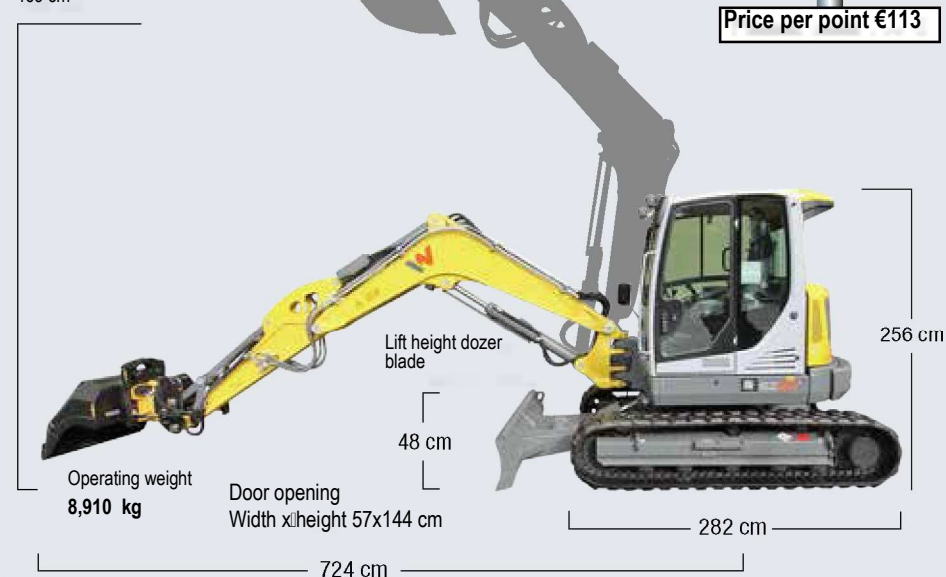
Standard equipment: LED work lights, refuelling pump, climate control in the operator's cab, reversing camera, 2 pcs. two-way auxiliary hydraulics (proportional control), Defa engine preheater + battery charger

Additional options of the test machine: Engcon EC209 tilt rotator with DC2 proportional control system
Price of the test machine: €88,000 + VAT 24%

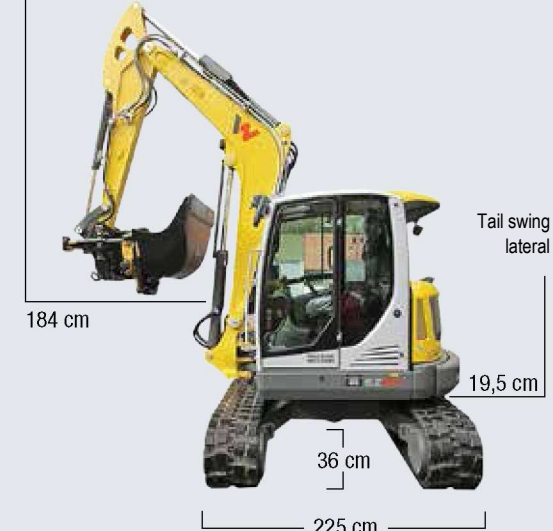
776
Points

Price per point €113

Lift height from the cutting edge of the bucket
469 cm



Space protruding beyond the track width, required for forward turn



Kubota KX080-4a

Fast efficiency package

The Kubota came mid-table in the technical tests, but with the help of the essential test operator points, the Japanese brand came as high as second. The machine came in the top group in almost all power measurements. However, the Kubota was deducted points for the operator's cab, which is very loud for a modern machine. During work, the sound pressure level increased to as much as 87 decibels, which is why the use of ear protection is more than recommended.

Although the engine of the Kubota is recessed relatively deep in the engine compartment, it offers easy access to the oil dipstick and the filling boring. The engine oil filter is, in contrast, located in a place which is difficult to access, but all other filters are clearly visible. Access to the battery and the fuel tank is also excellent.

The Kubota hydraulics perform extremely well when moving the boom while driving, because none of the movements is significantly slower. The general hydraulic control system and speed also appealed to the test operators.

The joysticks of the machine are very low compared to the armrests, but that did not bother test operators with long arms.

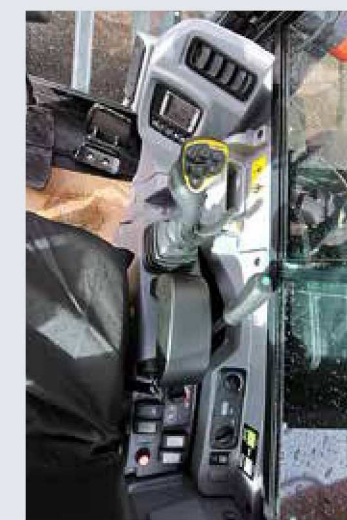
The black and white display is very small, but you can see the essential information on it well. The numerous and cleverly positioned mirrors were rated as the best in the test.

We have determined the operating weight of the Kubota to be 8,795 kilos, which was the second-lowest weight in the test. Nevertheless, the forward tipping load in particular was to a decent standard, but in the lateral direction, the value was nothing special. The stability is enhanced by a tail swing of 36 cm, so it is not a real reduced tail excavator in the classic sense.

Praise & criticism

+ Hydraulic control system and speed
Position of the battery and most filters
Mirror

- Loud operator's cab
Lateral stability
Relatively high tail swing



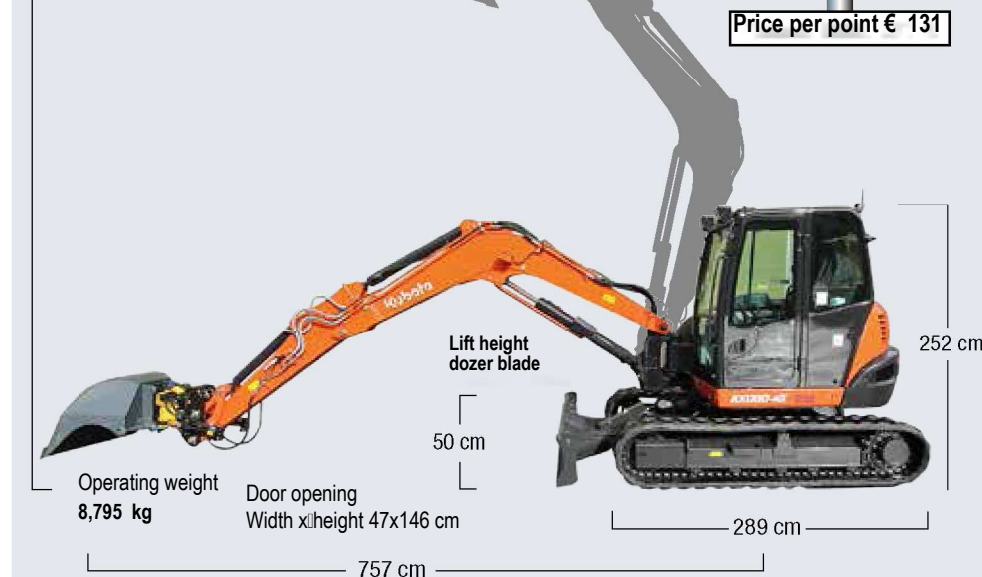
Standard equipment: Refuelling pump, radio, air-conditioning system, LED work lights, (450 mm) rubber track **Additional options of the test machine:** Engcon tilt rotator EC209

Price of the test machine: €92,900 + VAT 24%

710
Points

Price per point € 131

Lift height from the cutting edge of the buckets
493 cm



Space protruding beyond the track width, required for forward turn



Cat 308E2 CR SB

Serviceability of the highest class

The machine was lifted to third place by the test operator assessment points, although its less exciting technical performance efficiency brought about point deductions. The CAT hydraulics work quickly and precisely, which is why there was a bit more trench in the fuel consumption test than for the other machines. At the same time, its fuel consumption was the biggest.

As is typical for a Caterpillar, the serviceability of the test machine was also at a good standard. All filters and all other frequently repaired areas were clearly visible after lifting the engine hood. Thanks to good planning, even the central lubrication system bin has enough space underneath the metal plate that it can be accessed easily.

There was an additional weight on the rear weight, which is why the tail swing to the side was the largest in the comparison at 41 cm. With the steel tracks with rubber pads, which come as standard, the operating weight was over 9,700 kilos. Due to the above mentioned constellation, the tipping loads of the CAT are first-class. Also, the range was the best in the comparison, as the bolt of the upper cylinder was attached in the outer bracket. But the bucket did not reach the dozer blade.

However, the view from the operator's cab was not the best possible because the columns on the left were thick. The right window was again stuck with labels. The machine also comes with a reversing camera as standard. The test operators were also unenthusiastic about the attachment lock on the display because the solution was perceived as too slow.

The digging ergonomics are enhanced by the well-placed armrests, which are height-adjustable. There was also enough space in the operator's cab in the longitudinal direction and, for example, the dozer blade lever was in exactly the right place. The CAT is the only one to have a dozer blade with a replaceable cutting blade. The accelerator pedals were also praised.

Praise & criticism

+ Excellent serviceability of hydraulic control system
Accelerator pedals

- Large tail swing Fuel consumption
View from the operator's cab



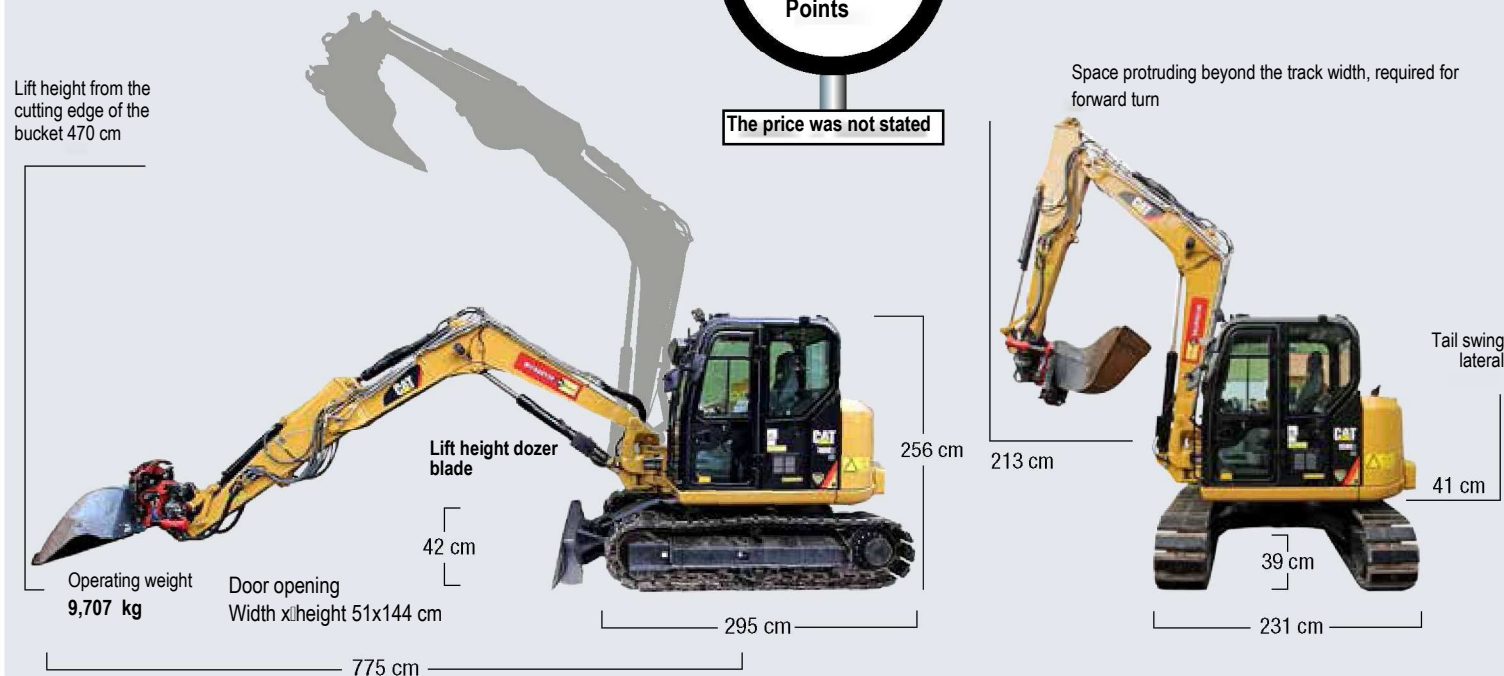
Standard equipment: LED work lights, refuelling pump, steel tracks, 450 mm + bolted rubber pads, additional counterweight 250 kg, air-cushioned and heated seat, reversing camera

Additional options of the test machine: Engine preheater, SKF MonoFlex central lubrication system with 2 kg bin, Indexator RT30 Multi / S45 TE tilt rotator

Price of the test machine: The price was not stated

702
Points

The price was not stated



JCB 90Z-1

Reliable delivery

The JCB has given a stable performance in both areas, meaning that it secured fourth place. The points gap to the top trio was still relatively large. The JCB was the second test participant with zero tail. The 9,550 kilos machine was given additional stability by the additional weights on the chassis and on the counterweight. The additional mass is also necessary because the lateral tipping load was the second weakest.

Unlike with the other machines, the additional weight was accommodated at the rear under the body. However, the additional weight obscures the visibility slightly, as well as the access to the engine compartment and the capacitor. The hydraulic oil filter must be replaced manually from above. However, this is made easier by the cartridge-shaped filter. The battery is easily accessible in the front corner. The special features of the JCB include the graphite-impregnated bronze bushings, which make the lubrication interval of the bolts on the excavator arm as long as 500 hours. For repairs, it is also helpful that the operator's cab can be tilted by 30 degrees.

The JCB operator's cab is very quiet during idling, but, for example, the driving noise is very loud. The use of the small display takes some getting used to, because the touch controls are not as clear as they could be.

In the air-conditioning system test, the machine performed excellently, as the cooling performance was in the top range. The short armrests are not adjustable, but the mini control lever for the dozer blade is excellently placed. The measurements also provide evidence for the view from the operator's cab being very good.

The full revolutions of the test machine had to be started with two different switches, after which there was enough momentum in the hydraulics. Unfortunately, the movements were a bit hasty, which has a negative impact on accuracy.

Praise & criticism

+ Air-conditioning system performance No tail swing
Low idling

- Lateral tipping load
Narrow engine compartment
Space required for forward turn

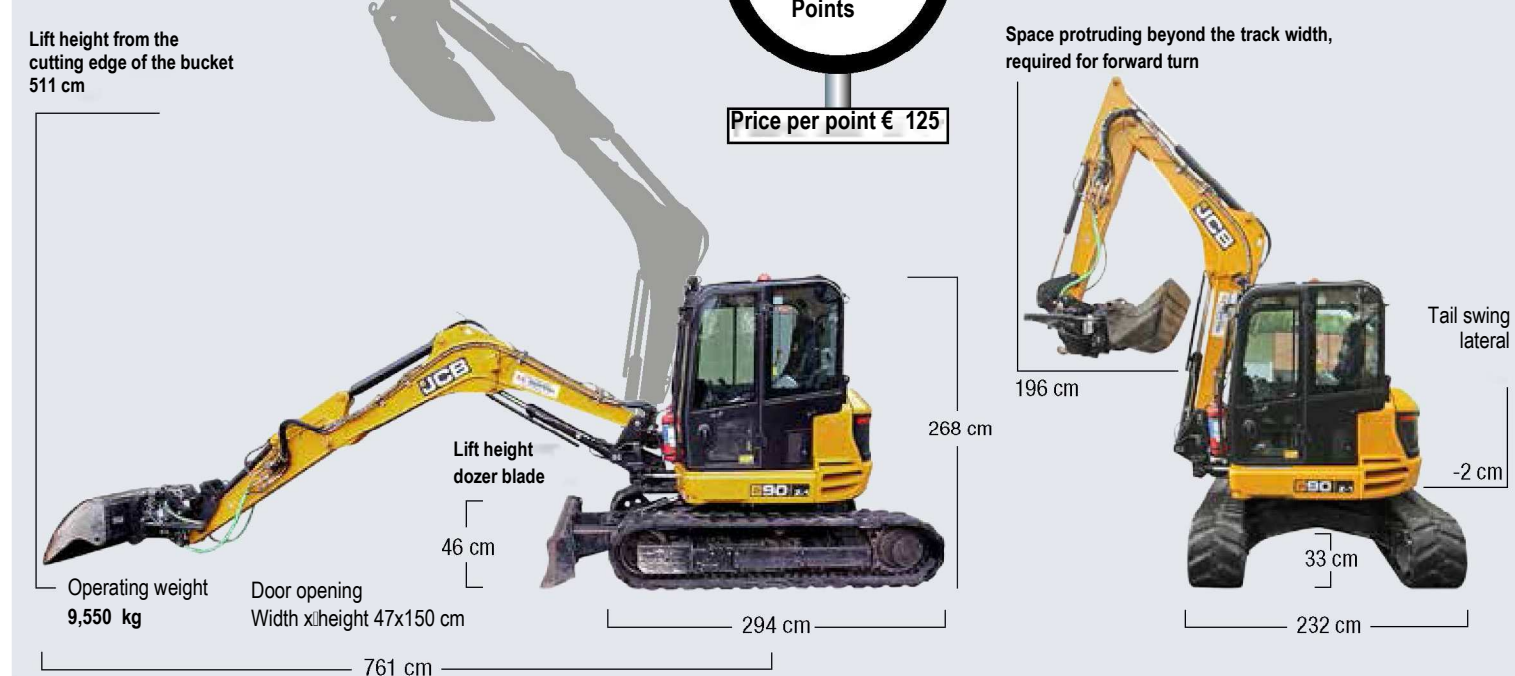


Standard equipment: Air-conditioning system, heated and air-cushioned seat, radio, LED work lights, roof-mounted work lights, engine pre-heater
Additional options of the test machine: Steelwrist X12, central lubrication system

Price of the test machine: €82,100 + VAT 24% (*The price does not include the tilt rotator, the buckets and the central lubrication system)

659
Points

Price per point € 125



Takeuchi TB280FR For tight spaces

The winner of the previous excavator comparison, the Takeuchi, did not quite make it into the top group in this test. It did not manage to finish higher because of its test operator assessment rating. The hydraulics of this brand are typically soft and smooth, but this time the control seemed to snag a little. As regards the technical points, there were deductions for the tractive force of the dipper stick and the lift capacity, on the other hand, the machine scored highly for the tractive force of the undercarriage and the travel speed. Also, the view from the operator's cab, when the boom was in the home position, and the function of the air-conditioning system were among the best in the comparison overall.

The Takeuchi test machine had the laterally displaceable boom which is characteristic of this brand. The excavator arm also folds together really well, meaning that the required space for a forward turn was by far the smallest in the comparison group. The difference from the largest required space was a full 132 cm. In addition, the transport height is below the rest of the comparison because the excavator arm folded lower than the cabin.

The boom displacement mechanism is under the operator's cab, which is why the accelerator pedals are positioned very high, which in turn makes it difficult to operate them.

The space into which the operator's seat can be pushed backwards is too short for larger operators. Ergonomic working is also hampered by the high fixed armrests which, even in the lowest position, are too high. The operator's cab is also relatively loud.

The tail swing of the Takeuchi is one of the smallest in the test. Therefore, compromises also had to be made in serviceability, because the battery is recessed in a very narrow space in the depths of the tail. The engine is otherwise installed pretty deep in the machine. However, you can get to the pump and the valve unit by tipping the operator's cab forward.

Praise & criticism

+ Performance efficiency of the undercarriage
Fuel consumption
Space required for turn

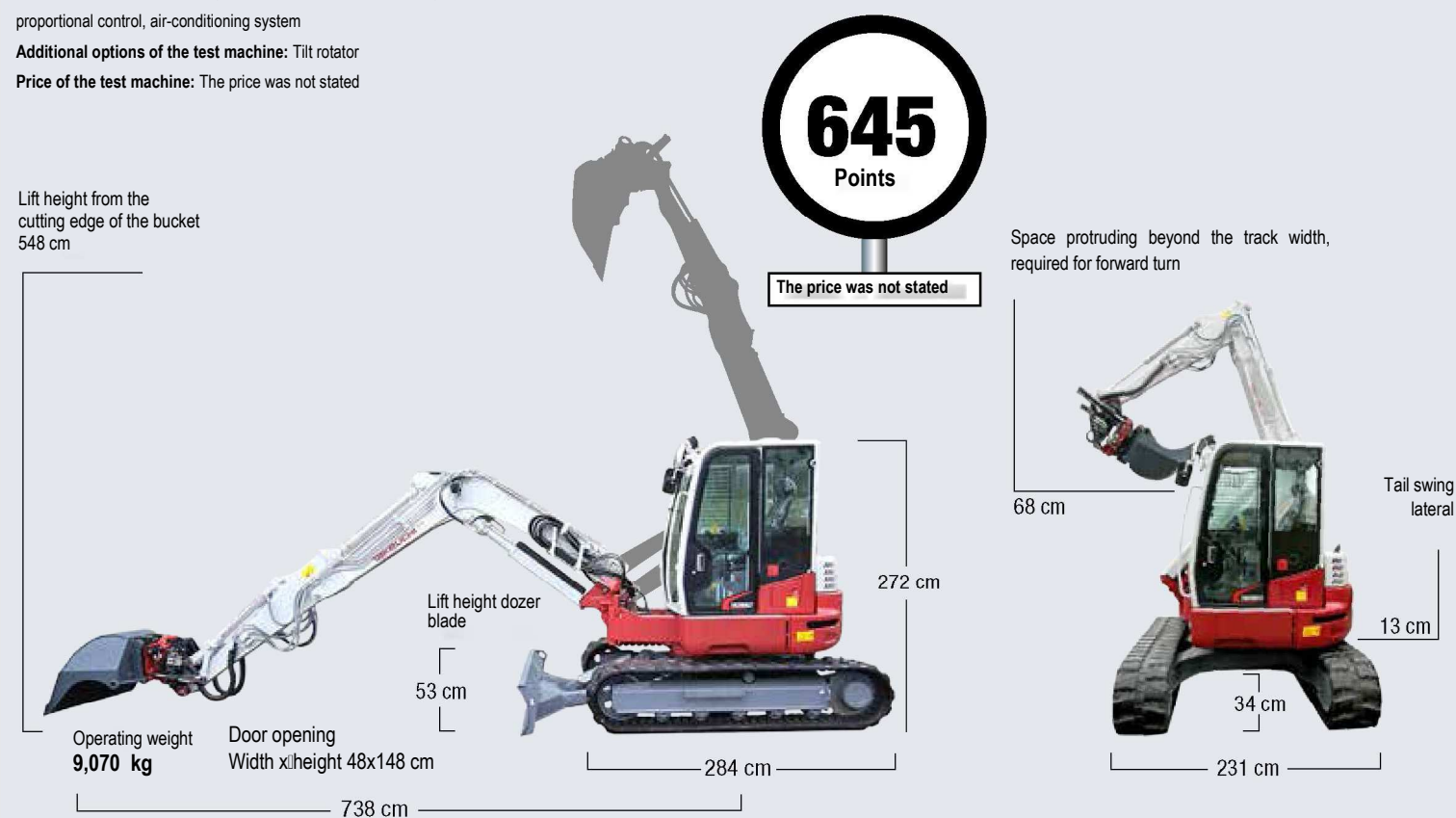
- Loud cabin
Lift capacity
Extremely high accelerator pedals



Standard equipment: Laterally displaceable boom, additional hydraulics with proportional control, air-conditioning system

Additional options of the test machine: Tilt rotator

Price of the test machine: The price was not stated



ECM ES85 Robust powerhouse

ECM excavators have also been sold under the Eurocomach brand. The latter is the main brand of the Italian manufacturer, but due to the import situation, only ECM machines can be found in Finland at the moment. The only difference is in the colour, because the basic colour of the ECM is white and the Eurocomach is red.

The ECM won in technical points thanks to its particularly strong hydraulics, but it came lower in the overall standings due to the test operator assessment points. Apart from the swing power, the machine came top in all power measurements. The undercarriage proved particularly stable, as the tractive force was by far the largest and the drive the fastest. There were further points for the zero tail, as the tail remains within the track width during the turn.

In the prospectus, the operating weight of the machine is given as 8,300 kilos. However, for the machine equipped with the steel tracks with rubber pads and the tilt rotator, the scale showed an operating weight of over 10,000 kilograms, including 70 kilograms for the operator. In contrast to the boom model requested in the test invitation, the ECM had a fixed boom. Because of the missing swivel joint, the centre of gravity was closer to the middle, which together with the large weight made the ECM very stable.

Because of the boom variant, however, the range was then the lowest by far.

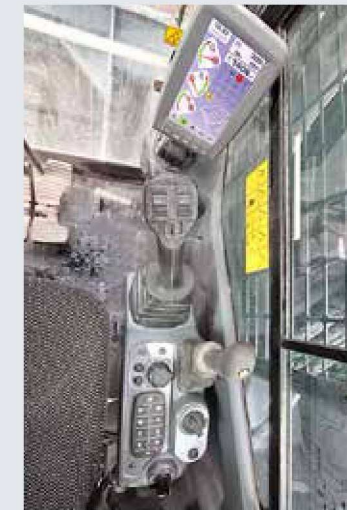
The compact dimensions come at the cost of poorer serviceability and repairability. For example, refilling oil or replacing filters is difficult because you have to go behind different hoses. You also have to unscrew some plates to get to the battery.

The view from the ECM operator's cab is also not the best. For example, the view to the right and to the rear is poor. Point deductions were also made for the weak accelerator pedals, the complicated display and the complicated air-conditioning system control.

Praise & criticism

+ Especially powerful hydraulics
Fast driving skills
No tail swing

- Significantly larger operating weight than indicated.
Complicated display and complicated air-conditioning system control.
Tight engine compartment

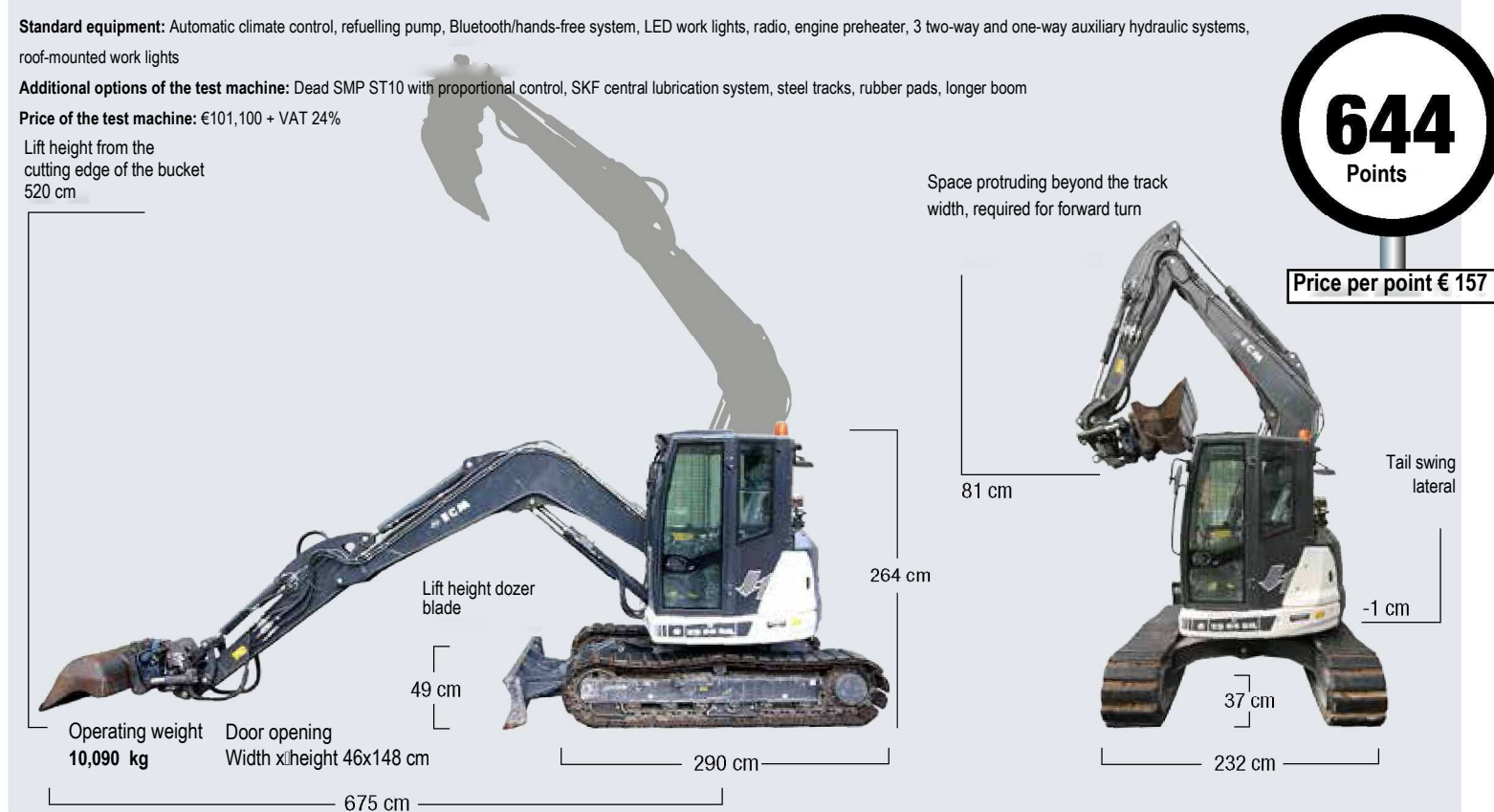


Standard equipment: Automatic climate control, refuelling pump, Bluetooth/hands-free system, LED work lights, radio, engine preheater, 3 two-way and one-way auxiliary hydraulic systems, roof-mounted work lights

Additional options of the test machine: Dead SMP ST10 with proportional control, SKF central lubrication system, steel tracks, rubber pads, longer boom

Price of the test machine: €101,100 + VAT 24%

Lift height from the cutting edge of the bucket: 520 cm



Bobcat E85

Solid digging

The Bobcat E85 is mid-range in the Doosan Infracore range because the same machine is sold as both Doosan and Bobcat. It is a relatively old model because the initial release was in 2013.

The test machine had a longer dipper stick and a larger counterweight. The range was also perceived as very good. The Bobcat's hydraulics were still described as a bit complicated, and the joysticks, which were too stiff, were unhelpful. Also, during driving, the function of the hydraulics left much to be desired. On the other hand, the switching button for activating the swivel joint was judged to be a successful solution, since no foot pedal had to be actuated; there was no foot pedal in the machine anyway. In terms of the tipping load measurements, the values of the Bobcat were at a good standard.

The performance of the Bobcat air-conditioning system was clearly the weakest in the group, even though the system was maintained during the test. The machine was the only one with a cabin temperature which remained above 30 degrees at the end of the cooling test. The difference between this result and the best result was 7 degrees. The sound pressure level at maximum fan power and the sound power level of the machine, however, were among the lowest in the test.

The accessibility of the filters and daily checkpoints of the Bobcat is very good. For example, the forward-tilted operator's cab facilitates access to the valve unit. The battery is ingeniously positioned next to the boom. It is tempting to use the space remaining over it as a storage space, because with such small machines, space is precious. It would also be very easy to make a storage container to put in the space.

The functions of the liquid crystal display are versatile. As with larger machines, this allows you to keep an eye on maintenance intervals and fuel consumption.

Praise & criticism

+ Stability during digging
Lateral tipping load
Daily checks and positioning of the filters

- Air-conditioning system power
Driving and using the hydraulics at the same time is impossible
Pretty stiff joysticks



Standard equipment: 450 mm rubber tracks, air-conditioning system, 3 auxiliary hydraulic systems, radio, long dipper stick and larger counterweight, refuelling pump

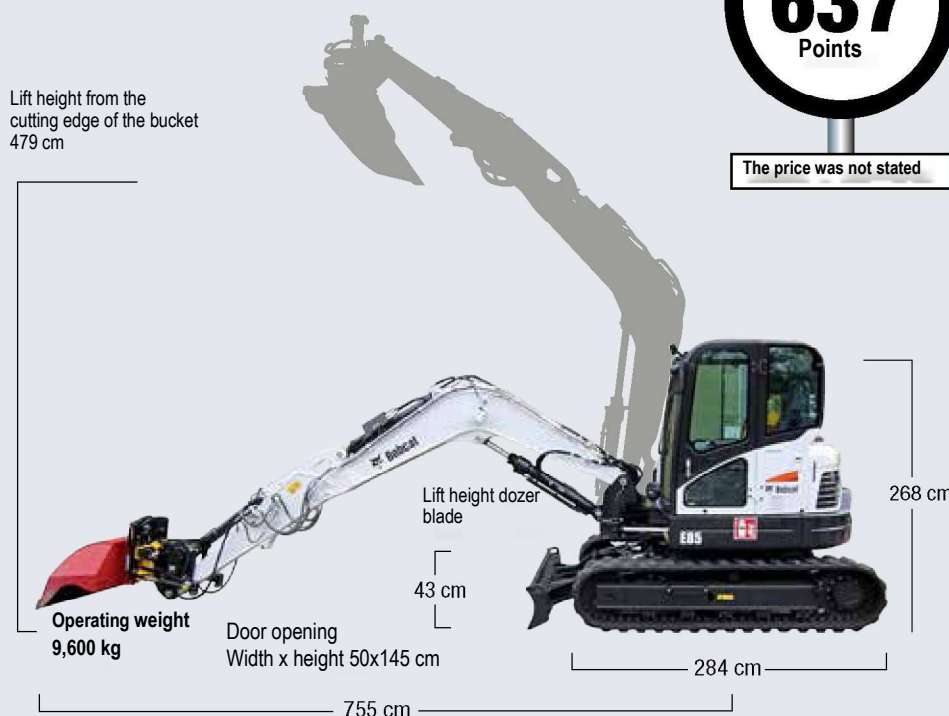
Additional options of the test machine: LED work lights, Engcon EC209 with grip clamp

Price of the test machine: The price was not stated

637
Points

The price was not stated

Space protruding beyond the track width, required for forward turn



Komatsu PC80MR-5

Reliable workhorse

With the measured operating weight of 8,595 kilos, the Komatsu is the lightest machine in the comparison. In principle, the brand would also have a slightly heavier machine to offer from another model series, the PC88MR-10, which, according to the official working weight of 8.5-9.13 tonnes, would have qualified for the test group.

Despite the change to the hinge model, the door opening of the Komatsu is small and larger operators have to awkwardly manoeuvre themselves into it. The operator's cab was one of the quietest in the comparison. For example, the decibel numbers were the lowest during idling.

The modestly sized display remains faithful to the blue brand colour. There are very few switches because most of the functions are controlled via the display. With the Eco display, you can dig in a more economical way.

Because of the comparatively short dipper stick, the range was not the best possible, but the tractive force of the boom was the best in the comparison. On the other hand, the longitudinal tipping load was poor compared to the other machines.

The hydraulics are not capable of handling several movements at the same time, especially when driving.

The joysticks trajectories were exceptionally large because, for some reason, extensions were fixed to the Engcon levers which are not actually necessary. Because of the extension, the rubber linings on the levers were also slightly too short. There was also slight criticism of the small, flap-shaped accelerator pedals.

Praise & criticism

+ Relatively quiet operator's cab
Breaking out force of dipper stick
Low shipping weight

- Tipping load in longitudinal direction, Narrow door opening
Driving and using the hydraulics at the same time is impossible



Standard equipment: Air-conditioning, underbody protection undercarriage, 2 x LED work lights on the boom, work lights on the roof: 2 x front, 1 x rear, radio, "Roadliner" tracks as an option on the test machine

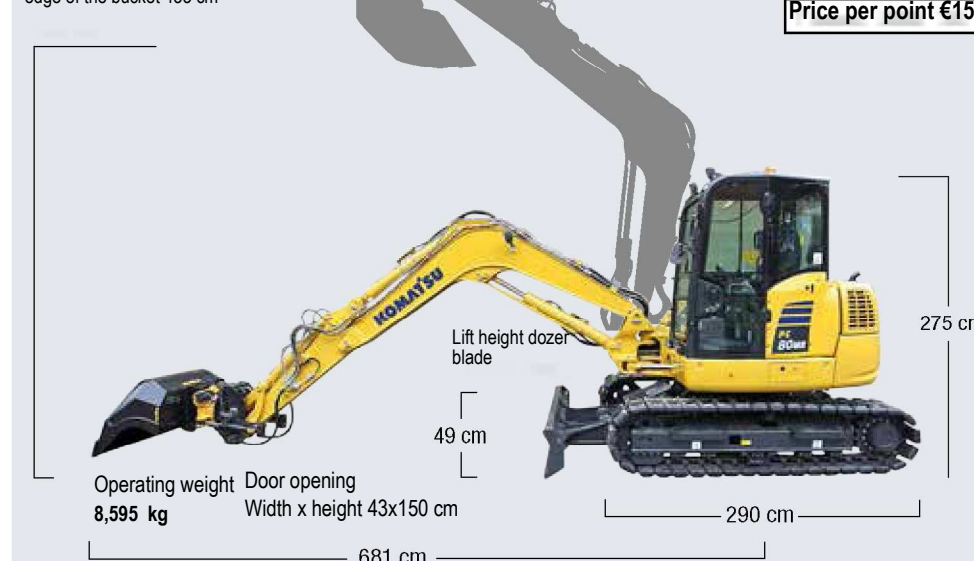
Additional options on the test machine: Engcon EC209

Price of the test machine: €95,000 + VAT 24%

615
Points

Price per point €155

Lift height from the cutting edge of the bucket 433 cm



Space protruding beyond the track width, required for forward turn

