# Service Manual

# JS 100 Series Tracked Excavators T4i





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World Class
Customer Support

# Noise Emissions

## General

To assist in compliance with European Directives 2000/14/EC and 2005/88/EC, the noise data values for this type of machine have been provided on the following page(s) and may be used for the assessment of risks to exposure from noise.

The noise data values shown only apply to CE marked machines.

For information relating to this machine when used with other JCB approved attachments, please refer to the literature accompanying the attachments.

**Table 1. Definition of terms**

| Term | Definition | Notes |
|---|---|---|
| LpA | A-weighted sound pressure level measured at the operator's station. | Determined in accordance with the test method defined in ISO 6396 and the dynamic test conditions defined on 2000/14/EC. |
| LwA | Equivalent A-weighted sound power level emitted by the machine. | Guaranteed equivalent sound power (external noise) determined in accordance with the dynamic test conditions defined in 2000/14/EC. |

## Noise Data



(For: JS115, JS130, JS145,)

**Table 1. All Machines**

| Engine rating[1] | LpA | LwA |
|---|---|---|
| 74kW | 72 | 100 |
| 81kW | 72 | 100 |

*(1) Net installed power.*

(For: JS160, JS180, JS190)

**Table 2.**

| Engine rating[1] | LpA | LwA |
|---|---|---|
| 93kW | 71 | 100 |
| 97kW | 73 | 100 |

*(1) Net installed power.*

(For: JS200, JS210, JS220, JS235)

**Table 3.**

| Engine rating[1] | LpA | LwA |
|---|---|---|
| 129kW | 73 | 102 |

*(1) Net installed power.*

# Vibration Emissions

## General

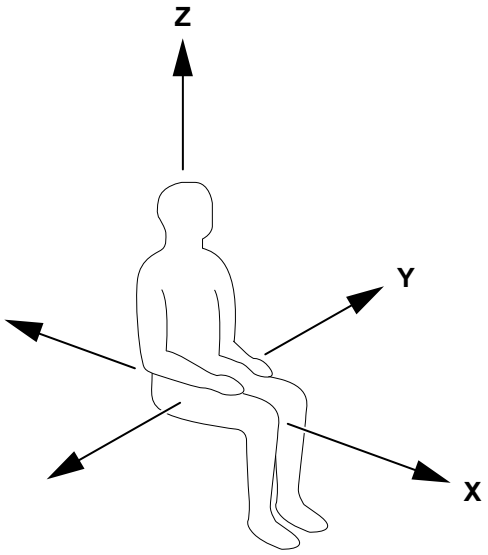
To assist in compliance with the European Directive 2002/44/EC, the duty specific vibration emission values for this machine type have been provided on the following page(s) and may be used for the assessment of risks to exposure from vibration.

Unless otherwise indicated for a specific operating condition, the vibration values are calculated with the machine equipped with the standard attachments (for example bucket, shovel, fork, etc.) for the respective operating condition.

The vibration values are calculated from measurements in three perpendicular axes (X, Y and Z). The highest weighted (RMS (Root Mean Square)) value is used to specify the vibration emission.

The axis upon which the highest weighted (RMS) value occurs is shown on the vibration chart for each of the machine operating duties, see dominant axis (X, Y or Z).

**Figure 362.**




### Exposure to Vibration

Exposure to vibration can be minimised through:

- Selection of the correct size and capacity of machine, equipment and attachments for a particular application
- Use of a machine equipped with an appropriate seat, keeping the seat maintained and adjusted
- Checks to make sure that the machine is correctly maintained, reporting and correcting any faults
- Steering, braking, accelerating, shifting gears, moving the attachments and load smoothly
- Adjusting the machine speed and travel path to minimise the vibration level
- Keeping the terrain on worksites where the machine works and travels in good condition, removing any large rocks or obstacles and filling in any ditches and holes
- Choosing routes that avoid rough surfaces and, if this is not possible, drive more slowly to avoid bumping and jolting
- Travel over longer distances at an adjusted (medium) speed
- Avoiding bad postures, i.e. slumping in your seat, constantly leaning forward or sideways or driving with your back twisted.

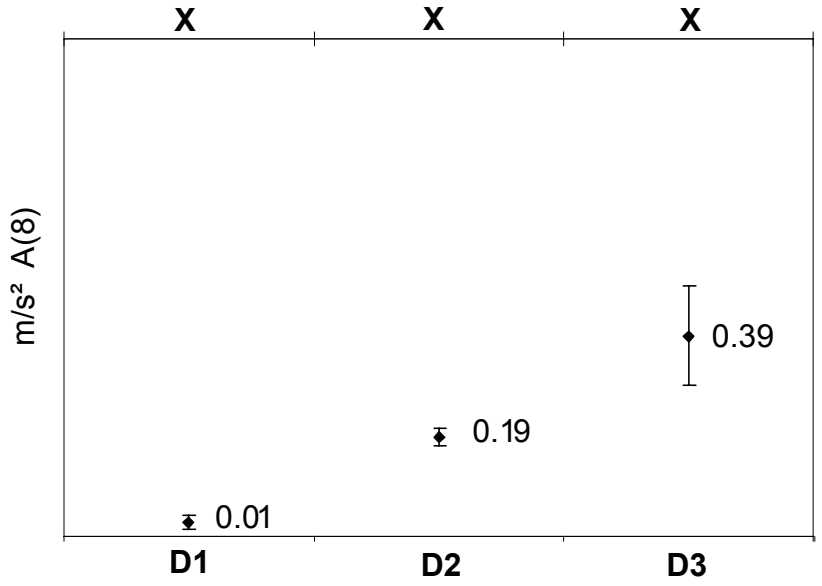
# Vibration Data



## (For: JS115, JS130, JS145,)

The whole-body vibration emission under representative operating conditions (according to the intended use) are shown.

**Figure 363.**




**X-Z** Dominant axis
**D1** Machine operating duty: Low idle
**D2** Machine operating duty: Excavating
**D3** Machine operating duty: Tracking (rough terrain)

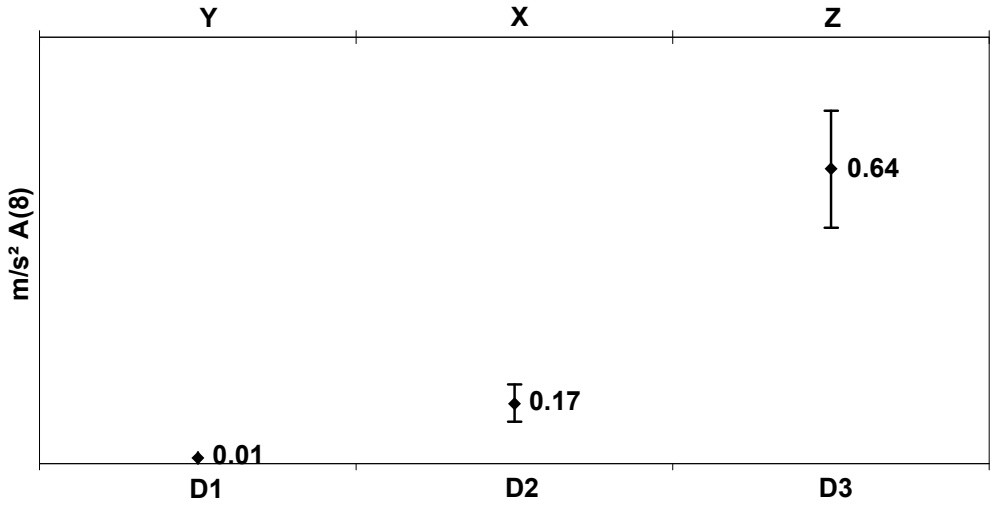
The whole-body vibration emission calculated in accordance with ISO 2631-1:1997 for this machine type is 0.19m/s² normalised to an 8h reference period [A(8)] and based upon a test cycle defined in SAE J1166.

The hand-arm vibration calculated in accordance with the dynamic test conditions defined in ISO 5349-2: 2001 does not exceed 2.5m/s².

The errors bars are due to variations in vibration emissions due to measurement uncertainty (50% in accordance with EN 12096:1997).

(For: JS160, JS180, JS190)

**Figure 364.**




**X-Z** Dominant axis
**D1** Machine operating duty: Low idle
**D2** Machine operating duty: Excavating
**D3** Machine operating duty: Tracking (rough terrain)

The whole-body vibration emission under representative operating conditions (according to the intended use) are shown. Refer to Figure 364.

The whole-body vibration emission calculated in accordance with ISO 2631-1:1997 for this machine type is 0.17m/s² normalised to an 8h reference period [A(8)] and based upon a test cycle defined in SAE J1166.

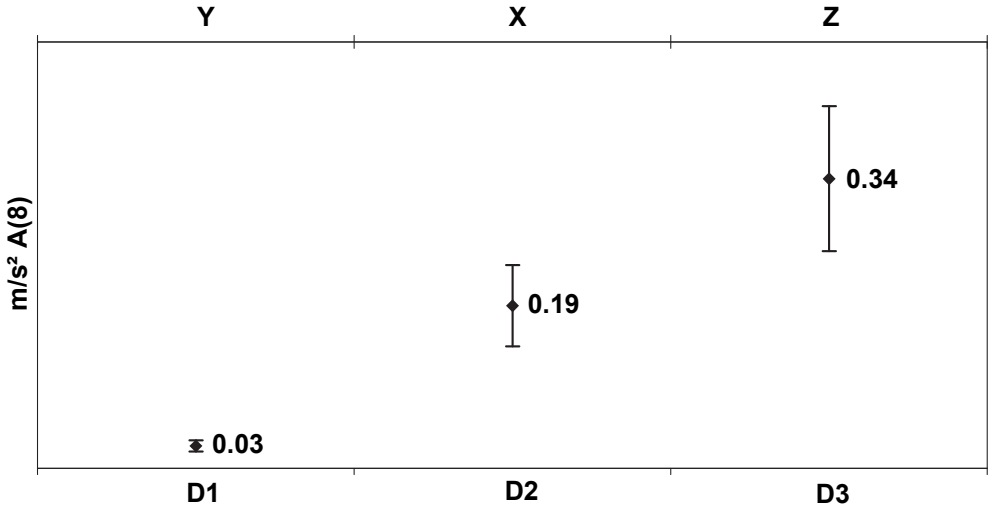
The hand-arm vibration calculated in accordance with the dynamic test conditions defined in ISO 5349-2: 2001 does not exceed 2.5m/s².

The errors bars are due to variations in vibration emissions due to measurement uncertainty (50% in accordance with EN 12096:1997).

(For: JS330)

The whole-body vibration emission under representative operating conditions (according to the intended use) are shown.

**Figure 365.**




**X-Z** Dominant axis
**D1** Machine operating duty: Low idle
**D2** Machine operating duty: Excavating
**D3** Machine operating duty: Tracking (rough terrain)

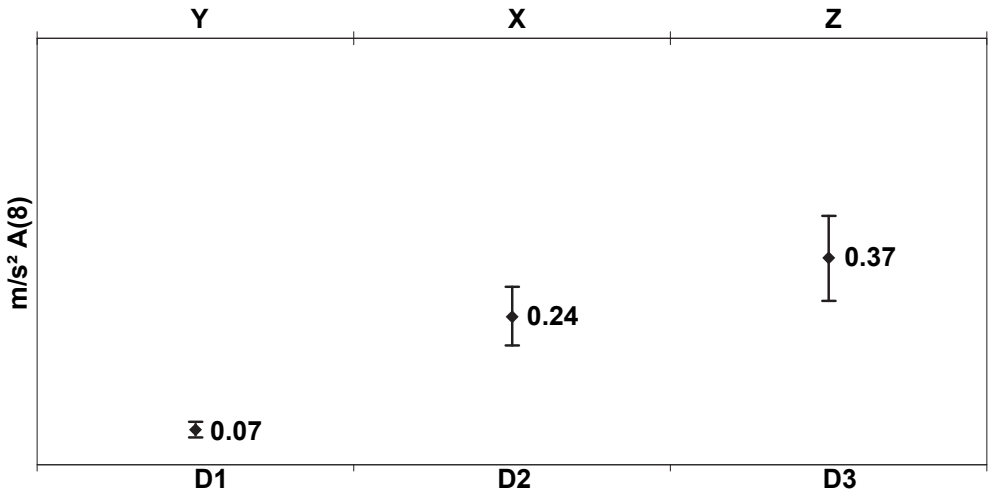
The whole-body vibration emission calculated in accordance with ISO 2631-1:1997 for this machine type is 0.19m/s² normalised to an 8h reference period [A(8)] and based upon a test cycle defined in SAE J1166.

The hand-arm vibration calculated in accordance with the dynamic test conditions defined in ISO 5349-2: 2001 does not exceed 2.5m/s².

The errors bars are due to variations in vibration emissions due to measurement uncertainty (50% in accordance with EN 12096:1997).

(For: JS200, JS210, JS220, JS235)

**Figure 366.**




**X-Z** Dominant axis
**D1** Machine operating duty: Low idle
**D2** Machine operating duty: Excavating
**D3** Machine operating duty: Tracking (rough terrain)

The whole-body vibration emission under representative operating conditions (according to the intended use) are shown. Refer to Figure 366.

The whole-body vibration emission calculated in accordance with ISO 2631-1:1997 for this machine type is 0.24m/s² normalised to an 8h reference period [A(8)] and based upon a test cycle defined in SAE J1166.

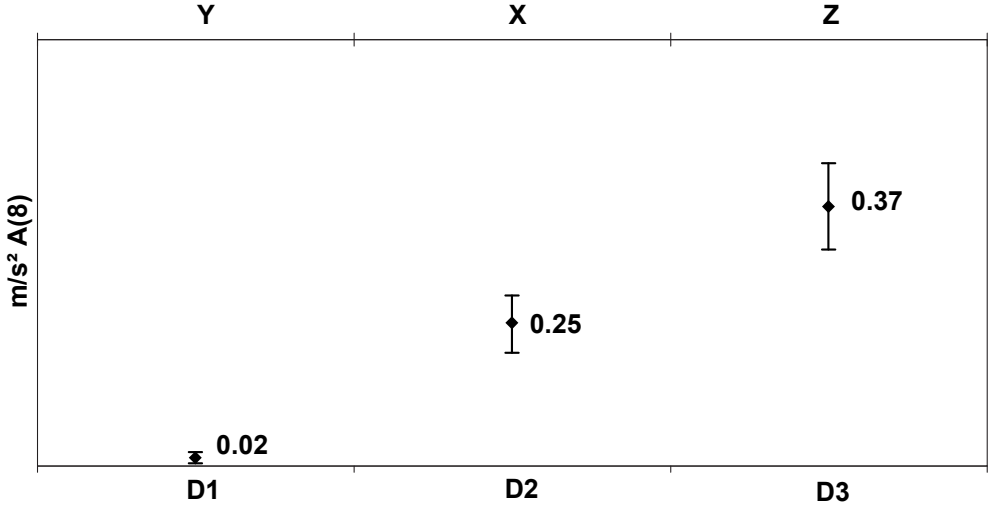
The hand-arm vibration calculated in accordance with the dynamic test conditions defined in ISO 5349-2: 2001 does not exceed 2.5m/s².

The errors bars are due to variations in vibration emissions due to measurement uncertainty (50% in accordance with EN 12096:1997).

(For: JS360)

The whole-body vibration emission under representative operating conditions (according to the intended use) are shown.

**Figure 367.**




**X-Z** Dominant axis
**D1** Machine operating duty: Low idle
**D2** Machine operating duty: Excavating
**D3** Machine operating duty: Tracking (rough terrain)

The whole-body vibration emission calculated in accordance with ISO 2631-1:1997 for this machine type is 0.25m/s² normalised to an 8h reference period [A(8)] and based upon a test cycle defined in SAE J1166.

The hand-arm vibration calculated in accordance with the dynamic test conditions defined in ISO 5349-2: 2001 does not exceed 2.5m/s².

The errors bars are due to variations in vibration emissions due to measurement uncertainty (50% in accordance with EN 12096:1997).

# Fluids, Lubricants and Capacities

## General



(For: JS115, JS130, JS145,)

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

**Table 1. Fluids, Lubricants and Capacities**

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| Fuel Tank | 253L | Diesel | - | - |
| Engine (Oil)[2] | 20.4L | Above -10°C (14°F): JCB Engine Oil EP 15W/40 | 4001/1805 | 20L |
| | | -20°C (-4°F) to 50°C (122°F): JCB Cold Climate Engine Oil EP 5W40 | 4001/2705 | 20L |
| Cooling System | 19.7L | JCB Antifreeze HP/Coolant | 4006/1120 | 20L |
| Track Gearbox (each) | 3.5L | JCB HD90 Gear Oil | 4001/0305 | 20L |
| Slew Gearbox | 2.2L | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Track Rollers and Idler Wheels | | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Recoil Spring Cylinder | | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Hydraulic System | 124L | JCB Hydraulic Fluid HP32-20°C (-4°F) to 15°C (59°F) | 4002/1024 | 200L |
| | | JCB Hydraulic Fluid HP46-10°C (14°F) to 30°C (86°F) | 4002/0803 | 200L |
| | | JCB Hydraulic Fluid HP680°C (32°F) to 40°C (104°F) | 4002/0701 | 200L |
| Slew Ring Bearings | 0.06kg | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Slew Ring Gear Teeth | 11kg | JCB Special HP Grease | 4003/2006 | 12.5kg |
| All Other Grease | As required | JCB Special HP Grease | 4003/2017 | 0.4kg |

*(1) For information about the different container sizes that are available (and their part numbers), contact your local JCB dealer.*
*(2) Do not use ordinary engine oil.*

(For: JS160, JS180, JS190)

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

**Table 2. Fluids, Lubricants and Capacities**

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| Fuel Tank | 253L | Diesel | - | - |
| Engine (Oil)[2] | 20.4L | -10°C (14°F) to 50°C (121.9°F): JCB Engine Oil EP 15W/40 | 4001/1805 | 20L |

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| | | -20°C (-4°F) to 50°C (122°F): JCB Cold Climate Engine Oil EP 5W40 | 4001/2705 | 20L |
| Cooling System | 19.7L | JCB Antifreeze HP/Coolant | 4006/1120 | 20L |
| Track Gearbox (each) | 4.4L | JCB HD90 Gear Oil | 4001/0301 | 5L |
| Slew Gearbox | 6L | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Track Rollers and Idler Wheels | | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Recoil Spring Cylinder | | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Hydraulic System | 142L | JCB Hydraulic Fluid HP32-20°C (-4°F) to 15°C (59°F) | 4002/1024 | 200L |
| | | JCB Hydraulic Fluid HP46-10°C (14°F) to 30°C (86°F) | 4002/0803 | 200L |
| | | JCB Hydraulic Fluid HP680°C (32°F) to 40°C (104°F) | 4002/0701 | 200L |
| Slew Ring Bearings | 0.075kg | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Slew Ring Gear Teeth | 11kg | JCB Special HP Grease | 4003/2006 | 12.5kg |
| All Other Grease | As required | JCB Special HP Grease | 4003/2006 | 12.5kg |

*(1) For information about the different container sizes that are available (and their part numbers), contact your local JCB dealer.*
*(2) Do not use ordinary engine oil.*

(For: JS330, JS360)

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

**Table 3. Fluids, Lubricants and Capacities**

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| Fuel Tank | 590L | Diesel | - | - |
| Engine (Oil)[2] | 25L | JCB Ultimate Performance 15W40 API CJ-4, ACEA E6, E9, JASO DH-2[3] | 4001/2905 | 20L |
| Cooling System | 45L | JCB Antifreeze HP/Coolant | 4006/1120 | 20L |
| Track Gearbox (each) | 5L | JCB HD90 Gear Oil | 4001/0301 | 5L |
| Slew Gearbox | 14.5L | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Track Rollers and Idler Wheels | | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Recoil Spring Cylinder | | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Hydraulic System | 430L | JCB Hydraulic Fluid HP32-20°C (-4°F) to 15°C (59°F) | 4002/1024 | 200L |
| | | JCB Hydraulic Fluid HP46-10°C (14°F) to 30°C (86°F) | 4002/0803 | 200L |
| | | JCB Hydraulic Fluid HP680°C (32°F) to 40°C (104°F) | 4002/0701 | 200L |
| Slew Ring Bearings | | JCB Special HP Grease | 4003/2017 | 0.4kg |

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| Slew Ring Gear Teeth | | JCB Special HP Grease | 4003/2017 | 0.4kg |
| All Other Grease | As required | JCB Special HP Grease | 4003/2006 | 12.5kg |

*(1) For information about the different container sizes that are available (and their part numbers), contact your local JCB dealer.*
*(2) Do not use ordinary engine oil.*
*(3) Failure to use oil of the correct specification will decrease the life of the engine and the diesel particulate filter.*

(For: JS200, JS210, JS220, JS235)

JCB recommend that you use the JCB lubricants shown as they have been verified by JCB for use on JCB machines. However, you could use other lubricants that are equivalent to the JCB standards and quality or offer the same machine component protection.

**Table 4. Fluids, Lubricants and Capacities**

| Item | Capacity | Fluid/Lubricant | JCB Part Number | Container Size [1] |
|---|---|---|---|---|
| Fuel Tank | 343L | Diesel | - | - |
| Engine (Oil)[2] | 17.5L | -10°C (14°F) to 50°C (121.9°F) JCB Engine Oil EP 15W/40 | 4001/1805 | 20L |
| | | -20°C (-4°F) to 50°C (122°F): JCB Cold Climate Engine Oil EP 5W40 | 4001/2705 | 20L |
| Cooling System | 28L | JCB Antifreeze HP/Coolant | 4006/1120 | 20L |
| Track Gearbox (each) | 4.7L | JCB HD90 Gear Oil | 4001/0301 | 5L |
| Slew Gearbox | 5L | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Track Rollers and Idler Wheels | | JCB HD90 Gear Oil | 4000/0305 | 20L |
| Recoil Spring Cylinder | | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Hydraulic System | 200L | JCB Hydraulic Fluid HP32-20°C (-4°F) to 15°C (59°F) | 4002/1024 | 200L |
| | | JCB Hydraulic Fluid HP46-10°C (14°F) to 30°C (86°F) | 4002/0803 | 200L |
| | | JCB Hydraulic Fluid HP680°C (32°F) to 40°C (104°F) | 4002/0701 | 200L |
| Slew Ring Bearings | 0.1kg | JCB Special HP Grease | 4003/2017 | 0.4kg |
| Slew Ring Gear Teeth | 17kg | JCB Special HP Grease | 4003/2006 | 12.5kg |
| All Other Grease | As required | JCB Special HP Grease | 4003/2006 | 12.5kg |

*(1) For information about the different container sizes that are available (and their part numbers), contact your local JCB dealer.*
*(2) Do not use ordinary engine oil.*

# Fuel



(For: JS115, JS130, JS145, JS160, JS180, JS190, JS200, JS210, JS220, JS235,)

## Acceptable and Unacceptable Fuels

⚠ **Notice:** No warranty liability whatsoever will be accepted for failure of fuel injection equipment where the failure is attributed to the quality and grade of the fuel used.

**Warning!** Do not use petrol in this machine. Do not mix petrol with the diesel fuel. In storage tanks the petrol will rise to the top and form flammable vapours.

## Fuel Groups

The major world fuels standards are divided into four categories. Those that are fully accepted as suitable fuels, those that are acceptable from a "warranty" point of view, but may have undesirable affects on the expected life of the engine performance changes from original specification, those that will lead to reduce the expected life, and lastly those that are viewed as unacceptable for use (fuels shown on the same line as each other are considered equivalents).

The lists below are not exhaustive of all diesel fuel standards encountered in the marketplace. If comment is required on the suitability of fuel standards not on the list, requests with, if possible, specification details showing at least the key characteristics described above should be forwarded to JCB Service for assessment and comment.

**Table 1. Group 1**

| Fuel | Advice | Service Requirements |
|---|---|---|
| EN590 Diesel fuel types - Auto/C0/ C1/C2/C3/C4 | Preferred and may be used with no restrictions or conditions. | For fuel with unspecified parameters, EN590 values apply. Fuel grades within each standard must be appropriate to the ambient temperature. The appropriate level of fuel cleanliness at the FIE inlet after filtration has to be ensured by the customer. |
| BS2869 Class A2 | | |
| ASTM D975-076 2-D, US DF1, US DF2, US DFA | | |
| JIS K2204 Grades 1, 2, 3 and Special Grade 3 | | |

*(1) See your JCB dealer for advice on service requirements.*

**Table 2. Group 2**

| Fuel | Advice | Service Requirements |
|---|---|---|
| Group1 fuels with HFFR WSD in the range 460 to 520 | Not preferred and may be used but may lead to reduced FIE life and / or loss of performance. | |
| ASTM D975-91 Class 1-1DA | | |
| B20 Biodiesels can cause serious problems for engines. JCB Ecomax Stage 3b / Tier 4i engines have been developed to run with biodiesels up to 20 mix (B20), but NOT with higher biodiesel proportion. The biodiesel content of this mix must be to ASTM D6751, DIN 51606, or ISO 14214 standards. Using a B20 blend of biodiesel requires caution and additional servicing of the engine is required.(1) | | The Ecomax dealer, or JCB Power Systems Applications department, should be consulted for further guidance. Biodiesel is very problematic to store; fuel in storage has to be very carefully managed to ensure that it does not deteriorate during this period. No warranty liability will be accepted for failure of fuel injection equipment where the failure is attributed to the quality and grade of the fuel used. |

*(1) See your JCB dealer for advice on service requirements.*

**Table 3. Group 3**

| Fuel | Advice |
|---|---|
| AVTUR FS11 (NATO F34, JP8, MIL T83133, DEF STAN 91-87, DERD 2463) | Not preferred and may be used only with appropriate additives and will lead to reduced FIE life and / or loss of performance. |
| AVCAT FS11 (NATO F44, JP5, MIL T5624, DERD 2452, AVTOR)) | |
| JET A1 (NATO F35, DEF STAN 91-91, DERD 2494) | |
| AVCAT (NATO F43, JP5 without additives) | |
| JET A (ASTM D1655) | |
| ASTM D3699 Kerosene | |
| JP7 (MIL T38219 XF63) | |
| NATO F63 | |

*(1) See your JCB dealer for advice on service requirements.*

**Table 4. Group 4**

| Fuel | Advice |
|---|---|
| Unmodified Vegetable Oils and Biodiesels over 20concentration | Unacceptable |

*(1) See your JCB dealer for advice on service requirements.*

**Additives**

The additives listed below are advertised as being suitable for bringing the lubricity levels of kerosene/low sulphur fuels up to those of diesel fuels.

These products are given as examples only. The information is derived from the manufacturers data. The products are not recommended or endorsed by JCB. Contact your JCB dealer for further advice.

- Elf 2S 1750. Dosage 1000-1500 ppm (0.1% to 0.15%), specifically for Indian Superior Kerosene (SKO) but may be applicable to other fuels.
- Lubrizol 539N. Dosage (on Swedish low sulphur fuel) 250 ppm.
- Paradyne 7505 (from Infineum). Dosage 500 ppm (0.05%).

These products are given as examples only. The information is derived from the manufacturers data. The products are not recommended or endorsed by JCB.

**Service Requirements for use of B20 Biodiesel**

- The engine oil must be a grade CH4 as minimum specification.
- Do not leave unused B20 biodiesel in the fuel tank for extended periods (top up each day).
- Make sure that 1 in 5 fuel tank fills use standard diesel to EN590 specification, this will help to prevent 'gumming'.
- Make sure regular oil sampling is completed (look for excessive unburnt fuel content, water or wear particles.
- Change the engine oil and filter more frequently (as a minimum half the recommended intervals), or as indicated by oil sampling.
- Change the fuel filters more frequently (as a minimum half the recommended intervals), or if there are engine performance related issues..
- Make sure the fuel is stored correctly, care must be taken to make sure no water enters the machine fuel tank (or the storage tank). Water will encourage micobacterial growth.
- Make sure that the fuel pre-filter is drained daily (not every week as currently advised).
- Use heater kits in low ambient temperature territories.
- The biodiesel must meet the following standards: ASTM D6751, DIN 51606, ISO 14214.

If necessary use a test kit to confirm the fuel specification. Testing kits are available (not from JCB currently), use the internet as a source for the kits.

If performance related issues are to be reported to JCB Service, and the engine has been run on biodiesel, then the fuel system must be filled with standard diesel (at least 2 x tank fills) to EN590 specification and relevant stall speeds recorded prior to making the report.

**Warranty**

JCB have shown a commitment to support the environment by approving the use of biodiesel blended fuels.

Using a B5 blend of biodiesel requires caution and additional servicing of the engine is required.

Failure to follow the additional recommended service requirements may lead to a warranty claim being declined.

Failures resulting by the incorrect use of biodiesels or other fuel additives are not defects of the engine workmanship and therefore will not be supported by JCB Warranty.

## Usage and Effects of Fuels

The information that follows does not indicate types of fuel that are acceptable or unacceptable.

## Acceptable Fuels

**Ultra Low Sulphur Diesel (EN590)**

Available throughout the UK, Europe and North America since March 1999. This fuel has a maximum sulphur content of 0.001% (0.0015% in North America) by weight and a further reduction in the natural lubricity and aromatic content than experienced with low sulphur diesel. Major oil producers will add lubrication improvers and also maintain the total aromatic content to an acceptable level.

**B20 Biodiesel**

Biodiesel refers to pure fuel before it is blended with diesel fuel. When biodiesel is blended with diesel fuel it is referred to as B5, B20 etc., where the number indicates the percentage of biodiesel in the fuel, for example B5 contains 5% biodiesel.

Biodiesel has different characteristics than mineral based fuels, this could lead to seals swelling, fuel system corrosion and seal damage.

Biodiesels will 'cloud' at higher temperatures than mineral based fuels. To explain Cloud Point - the lowest temperature at which fluid can flow and performs its functions is referred to as Pour Point. Just prior to reaching its Pour Point the diesel fluid becomes 'cloudy' due to crystallization of waxy constituents - this is know as Cloud Point. Using diesel at temperature below its cloud point can result in filter clogging. To prevent this happening preheating will be required.

Using B20 biodiesel can result in unburnt fuels accumulating in the engine oil, ultimately this can affect the engine oil efficiency and lead to engine damage (with standard diesel any unburnt fuel evaporates off the lubricating oil).

The natural properties of biodiesel make it a good medium for micro bacterial growth, these microbes can cause fuel system corrosion and early fuel filter blocking. Biodiesels must be stored to exclude water absorption and oxidation. It will be necessary to consult and seek advice from your fuel supplier, the effectiveness of conventional antibacterial additives when used in biodiesel is still being investigated in the fuel industry. A high percentage biodiesel mixture (>205%) can lead to fuel gelling and filter blocking in low temperature operation, it may also effect the power and performance of the engine.

To minimise the risk of engine damage when using a B20 mix, there are additional service requirements.

If the recommended actions are not taken there may be the following consequences:- low temperature filter clogging- injectors lacquering / sticking deterioration of seals and rubber hoses- corrosion of metal parts in the fuel system- engine performance problems. These risks will be increased if the fuel has been poorly stored, that is deteriorated through oxidation and / or water absorption.

## Unacceptable Fuels

### B100 - Chemically Modified Vegetable Oils (FAME/ VOME)

These fuels have been derived from a wide range of vegetable oils and animal fats, resulting in better stability, viscosity and cetane number than those produced from unmodified vegetable oils, but it is recognised that there are potential problems associated with the finished fuel characteristics. These oils are less stable than mineral oil derived fuels when stored and they will readily degrade producing fatty acids, methanol and water, none of which are desirable in the FIE. These effects are known to be accelerated when the fuel is stored in the presence of air and water together.

An extract 'common statement' from the FIE manufactures specifies that "The fuel injection equipment manufacturers can accept no liability whatsoever for failure attributable to operating their products with fuels for which the products were not designed, and no warranties or representations are made as to the possible effects of running these products with such fuels".

### Unmodified Vegetable Oils

Burned in diesel engines neat or used as an extender to mineral derived fuel. When these are subjected to heat in the fuel injection system they form sticky deposits that can be found inside the fuel pump and a hard lacquer in the injectors where exposure to even higher temperatures takes place.

## Sulphur Content

⚠ **Caution!** A combination of water and sulphur will have a corrosive chemical effect on fuel injection equipment. It is essential that water is eradicated from the fuel system when high sulphur fuels are used.

## Effects of Fuel Contaminates

The effect of dirt, water and other contaminants in diesel can be disastrous for injection equipment:

### Dirt

A severely damaging contaminant. Finely machined and mated surfaces such as delivery valves and distributor rotors are susceptible to the abrasive nature of dirt particles - increased wear will almost inevitably lead to greater leakage, uneven running and poor fuel delivery.

### Water

Water can enter fuel through poor storage or careless handling, and will almost inevitably condense in fuel tanks. The smallest amounts of water can result in effects that are just as disastrous to the fuel injection pump as dirt, causing rapid wear, corrosion and in severe cases, even seizure. It is vitally important that water is prevented from reaching the fuel injection equipment. The filter/water trap must be drained regularly.

### Wax

Wax is precipitated from diesel when the ambient temperature falls below that of the fuel's cloud point, causing a restriction in fuel flow resulting in rough engine running. Special winter fuels may be available for engine operation at temperatures below 0°C (32.0°F). These fuels have a lower viscosity and limit wax formation.

## Chemical Contamination

It should be noted that exposure of fuel to surfaces containing Copper (Cu), Zinc (Zn) or Lead (Pb) can adversely affect fuel quality and should be minimised.

(For: JS330, JS360)

## Types of Fuel

Use good quality diesel fuel to get the correct power and performance from your engine.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