

## 2.0 - 3.0 Tonne (manual)

Thwaites

Mach 420  
Mach 422  
Mach 423  
Mach 570  
Mach 573

# Operator's Instruction Manual



Mach 422 - 2 Tonne powerswivel



Mach 420 - 2 Tonne front tip

## Thwaites Limited puts Safety First

It is the policy of Thwaites Limited to promote safety in the operation of its machines and to create a general awareness of site safety and safe working practices for the operators of its machines.

This Operator's Instruction Manual is intended for both new and experienced machine operators. It should remain with the machine at all times. All operators should be aware of its location and contents.

It is important that all operators are fully trained and familiar with the machine and that they have read and understood the information contained within this book before they attempt to operate in the site conditions for which the machine was designed.

This book details practices and operations which Thwaites Limited recommends. DO NOT operate this machine in ways other than those detailed within this book.

This machine is designed for customary construction site operations, and the transportation of bulk materials commonly carried on such sites; that is their 'intended use'. Under certain controlled conditions the dumper may be used for towing wheeled loads.

Due to the varied nature of the operation of site dumpers and the absence of an agreed test standard, any figures quoted by Thwaites in relation to vibration values and exposure are for reference purposes only. It is the responsibility of the employer to assess vibration exposure based on the actual site conditions, and operating practices, at the point of use.

**Hand Arm Vibration** - The daily exposure Action/Limit Values of between 2.5 - 5.0m/s<sup>2</sup> (A8) are unlikely to be exceeded in an eight-hour reference period.

**Whole Body Vibration** - The daily exposure can only be accurately determined at the point of use. This exposure must be managed in respect of the Action/Limit Values of 0.5 and 1.15 m/s<sup>2</sup> (A8) respectively.

Employers should not rely solely on published vibration figures when undertaking risk assessments. Depending on the site conditions, cycle times may need to be adjusted in order to reduce operator exposure levels.

Vibration values based on typical duty cycles are available on request from Thwaites. These may be used for reference purposes only.

## Safety symbols



- Attention!
- Become alert!
- Your safety is involved



- Correct action



- Incorrect action/procedure which should NOT be carried out

## Signal words:

Signal words are used on the machine and within this manual to identify levels of hazard seriousness



**DANGER**



**WARNING**



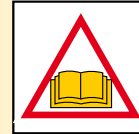
**CAUTION**

# 1 Before operating this machine

**Thwaites**



## Read this operator's instruction manual



**Thwaites**  
**Distributor**

- 1 Contact your Thwaites dealer in case of further questions
- 2 Learn to operate this machine
- 3 Ensure you are fit to operate
- 4 Wear correct safety clothing and ensure safety equipment is available

Complete checks in section

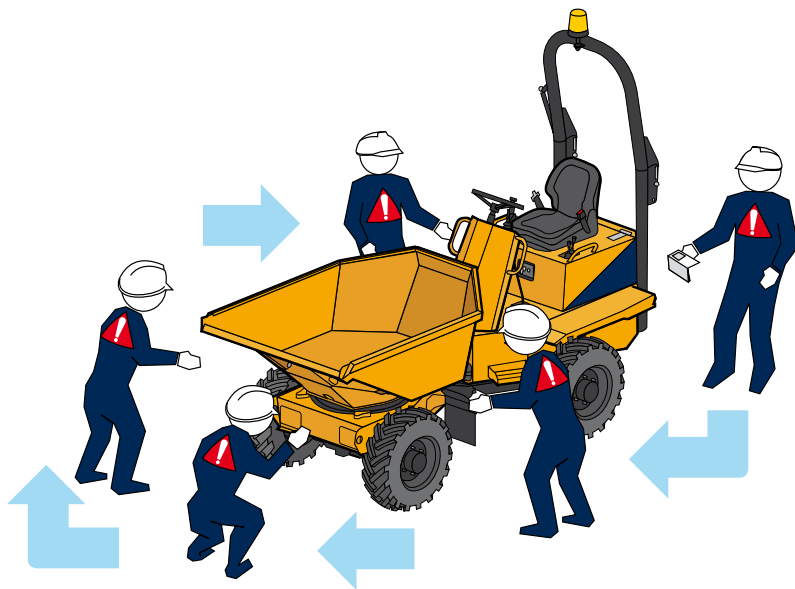
**1**

before starting the engine

# 1 Before operating this machine

Thwaites

Walk Around The Machine



## Visually check the machine

- 1 Are the chassis lock and the skip lock disengaged?
- 2 Are the controls, crush zone or hydraulic rams clean, and clear of any debris?
- 3 Is the Roll-Over Protective frame (ROPS frame) secure, fully upright and undamaged?
- 4 Is the seatbelt anchorage secure and serviceable?
- 5 Are the covers and mudguards secure?
- 6 Are the hoses free from fluid leaks?
- 7 Are all safety decals legible?
- 8 Are the tyres free of cuts or splits?
- 9 Are all bolts tight and in position?
- 10 Are the steering wheel and the steering column undamaged?
- 11 **Have the daily maintenance tasks been performed? (See rear cover)**

Report all faults immediately.



**DO NOT OPERATE THE MACHINE UNTIL ALL FAULTS HAVE BEEN RECTIFIED**

Complete checks in section



before starting the engine

# 1 Before operating this machine

Thwaites



## Mount the machine and check the controls

- 1 Use the grabrails and foot steps provided to manoeuvre into seating position. Face the machine at all times when mounting and dismounting
- 2 Is the engine cover secure and locked?
- 3 Adjust the seat position for comfort and easy access to controls
- 4 Fasten the seatbelt. Adjust accordingly for safety and comfort
- 5 Is the hand brake ON?
- 6 Set the transmission to neutral
- 7 Does the foot brake feel firm?
- 8 Do not operate the machine without understanding all its controls as described in the following pages



## WARNING

Seatbelt **MUST BE WORN** when operating machines fitted with ROPS frame.

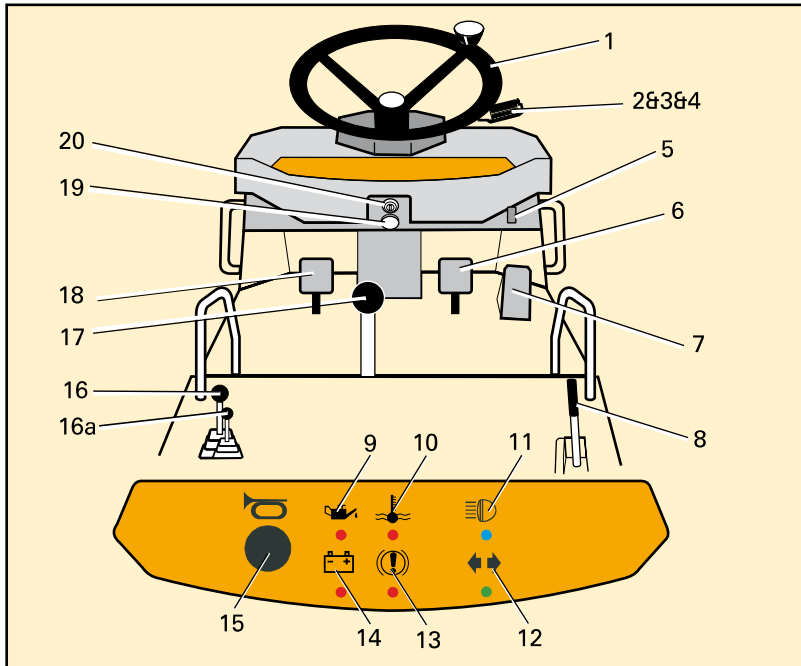
Complete checks in section



before starting the engine

# 1 Layout of controls

**Thwaites**



## Control location & functions

- 1 Steering wheel
- 2 Direction indicator selector - forward = left turn - back = right turn\*
- 3 Lights – twist 1 = sidelights ON  
twist 2 = dipped headlights ON\*
- 4 Lights – up = flash. Down = main beam\*
- 5 Hazard warning light switch\*
- 6 Foot brake pedal
- 7 Throttle pedal
- 8 Hand brake lever
- 9 Engine oil pressure warning light
- 10 Water temperature warning light
- 11 Headlamp main beam pilot light\*
- 12 Direction indicator pilot light\*
- 13 Heat/start pilot light
- 14 Battery charging warning light
- 15 Horn push
- 16 Tip-skip lever (Fwd tip model)  
Tip-skip and rotate-skip lever (powerswivel and hi swivel models)
- 16a Raise-skip lever (hi swivel model only)
- 17 Gear lever
- 18 Clutch pedal (start inhibitor)
- 19 Ignition & hand brake warning buzzer
- 20 Ignition switch

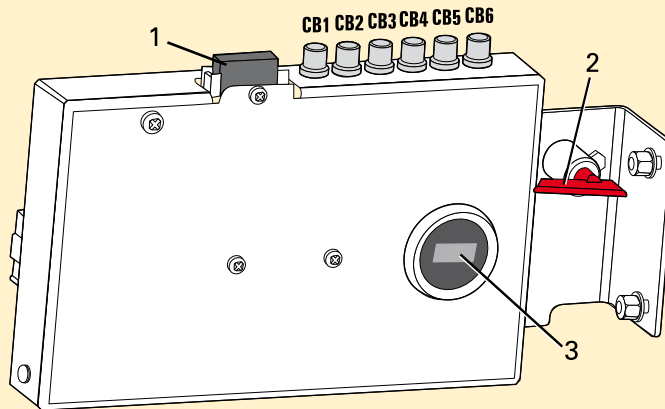
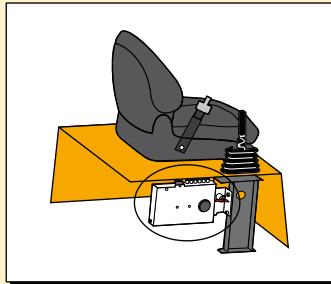
*\* Optional items*

Complete checks in section



before starting the engine

# 1 Layout of battery



- 1 Maxi fuse
- 2 Isolater switch
- 3 Hour meter

- CB1 Power
- CB2 Ancilliaries
- CB3 Brake light\*
- CB4 Lights\*
- CB5 LH side lights\*
- CB6 RH side lights\*

\* *Optional items*

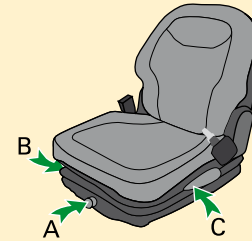
Complete checks in section  before starting the engine

# 1 Control functions – explained

Thwaites


## Seat Adjustment

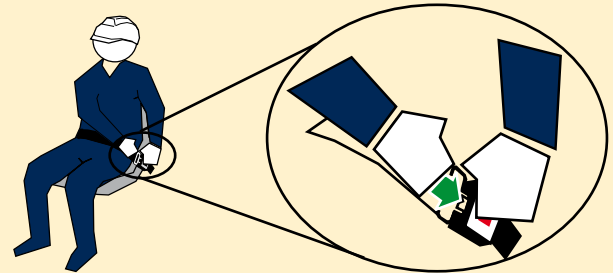
- A – Turn knob to set driver weight
- B – Lift to slide seat assembly forwards/backwards
- C – Lift handle to adjust backrest



## Seatbelt

- Adjust length of belt when seated on machine
- Press buckle blade into buckle lock
- Pull belt webbing through buckle blade to remove slack

 *Seatbelt should not be worn loose, it should pass comfortably across hip bones and not the abdomen*



Complete checks in section



before starting the engine

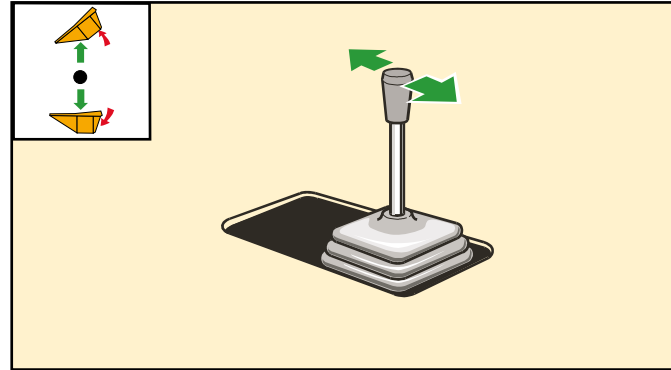


# 1 Control functions – explained


Thwaites


## Tip-skip lever (front tip models)

- Push forward to discharge skip
- Push backwards to park skip



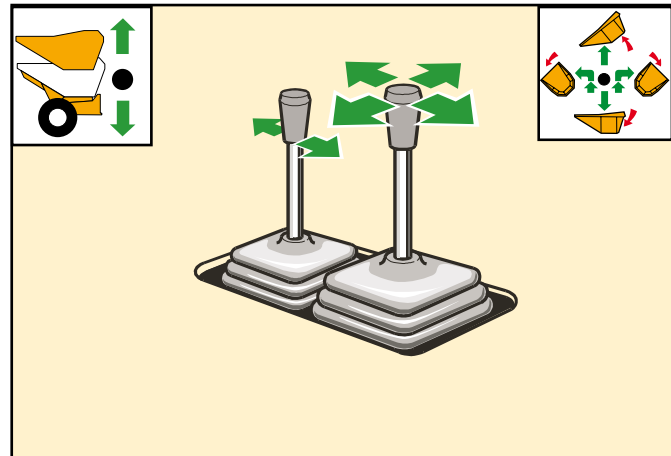
## Rotate-skip lever (swivel models)

- Raise skip 100 mm to disengage pivot centring lock.
-  Rotate skip, fully lowered, to automatically engage centring lock.
- Raise skip and push lever to the right to rotate skip to right
- Raise skip and push lever to the left to rotate skip to left
- An increased engine speed will reduce cycle times

 Movement of the skip is disabled if the steering wheel is moved (priority steering).

## Raise-skip lever (Hi-Swivel model only)

- Push forward to raise skip
- Push backwards to lower skip



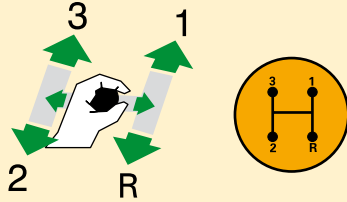
Complete checks in section



before starting the engine

# 1 Control functions – explained

**Thwaites**



## Gear lever – left hand

Forward-left  
Third gear

Neutral

Forward-right  
First gear

Back-left  
Second gear

Back-right  
Reverse

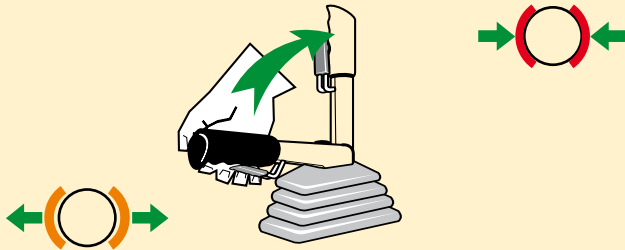
## Hand brake lever – right hand

Use only when the machine is stationary (or in an emergency):

- Pull lever up to apply
- Pull catch and lower lever to release

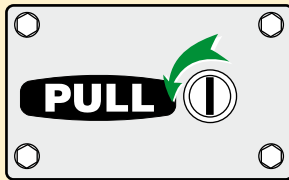


*An audible warning device is fitted to your machine. This will sound when the parking brake is engaged.*



## Engine cover open/close

- Insert ignition key and turn anti-clockwise to unlock
- Pull handle to release and raise cover
- Lower cover, secure and lock before driving



Complete checks in section




before starting the engine

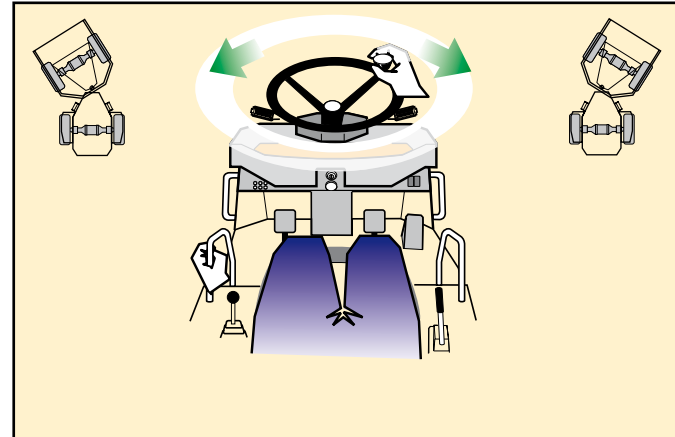
# 1 Control functions – explained

Thwaites

## Steering wheel

- Turn the wheel clockwise to turn machine to right
- Turn the wheel anti-clockwise to turn machine to left

 Ensure the non-steering hand is on the engine cover grab rail when using the spinner knob for low-speed single-handed steering.



## Throttle pedal - right foot (A)

- Apply pressure to increase speed
- Reduce pressure from the pedal to reduce speed

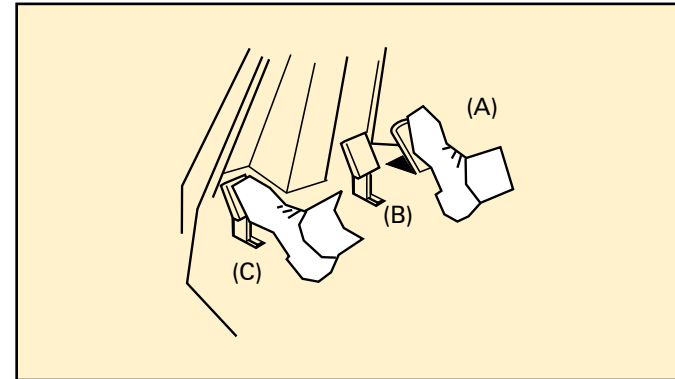
## Foot brake pedal - right foot (B)

- Apply pressure down on the pedal to slow/stop the machine

## Clutch pedal - left foot (C)

- Press down before each gear change - select gear and release

 Start inhibitor fitted - press down clutch pedal before starting engine



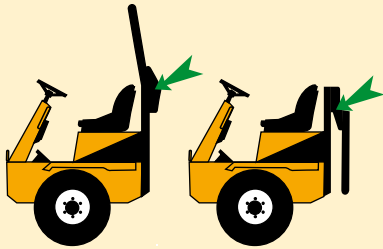
Complete checks in section



before starting the engine

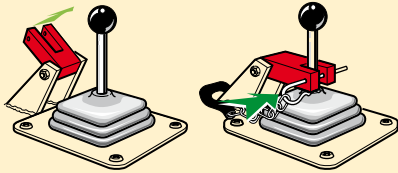
# 1 Control functions – explained

**Thwaites**



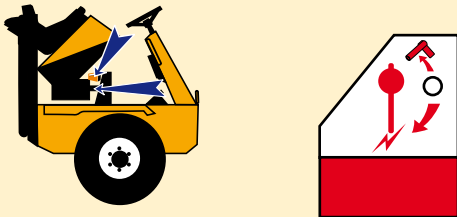
## Lowering and raising the folding ROPS frame

- Remove lynch pins and withdraw frame lock pins
- Lower frame and insert lock pins and lynch pins in new position
- Reverse the procedure to raise the frame
- Ensure all pins are secure before driving



## Tipping lever lock (*optional*)

- Place yolk over tipping lever and secure with lynch pin



## Beacon stowage

- Unplug and remove beacon
- Secure beacon on bracket provided beneath bonnet

## Battery isolator (*beneath engine cover*)

- Turn key anti-clockwise to isolate the battery power supply

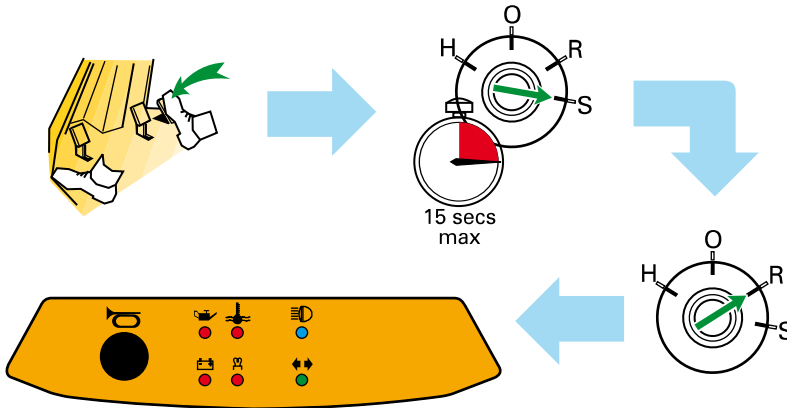
Complete checks in section



before starting the engine

## 2 How to START and STOP the engine

Thwaites



### To start the engine

- Depress clutch pedal
- Cold start aid (when required)-

*Turn key to position 'H'. When panel light extinguishes start engine (as above).*

Depress accelerator pedal fully and turn the key clockwise to the start position 'S'.

*All panel lights self-test (illuminate) and should extinguish on start-up.*

- Allow the engine to turn for a maximum of 15 seconds.

*If the engine does not start within 15 seconds, return key to position 'O' and wait 30 seconds before turning to 'S' again.*

- When the engine fires, release key.

*(Springs back to 'Run' position 'R').*

- Reduce accelerator pedal pressure to prevent over revving.

### To stop the engine

- Turn key to position 'O'.



### WARNING

DO NOT START THE ENGINE UNLESS SEATED IN THE DRIVING POSITION.

### CAUTION

If a panel light remains on switch off engine (key to 'O') and investigate the problem.

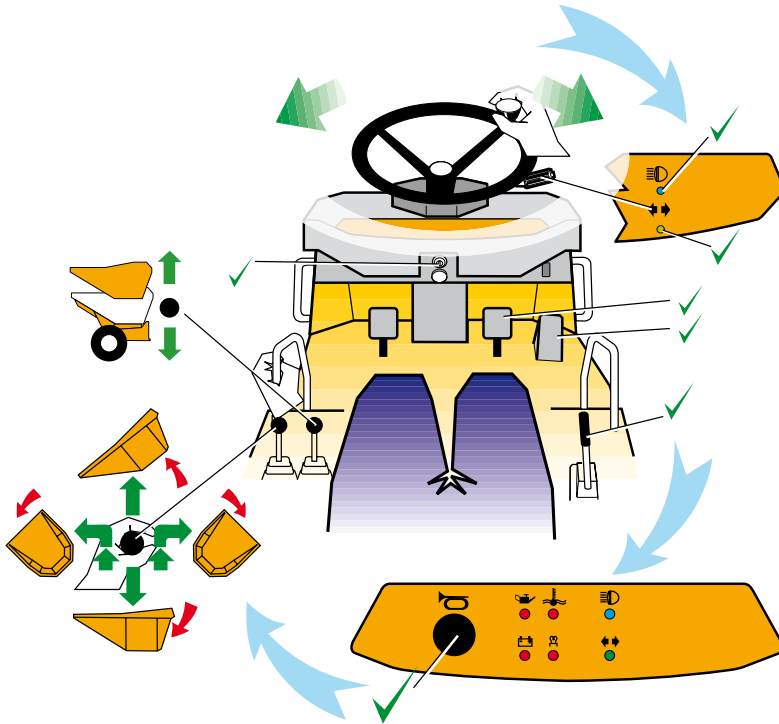
### CAUTION

- Do not use unauthorised starting aids
- Do not tow or bump start

Complete checks in section  before loading the machine

## 2 Preliminary checks

Thwaites



### Function checks - engine ON

#### Brakes

- Does the foot brake pedal feel firm?
- Hand brake – carry out hand brake test (*described on next page*).

#### Steering

- Rotate steering wheel clockwise and anti-clockwise

#### Electrics

- Does the horn sound correctly?
- Does the reverse alarm sound correctly? (optional).
- Is the beacon flashing?
- Are the lamps working correctly? (optional) –
  - \* Side
  - \* Main
  - \* Stop
  - \* Indicators
  - \* Hazards

#### Tip-skip lever/Rotate-skip lever

- Discharge/park skip
- Rotate - right to left/left to right. (powerswivel and Hi-Swivel models).

#### Raise-skip lever

- Raise/lower skip. (Hi-Swivel model only)

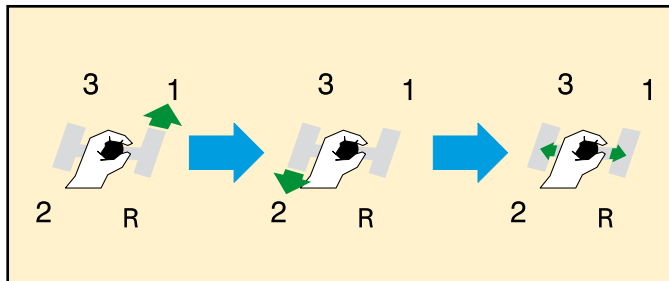
Complete checks in section



before loading the machine

## 2 How to test the hand brake

Thwaites



### WARNING

- Before testing handbrake, ensure that the machine is on firm, level ground and that the area is clear of people.
- Do not operate a machine that has failed the handbrake test.
- The handbrake must not be over-tightened, as this may cause damage to the axle.

If any of the following tests result in failure, consult the service book for instructions for hand brake adjustment.

- 1 Start engine.
- 2 With the handbrake applied, engage first gear and release clutch slowly, with engine revs at tick-over; the machine should move forward.
- 3 Release throttle and apply clutch and footbrake.
- 4 With the handbrake applied, engage second gear and release clutch slowly, with full engine revs; the machine should stall.
- 5 If the machine moves forward, release throttle and apply clutch and footbrake.
- 6 Select Neutral
- 7 Switch engine off.

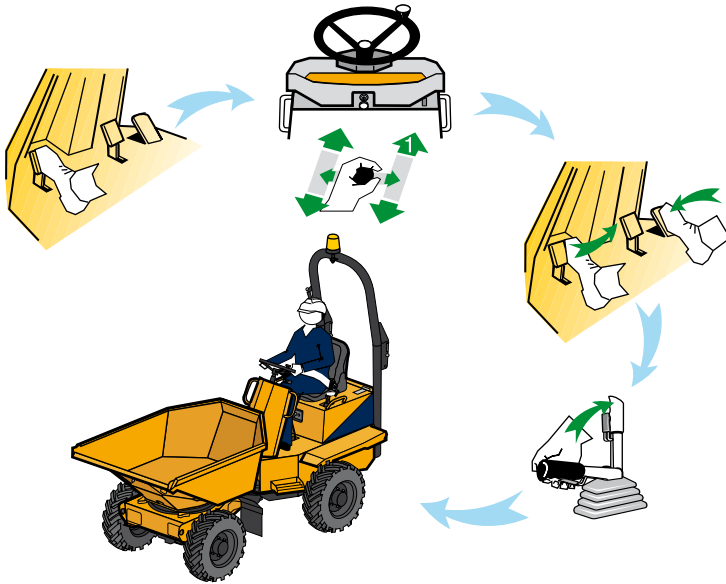
Complete checks in section



before loading the machine

## 2 Driving procedure and safe parking

Thwaites



### Moving from rest and stopping

- Depress clutch pedal
- Select first gear
- Slowly depress accelerator pedal, release clutch pedal and hand brake lever and move slowly
- Hold steering wheel with both hands
- Remove foot from accelerator pedal
- Brake gently to a halt, using foot brake pedal, and press clutch pedal to prevent stalling
- Apply hand brake and select neutral

### Changing speed/direction

- Release accelerator pedal
- Depress clutch pedal
- Select an alternative gear
- Release clutch pedal and press accelerator pedal
- Before changing direction (forward/reverse), stop the machine and engage the hand brake

### After operating – park safely

- Always leave skip empty when not in use
- Ensure machine is on firm level ground
- Apply hand brake
- Engage neutral
- Hydraulic system at rest in a safe condition
- Stop engine and remove key
- Lock engine cover



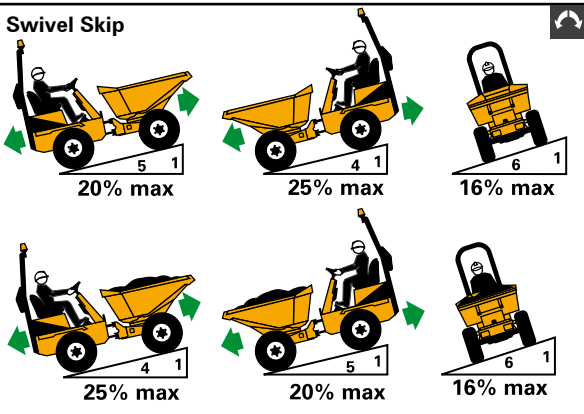
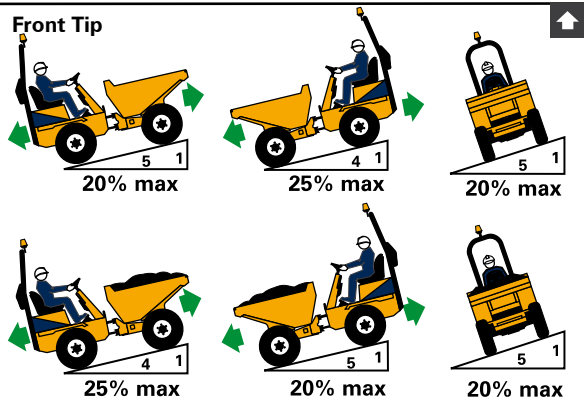
### CAUTION

- Novice operators should always start with forward motion on clear, level ground.
- A low gear should always be selected when a driver is unfamiliar with machine type.

 2

Complete checks in section  2 before loading the machine



**3****DANGER****IMMEDIATE HAZARDS WHICH WILL RESULT IN SEVERE PERSONAL INJURY OR DEATH****Thwaites****Swivel Skip****Front Tip****WORKING ON GRADIENTS**

DO NOT exceed maximum stated gradients



DO NOT turn across gradients



DO NOT brake suddenly in wet, muddy, icy conditions or when operating on loose surfaces



DO NOT run downhill with controls in neutral

DO NOT operate lift mechanism on sloping ground  
**(Hi-Swivel model only)**

Check indicator



Travel straight up, down or along a gradient



Keep speed to a minimum and use the foot brake to reduce speed when travelling down gradients

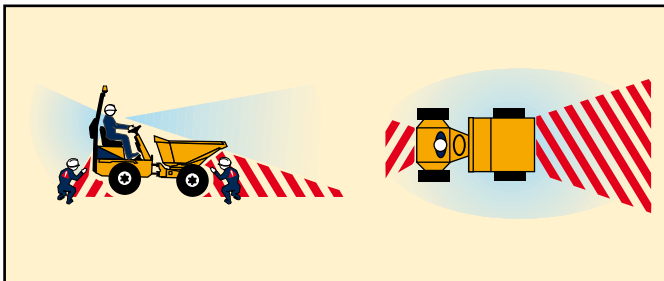


To prevent movement always engage parking brake when stopped on sloping ground. Chock wheels securely when leaving the machine unattended



Always position swivel skip in central lock (powerswivel and hi swivel models)

*Attention! Section 3 correct and incorrect working practices*

**3****DANGER****IMMEDIATE HAZARDS WHICH WILL RESULT IN SEVERE PERSONAL INJURY OR DEATH****Thwaites****VISIBILITY**

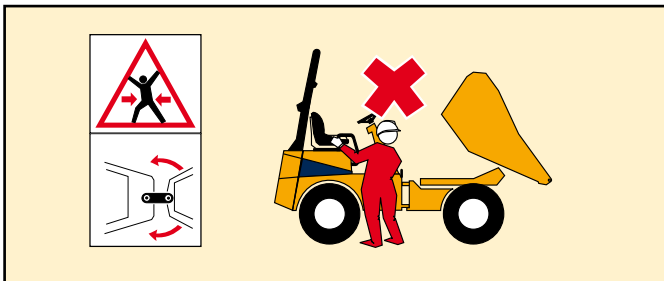
Check ahead and behind machine before operation



Be aware of low-visibility areas when operating



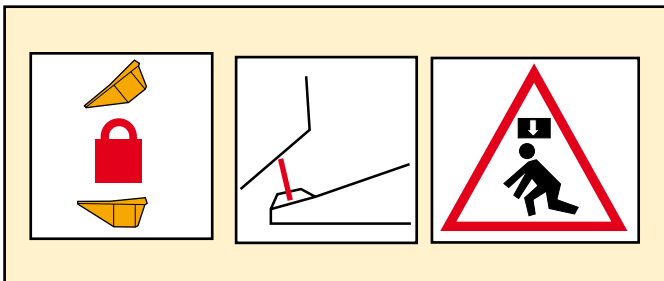
Before operating, sound the horn to warn people in the immediate area

**CRUSH ZONE**

Stay clear of articulation area when the engine is running



Never operate the machine's controls when standing on either side of machine

**WORKING UNDER A RAISED SKIP**

Lock skip safety prop during maintenance



Never work under an unpropped skip



When using skip safety prop engage tipping lever lock (if fitted)

**3***Attention! Section 3 correct and incorrect working practices*

**3****WARNING****HAZARDS OR UNSAFE PRACTICES WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH****Thwaites****LOADING THE MACHINE****DO NOT** exceed the machine's rated capacityEnsure **SAFE, STABLE, LOW** load which allows good visibility

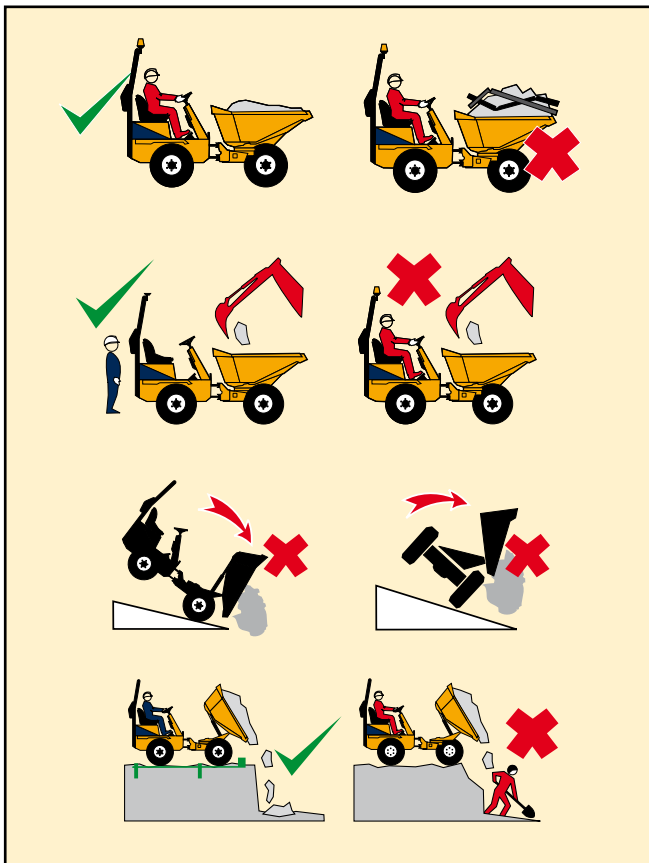
Reduce payload if materials being carried are not free flowing



Activate the hand brake, set drive to neutral, turn the engine off, disembark the machine, and stand clear.



Clear debris from controls

**UNLOADING THE MACHINE**Use **STOPBOARDS** and **SUPPORT** walls on trenches**DO NOT** tip skip if load is sticking**DO NOT** discharge load when working on sloping ground**3***Attention! Section 3 correct and incorrect working practices*

3

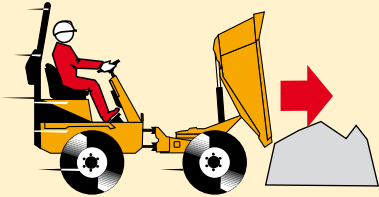


WARNING

HAZARDS OR UNSAFE PRACTICES WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH

Thwaites

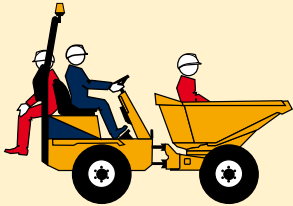
DRIVING



DO NOT drive with the skip tipped (bulldozing)



NEVER dismount from a moving machine



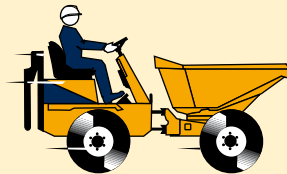
DO NOT carry passengers



Avoid confined work areas - exhaust fumes and noise can be a hazard



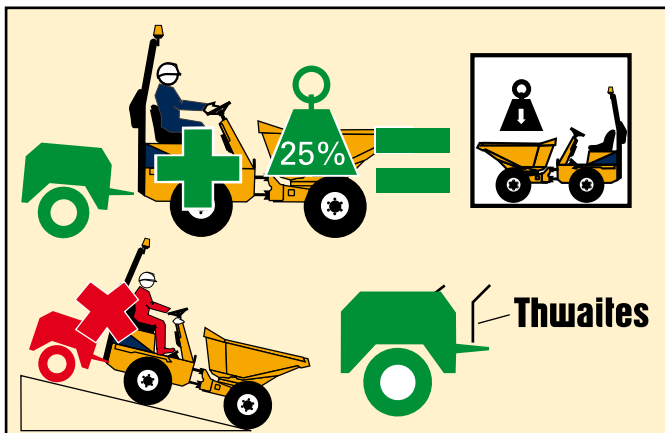
Site hazards to avoid: adverse weather conditions; icy surfaces; people



DO NOT operate with the ROPS frame folded



Attention! Section 3 correct and incorrect working practices

**3****WARNING****HAZARDS OR UNSAFE PRACTICES WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH****Thwaites****TOWING A TRAILER**

Place ballast load in skip. This load should be a minimum of 25% of the machine's rated payload

The gross weight to be towed plus the ballast load **MUST NOT** exceed rated payload of machine**DO NOT** exceed maximum tow bar pull or vertical load

Towing must not be carried out on sloping ground



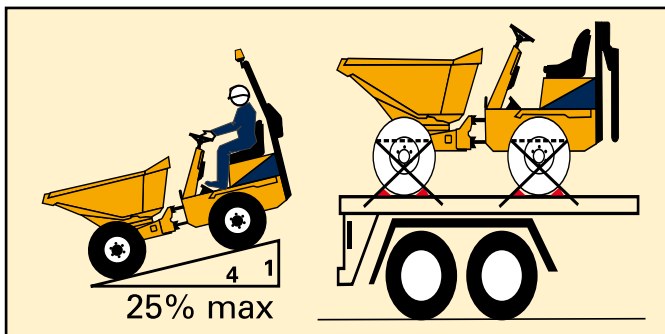
Always use a Thwaites-approved towing pin

**TRANSPORTATION**

Reverse machine slowly onto a suitable trailer

**DO NOT** drive the machine forwards when loading

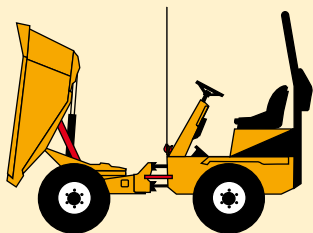
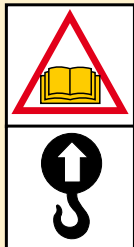
- 1 Apply parking brake
- 2 Stop engine
- 3 Chock wheels *(to prevent movement)*
- 4 Engage chassis locking bar
- 5 Secure to trailer
- 6 Ensure legal load *(height/weight)*



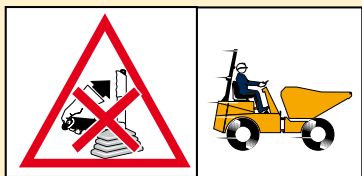
Attention! Section

**3**

correct and incorrect working practices

**3****CAUTION**HAZARDS OR UNSAFE PRACTICES WHICH **COULD** RESULT IN MINOR PERSONAL INJURY OR PRODUCT OR PROPERTY DAMAGE**Thwaites****LIFTING (USING A CRANE)**

- Tip skip fully forward
- Engage skip safety prop
- Engage chassis locking bar
- Lift using centre eye provided

**HAND BRAKE****DO NOT** apply hand brake if machine is moving (except in an emergency)**SLOPING SURFACES****DO NOT** step on the rear mudguards' sloping surfaces**SCISSOR LIFT**

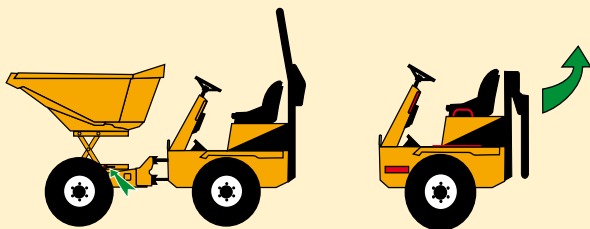
Insert locking pin when working beneath skip

**HINGED ROPS**

Use grab handles, tread grips (if fitted) and steps when standing on the machine to lower the ROPS frame.



Avoid wet surfaces.









Attention! Section



correct and incorrect working practices

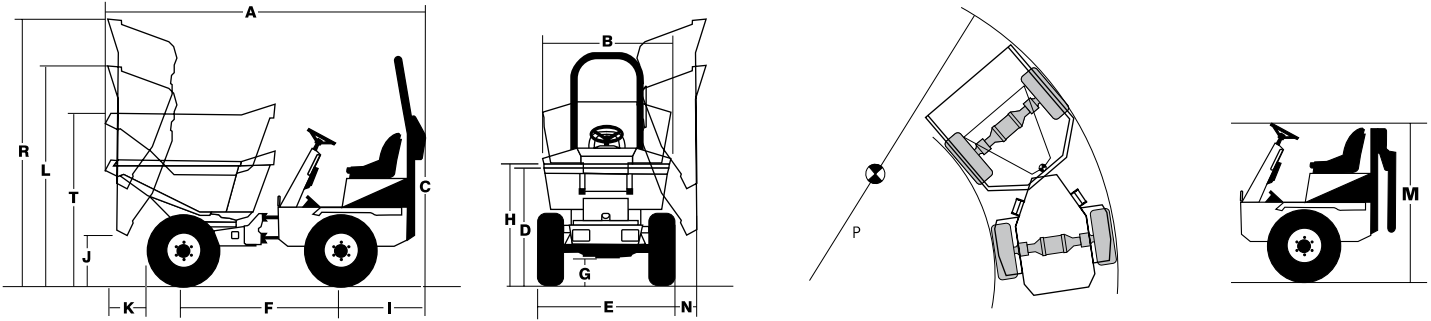
# 4 Troubleshooting

Problem	Reason	Solution
Engine will not start	Isolator switch OFF FNR lever not in neutral Battery voltage too low Faulty fuel supply Electrical stop on fuel pump defective Circuit breaker tripped	Switch on Shift FNR lever to a neutral position Check battery and connections Check fuel level and connections Check connections Rectify electrical fault and reset (push to reset)
Complete loss of electrical functions	Maxi fuse blown	Rectify electrical fault and replace fuse
Starter motor will not operate	Faulty battery	Replace
Maxi fuse blown	Faulty starter motor/solenoid (Current drawn by solenoid exceeds 25A) Short circuit on main feed or starter solenoid cables	Replace starter motor/solenoid and maxi fuse (only replace with a 30 amp fuse) locate and repair
Engine stops soon after start-up	Blocked fuel or air filter Air in fuel system	Replace fuel or air filter Check fuel line connections
Black engine smoke	Air filter clogged (air filter indicator is red) Fuel system defect Wrong fuel	Replace or clean air filter Contact Thwaites dealer Replace fuel and filter
 ● Engine oil pressure  ● High engine temperature  ● Irregular alternator  ● Transmission oil temperature  ● Transmission oil pressure  ● Low brake oil Warning buzzer sounds	Low oil level Radiator choked Low coolant level Defective or loose alternator belt Oil cooler choked Over/under filled with oil Low transmission fluid level Check oil level/leaks Hand brake ON	Top up engine oil Clean radiator Top up coolant Adjust, or, if necessary, replace alternator belt Clean oil cooler Correct oil level Top up transmission fluid Top up brake oil Release hand brake

*Always check panel warning lights, tripped circuit breakers or blown maxi fuse*

# 4 Powerswivel and Hi swivel – data chart

# Thwaites



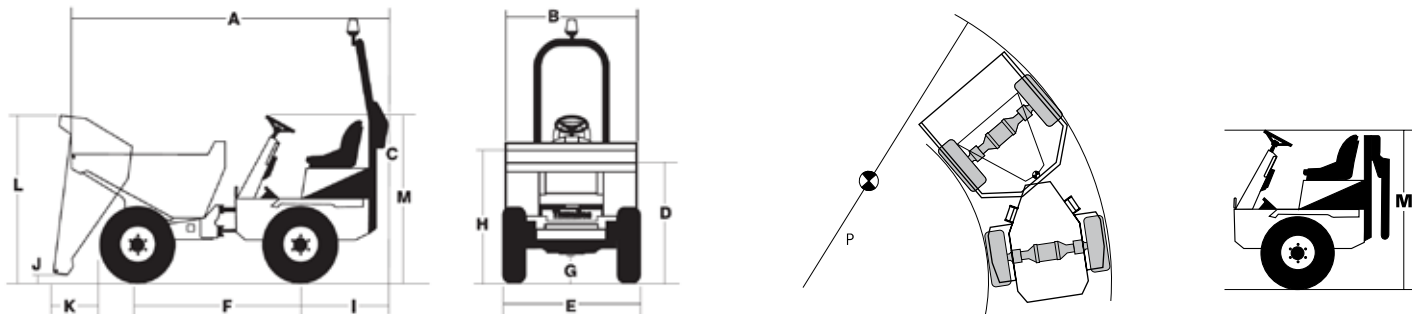
Dimensions (mm)	3T	2T	2T	Weight (Kg)	3T	2T	2T	Noise
A. Length .....	3935	3735	3740	<b>Unladen</b>				Airborne (10m) 
B. Width .....	1650	1475	1475	Front axle .....	780	700	920	
C. Height (ROPS & Beacon) .....	3092	3037	3037	Rear axle .....	1300	1240	1280	Operator 
D. Skip lip height .....	1440	1340	1463	Total .....	2080	1940	2200	
E. Width over tyres .....	1650	1467	1467	<b>Rated payload (including driver at 80 kg)</b>				
F. Wheelbase .....	1950	1850	1850	Laden .....	3000	2000	2000	
G. Ground clearance .....	330	275	275	Front axle .....	3530	2510	2760	
H. Skip load height .....	1565	1400	1520	Rear axle .....	1630	1510	1520	
I. Axle to rear .....	1032	1032	1032	Total .....	5160	3960	4280	
J. Tipping ground clearance .....	735	712	1220	<b>Towbar (Max)</b>				
K. Tipping tyre clearance .....	510	430	422	Pull load .....	2250	1500	1500	
L. Height tipped (skip) .....	2825	2655	3136	Vertical load .....	375	375	375	
M. Height (ROPS folded) .....	1965	1910	1910	<b>Tyre Pressure</b>				
N. Tipping side clearance .....	364	268	316	Bar (psi) Front .....	3.6(52)	3.5(51)	3.5(51)	
P. Tyre clearance diameter (m) .....	9.2	7.5	7.5	Rear .....	2.0(29)	2.3(33)	2.3(33)	
R. Max height tipped (raised skip) .....			3626					
T. Skip lip height (raised skip) .....			1955					


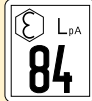
Typical vibration levels - whole body 0.7 - 0.8 m/s<sup>2</sup>. Hand/arm less than 2.5 m/s<sup>2</sup>.



# 4 Forward tip – data chart

**Thwaites**

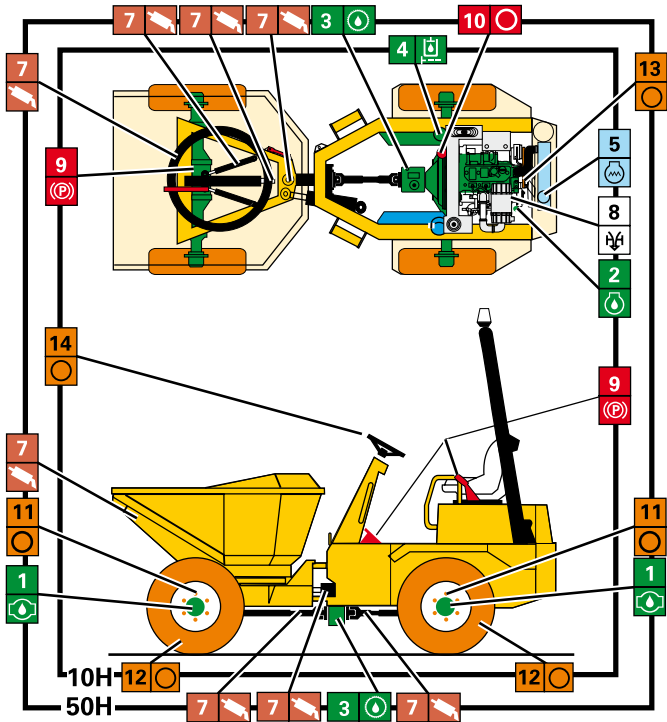


Dimensions (mm)	3T	2T	Weight (Kg)	3T	2T	Noise
A. Length .....	3774	3595	<b>Unladen</b>			Airborne (10m) 
B. Width .....	1650	1475	Front axle .....	630	580	
C. Height (ROPS & Beacon) .....	3092	3037	Rear axle .....	1300	1240	Operator 
D. Bucket lip height .....	1365	1330	Total .....	1930	1820	
E. Width over tyres .....	1650	1467	<b>Rated payload (including driver at 80 kg)</b>			
F. Wheelbase .....	1950	1850	Laden .....	3000	2000	
G. Ground clearance .....	330	275	Front axle .....	3380	2290	
H. Skip load height .....	1508	1415	Rear axle .....	1630	1610	
I. Axle to rear .....	1032	1032	Total .....	5010	3900	
J. Tipping ground clearance .....	305	262	<b>Towbar (Max)</b>			
K. Tipping tyre clearance .....	615	620	Pull load .....	2250	1500	
L. Height tipped (skip) .....	2115	1985	Vertical load .....	375	375	
M. Height (ROPS folded) .....	1965	1910	<b>Tyre Pressure</b>			
P. Tyre clearance diameter (m) .....	9.2	7.5	Bar (psi) Front .....	3.6(52)	3.5 (51)	
			Rear .....	2.0(29)	2.3 (33)	

Typical vibration levels - whole body 0.7 - 0.8 m/s<sup>2</sup>. Hand/arm less than 2.5 m/s<sup>2</sup>.

# 4 Daily/Weekly Checks

# Thwaites



	AXLE OIL (hubs and centre case)	1	Tractelf SF3
	ENGINE OIL	2	BP Vanellus C5 Global 15W 40
	TRANSMISSION OIL	3	Energear Hypo 80W 90
	HYDRAULIC OIL	4	Energol HLP HM32
	COOLANT LEVEL	5	H <sub>2</sub> O + 50% Antifreeze
	FUEL LEVEL	6	Diesel
	GREASE	7	Fill All Points
	AIR CLEANER	8	Check Indicator
	BRAKES	9	Test Park & Foot Brake
	BRAKE OIL	10	BP Bartran HV32
	WHEEL NUTS	11	330 Nm
	TYRE PRESSURE	12	See Data Chart
	FAN BELT	13	Condition/Tension
	STEERING WHEEL/COLUMN	14	Check condition

**This machine must be serviced after first 50 hours**

Normal service intervals:

250 hours      500 hours      1000 hours      2000 hours

Contact local Thwaites distributor for details or [www.thwaitesdumpers.co.uk](http://www.thwaitesdumpers.co.uk)