



Testing and Adjusting

**303C CR and 303.5C CR Mini Hydraulic Excavators
Hydraulic System**

S/N: DMY1-UP



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303C CR and 303.5C CR Mini Hydraulic Excavators Hydraulic System

Media Number -REN9615-04

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General Testing and Adjusting Information

SMCS - 5050



WARNING

Sudden movement of the machine or release of oil under pressure can cause injury to persons on or near the machine.

To prevent possible injury, perform the procedure that follows before testing and adjusting the power train.



WARNING

Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the attachments have been lowered, oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

1. Move the machine to a smooth horizontal location. Move the machine away from other machines and personnel. Lower the blade to the ground. Lower the boom, the stick and the bucket to the ground. Stop the engine.

2. Permit only one operator on the machine. Keep all other personnel away from the machine or in the operator's view.
3. Put chocks in front of the tracks and behind the tracks.
4. Raise the blade for tests and adjustments. Properly support the blade. Raise the boom, the stick and the bucket for tests and adjustments. Properly support the boom, the stick and the bucket. The implement circuit has high oil pressure when the implements raise the front of the machine.

Note: Unless a system test requires the front of the machine off the ground, do not stop the engine with the front of the machine off the ground. Lower the machine to the ground and stop the engine.

5. During testing, keep personnel away from the rotating track and sprockets.
6. Relieve all hydraulic pressure before loosening a fitting, a hose or a component. Relieve all hydraulic pressure before tightening a fitting, a hose or a component. Relieve all hydraulic pressure before removing a fitting, a hose or a component. Relieve all hydraulic pressure before adjusting a fitting, a hose or a component.

During the diagnosis of the hydrostatic system, remember that correct oil flow and correct pressure are necessary for correct operation. The output of the pumps increases when engine speed increases. The output of the pumps decreases when engine speed decreases. Oil pressure is caused by resistance to the flow of oil.

When any test is made to the hydrostatic system, the hydraulic oil must be at normal temperature for operation. In order to increase the oil temperature, start the engine. Lift the blade. Turn the machine in both directions.

Before any tests are made, visually inspect the complete hydrostatic system and the implements. Check the hydrostatic system and the implements for leakage of oil. Check the hydrostatic system and the implements for parts that have damage.



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Visual Inspection

SMCS - 5050-040

A visual inspection of the system is the first step when you troubleshoot a problem. The inspection should be made with the engine off and the implements lowered to the ground.

1. Check the level of the oil in the hydraulic tank. Slowly loosen the fill/vent plug and release the pressure before the fill/vent plug is removed.
 2. Remove hydraulic filter elements and check for material that would give an indication of damage to a component.
 3. Inspect all lines and connections for damage or leaks.
 4. Inspect control linkages for bent components, broken components or damaged components.
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Hydraulic System Pressure - Release

SMCS - 4250-553-PX; 5050-553-PX



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Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the attachments have been lowered, oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

1. Lower all implements to the ground.
2. Shut off the engine.
3. Turn the ignition to the ON position. Place the console in the DOWN position. Move the control levers through the full range of travel. This will relieve any pressure that may be present in the pilot system.
4. Slowly loosen the hydraulic tank air breather cap in order to release the pressure.
5. Tighten the hydraulic tank air breather cap.
6. The pressure in the hydraulic system has now been released.



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Main Hydraulic Pump Air - Purge

SMCS - 5070-542-AI

When the main pumps have been serviced or the hydraulic oil has been replaced, remove the air from the hydraulic system. Remove the air from the hydraulic system in the following manner:

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting, and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat products.

Dispose of all fluids according to local regulations and mandates.



Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the work tools have been lowered to the ground, and the oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

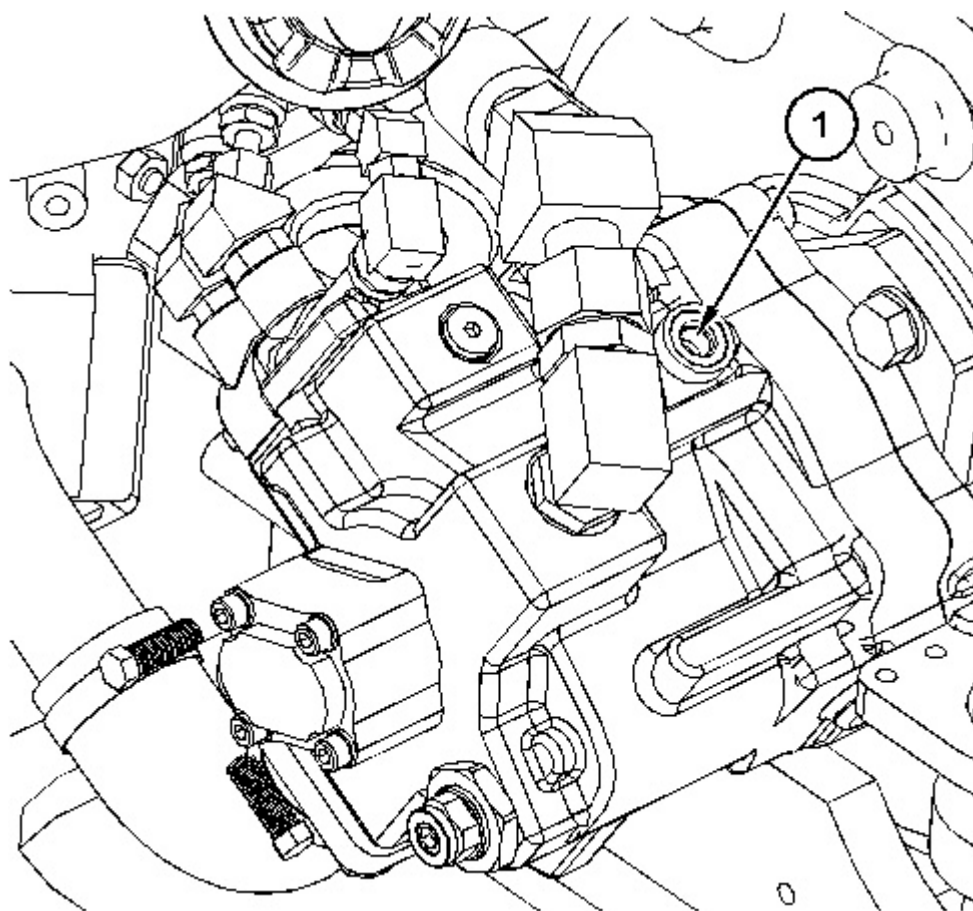


Illustration 1

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Main pump

(1) Vent Plug

1. While the engine is stopped, remove vent plug (1) from the top of the main pump housing.
2. Fill the main pumps with oil.
3. Inspect the O-Ring seal on vent plug (1). If the seal is damaged, replace the seal.
4. Install vent plug (1) in the pump housing.

NOTICE

To avoid system damage, make sure that the hydraulic pump is properly filled with hydraulic oil before start-up.

5. Start the engine.
 6. Heat the hydraulic oil to $55^{\circ} \pm 5^{\circ}\text{C}$ ($131^{\circ} \pm 9^{\circ}\text{F}$).
 7. Place the engine speed lever at the LOW IDLE position. Raise the boom and hold the boom in this position.
 8. Stop the engine. Slowly lower the boom until the bucket is on the ground. This action will pressurize the hydraulic tank.
 9. Slowly loosen vent plug (1) until oil begins to flow from the opening.
 10. Tighten the vent plug to the specified torque.
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Operational Checks

SMCS - 5050-535

The operational checks can be used to find leakage in the system and components that are not functioning correctly. The speed of rod movement or the torque on a motor can be used to check the condition of the cylinders, motors and the pumps.

Perform the following operational checks in order to troubleshoot problems concerning the hydraulic circuits and components on the machine.

- Testing and Adjusting, "Engine Performance - Test (Engine Speed)"
- Testing and Adjusting, "Travel on Level Ground - Test"
- Testing and Adjusting, "Travel on Level Ground - Test (Optional Test)"
- Testing and Adjusting, "Machine Drift on a Slope - Check"
- Testing and Adjusting, "Swing Speed and Overswing on Level Ground - Check"
- Testing and Adjusting, "Swing Speed and Swing Drift on a Slope - Check"
- Testing and Adjusting, "Cylinder Drift - Check"
- Testing and Adjusting, "Cylinder Speed - Check"

The specifications that are listed in tables for the operational checks are calculated average values. The values will vary due to the configuration of the machine and engine speed.



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Engine Performance - Test - Engine Speed

SMCS - 1000-081

Table 1

Required Tools		
Part Number	Description	Qty
1U-6602	Photo-Tachometer	1

1. Position the machine on level ground.
2. Stop the engine.
3. Install a piece of reflective tape on the fan or a pulley on the engine.
4. Start the engine.
5. Increase the hydraulic oil temperature to $55^{\circ} \pm 5^{\circ}\text{C}$ ($131^{\circ} \pm 9^{\circ}\text{F}$).
6. Read the engine speed display (rpm) on the photo-tachometer. Refer to Table 2 for the specifications for engine speed at the desired engine operation.

Table 2

Engine Speed		
Item	Specification	
	303C CR	303.5C CR
High Idle ⁽¹⁾	2400 - 2500 rpm	2500 - 2600 rpm
Low Idle ⁽¹⁾	1130 - 1230 rpm	1150 - 1250 rpm
Auto Idle ⁽¹⁾	1130 - 1230 rpm	1150 - 1250 rpm
Engine speed with load ⁽²⁾	2300 rpm ⁽³⁾	2400 rpm ⁽³⁾

- (1) No load
 - (2) Pressure is relieved from both pumps.
 - (3) Minimum RPM
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Travel on Level Ground - Test

SMCS - 4351-081

Note: The engine speed and/or the machine configuration that is used during this test can affect the results of this test. Refer to Testing and Adjusting, "Engine Performance - Test (Engine Speed)" for the engine speed that was used for this test. Refer to Testing and Adjusting, "Operational Checks" for the machine configurations that were used for this test.

Note: The relief valve pressure settings must be set to the relief valve pressure specification before performing this operational check. Refer to Testing and Adjusting, "Specifications".

Table 1

Required Tools	
Description	Qty
Tape Measure	1
Stopwatch	1

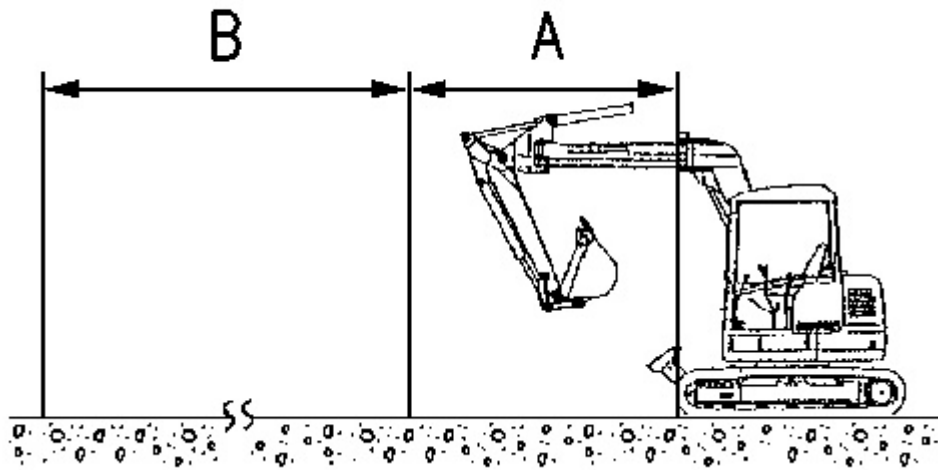


Illustration 1

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(A) Preliminary run 10 m (32.8 ft)

(B) Travel distance 20 m (65.6 ft)

1. Travel distance must be at least 20 m (65.6 ft) long. Travel test ground must be hard and as level as possible.
2. Draw a 20 m (65.6 ft) straight line on travel test ground as a reference line.
3. Start the engine.
4. Place the engine speed dial in the HIGH IDLE position.
5. Increase the hydraulic oil temperature to $55^{\circ} \pm 5^{\circ}\text{C}$ ($131^{\circ} \pm 9^{\circ}\text{F}$).
6. The bucket should be empty.
7. Position the machine so that one track is parallel with the reference line. Position the machine for the travel test. Refer to Illustration 1.
8. Place the travel speed control switch on the HIGH position.
9. Move the machine by operating both travel levers at the same time.
10. The first 10 m (32.8 ft) are for a preliminary run. Measure the travel time that is required to travel the remaining 20 m (65.6 ft). Measure the time that is required in each direction.
11. Measure the travel deviation from the reference line.
12. Place the travel speed control switch on the LOW position and repeat Steps 9 through 11.

Table 2

Travel Speed and Drift for 303C CR

Travel Mode (Forward and Reverse)		Time to travel 20 m (65.6 ft) in seconds	Maximum Drift
Rubber Tracks	High	15.9 - 18.5	1000 mm (39.4 inch)
	Low	24.5 - 28.0	1000 mm (39.4 inch)
Steel Tracks	High	16.1 - 18.7	1000 mm (39.4 inch)
	Low	25.8 - 29.1	1000 mm (39.4 inch)

Table 3

Travel Speed and Drift for 303.5C CR			
Travel Mode (Forward and Reverse)		Time to travel 20 m (65.6 ft) in seconds	Maximum Drift
Rubber Tracks	High	14.0 - 16.0	1000 mm (39.4 inch)
	Low	23.4 - 25.4	1000 mm (39.4 inch)
Steel Tracks	High	14.6 - 16.6	1000 mm (39.4 inch)
	Low	25.4 - 27.4	1000 mm (39.4 inch)

Note: The maximum drift represents the travel deviation (distance) from the reference line.



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Travel on Level Ground - Test - Optional Test

SMCS - 4351-081

Note: When the procedure for the Travel on Level Ground cannot be performed, this test may be used as a substitute.

Note: The engine speed and/or the machine configuration that is used during this test can affect the results of this test. Refer to Testing and Adjusting, "Engine Performance - Test (Engine Speed)" for the engine speed that was used for this test. Refer to Testing and Adjusting, "Operational Checks" for the machine configurations that were used for this test.

Note: The relief valve pressure settings must be set to the relief valve pressure specification before performing this operational check. Refer to Testing and Adjusting, "Specifications".

Table 1

Required Tools	
Description	Qty
Stopwatch	1

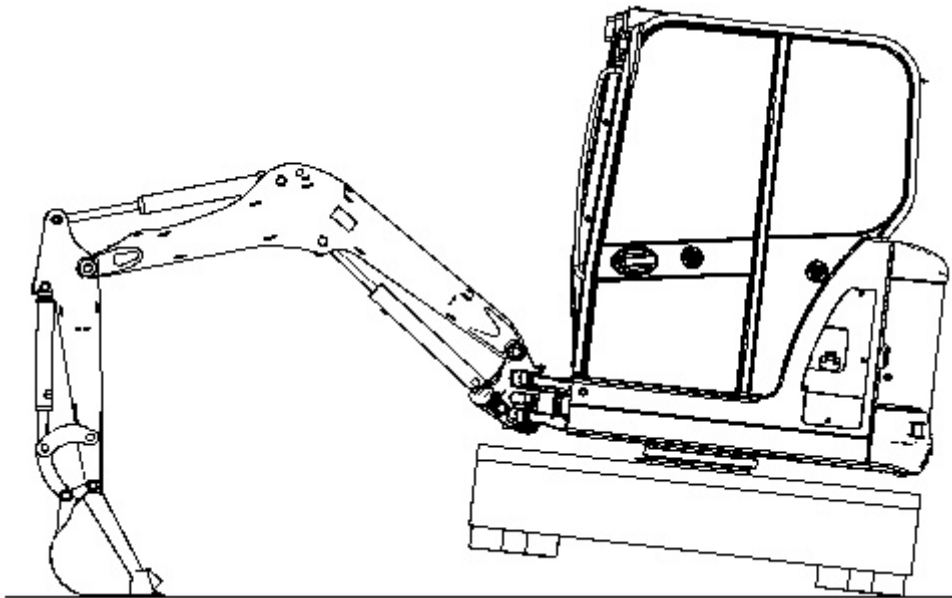


Illustration 1

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1. Start the engine.
2. Position the machine on level ground.
3. Increase the hydraulic oil temperature to $55^{\circ} \pm 5^{\circ}\text{C}$ ($131^{\circ} \pm 9^{\circ}\text{F}$).
4. Raise a track off the ground. Refer to Illustration 1.
5. Put a mark on a shoe of the raised track.
6. Place the engine speed dial in the HIGH IDLE position.
7. Place the travel speed control switch in HIGH position.
8. Move the travel lever of the raised track to full travel position.
9. Measure the time that is required for the raised track to make three complete revolutions. Measure the time that is required in each direction.
10. Place the travel speed control switch in the LOW position and repeat Steps 8 through 9.

Table 2

Time For Three Revolutions (time in seconds) Standard Undercarriage			
Travel Mode (Forward and Reverse)		303C CR	303.5C CR
Rubber Track	HIGH	10.5 - 12.5	9.6 - 11.6
	LOW	17.2 - 20.4	16.1 - 19.1
Steel Track	HIGH	10.6 - 12.6	10.3 - 12.3
	LOW	17.6 - 20.6	17.6 - 20.6



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Machine Drift on a Slope - Check

SMCS - 4095-535

Measuring the amount of drift of the machine on a slope will determine if there is a need to check the travel brake.

Note: The engine speed and/or the machine configuration that is used during this test can affect the results of this test. Refer to Testing and Adjusting, "Engine Performance - Test (Engine Speed)" for the engine speed that was used for this test. Refer to Testing and Adjusting, "Operational Checks" for the machine configurations that were used for this test.

Note: The relief valve pressure settings must be set to the relief valve pressure specification before performing this operational check. Refer to Testing and Adjusting, "Specifications".

Table 1

Required Tools	
Description	Qty
Tape Measure	1
Stopwatch	1
Scale 150 mm (6 inch)	1

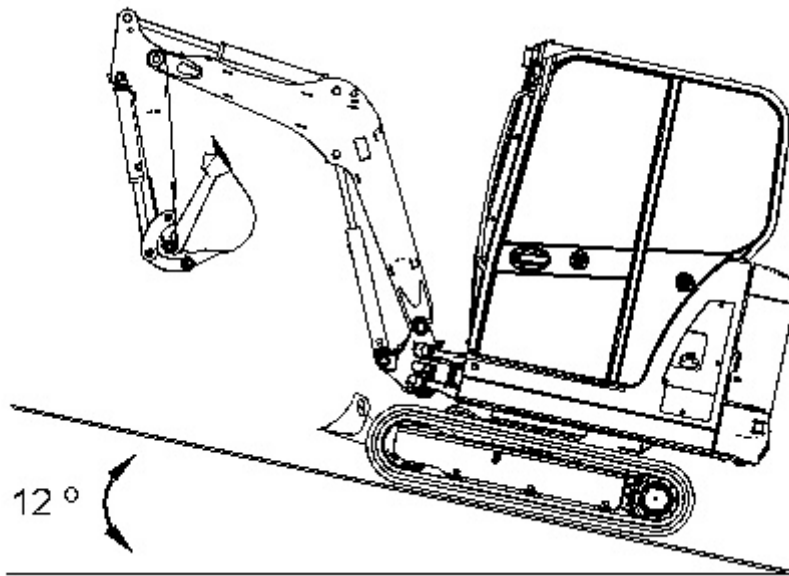


Illustration 1

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1. Place the machine on a slope of 12 degrees. The surface of the slope must be hard and smooth.
2. Position the implements, as shown. Refer to Illustration 1.
3. The bucket should be empty.
4. Fully extend the stick cylinder and the bucket cylinder.
5. If equipped, raise the blade.

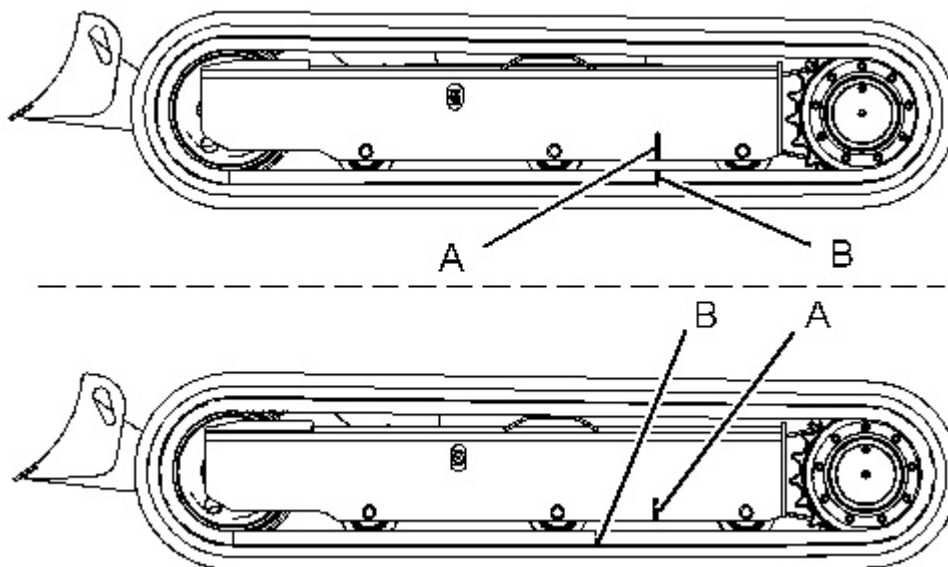


Illustration 2

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- (A) Mark on roller frame
 - (B) Mark on track
6. To indicate the relative position of the machine to the slope, put a mark on both the roller frame and the track.
 7. Stop the engine.
 8. Measure the machine movement on the slope after 3 minutes.

Table 2

Drift	
Item	Specification
Maximum drift	0 mm (0 inch)

Diesel Engines

ABS	Agco-Sisu
Akasaka	Baudouin
BMW	Bukh
Caterpillar	CHN 25/34
Cummins	Daihatsu
Detroit	Deutz
Doosan-Daewoo	Fiat
Ford	GE
Grenaa	Guascor
Hanshin	Hatz
Hino	Honda
Hyundai	Isotta
Isuzu	Iveco
John-Deere	Kelvin
Kioti	Komatsu
Kubota	Liebherr
Lister	Lombardini
MAK	MAN B&W
Mercedes	Mercruiser
Mirrlees BS	Mitsubishi
MTU	MWM
Niigata	Paxman
Perkins	Pielstick
Rolls / Bergen	Ruggerini
Ruston	Scania
Shibaura	Sisu-Valmet
SKL	Smit-Bolnes
Sole	Stork
VM-Motori	Volvo
Volvo Penta	Westerbeke
Wichmann	Yanmar

Machinery

ABG	Airman
Akerman	Ammann
Astra	Atlas Copco
Atlas Weyha.	Atlet
Bell	Bendi
Bigjoe	Bobcat
Bomag	BT
Carelift	Case
Caterpillar	Cesab
Challenger	Champion
Claas	Clark
Combilift	Crown
Daewoo-Doosan	Demag
Deutz-Fahr	Dressta

Machinery

Drott	Dynapack
Extec	Faun
Fendt	Fiat
Fiatallis	Flexicoil
Furukawa	Gehl
Genie	Grove-gmk
Halla	Hamm
Hangcha	Hanix
Hanomag	Hartl
Haulpack	Hiab
Hidromek	Hino truck
Hitachi	Hyster
Hyundai	IHI
Ingersoll-rand	JCB
JLG	John-Deere
Jungheinrich	Kalmar
Kato	Kioti
Kleeman	Kobelco
Komatsu	Kramer
Kubota	Lamborghini
Landini	Liebherr
Linde	Link-belt
Manitou	Massey-Ferg.
Mccormick	MDI-Yutani
Mitsubishi	Moxy
Mustang	Neusson
New-Holland	Nichiyu
Nissan	OK
OM-Pimespo	others-tech
Pel-Job	PH-mining
Poclain	Powerscreen
Same	Samsung
Sandvik	Scania
Schaefer	Schramm
Sennebogen	Shangli
Shibaura	Steiger
Steinbock	Steyr
Still	Sumitomo
Super-pac	Tadano
Takeuchi	TCM
Terex	Toyota
Valpadana	Venieri
Versatile	Vogele
Volvo	Weidemann
Wirtgen	Yale
YAM	Yanmar