Service Manual

Fastrac

3170, 3170 Plus
3190, 3190 Plus
3200, 3200 Plus
3220, 3220 Plus
3230, 3230 Plus

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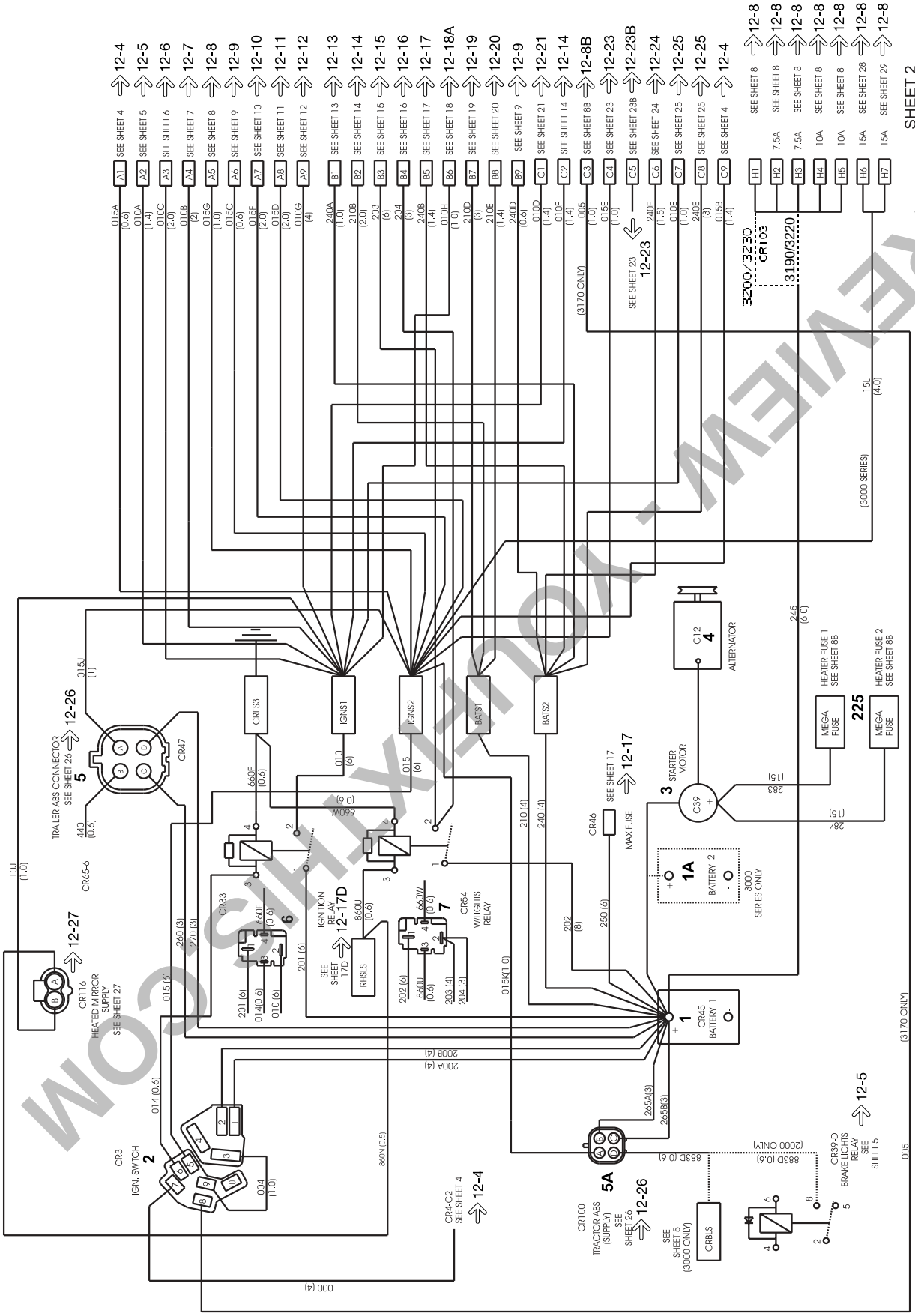
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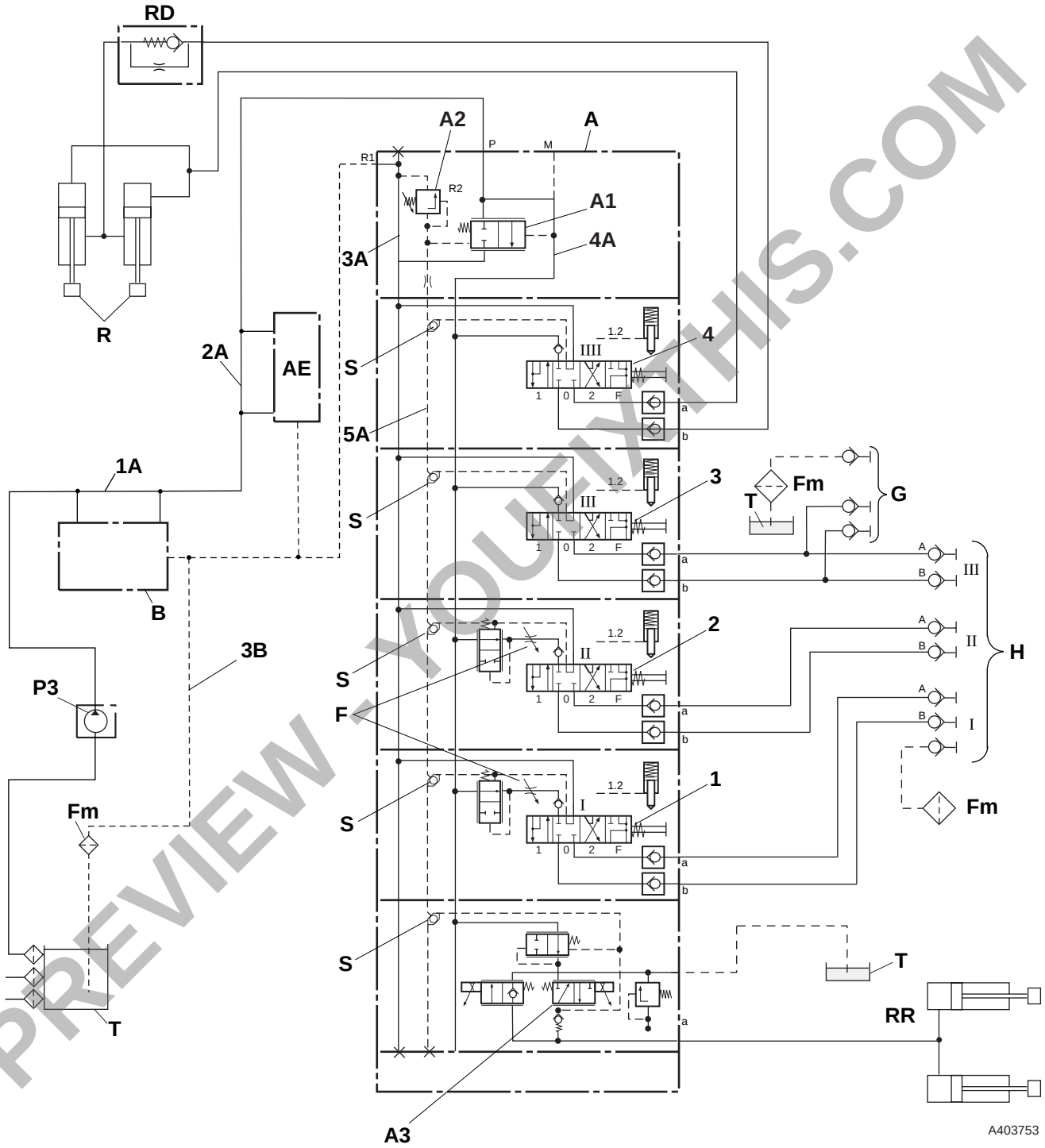
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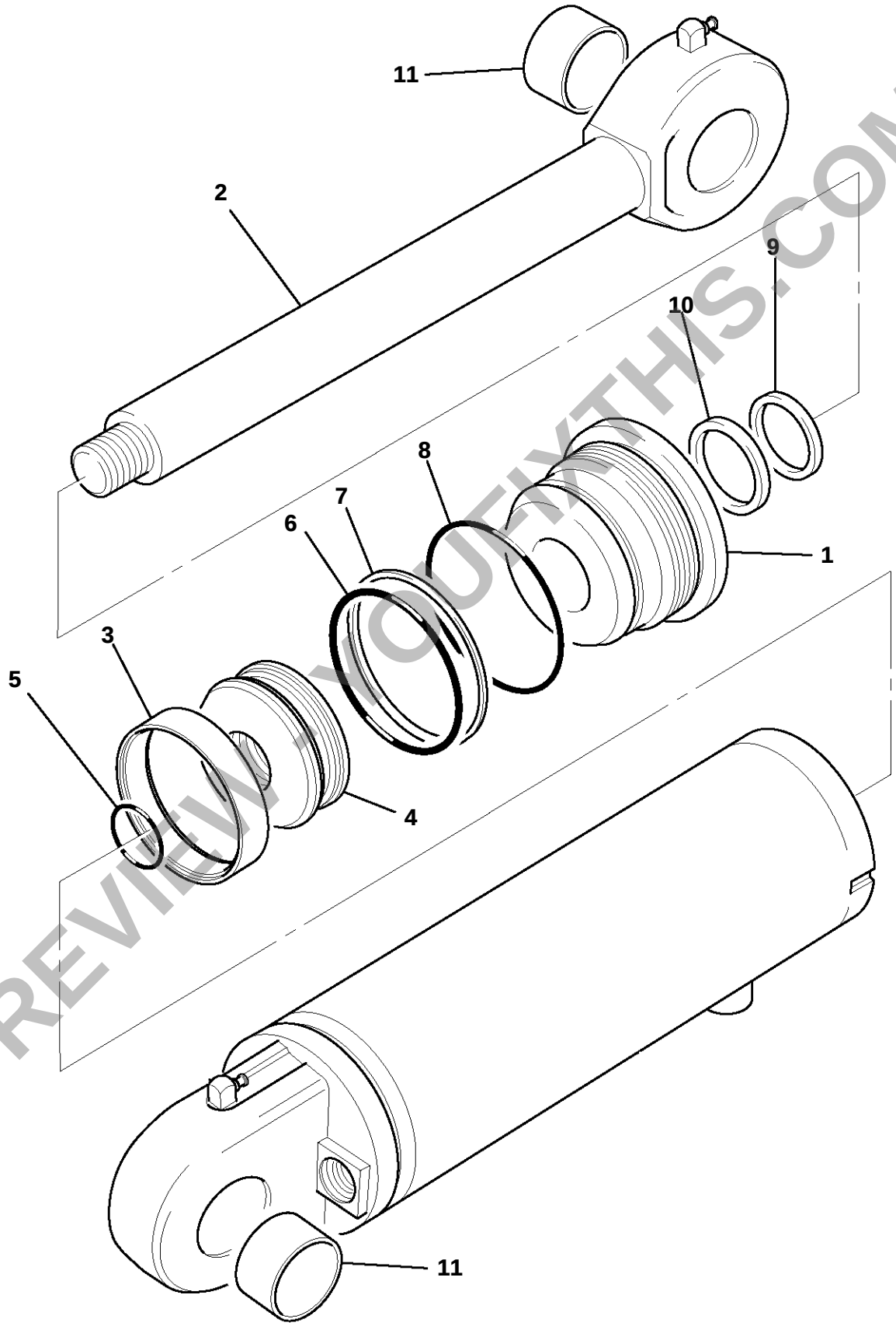


* External Hydraulics/Draft Control Valve, Mechanically Actuated - Neutral Circuit



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Zinc Plated Fasteners (golden finish)

Use only where no torque setting is specified in the text. Values are for dry threads and may be within three per cent of the figures stated. For lubricated threads the values should be REDUCED by one third.

Metric Grade 8.8 Bolts

Bolt size Dia.	(mm)	Hexagon (A/F) mm	Torque Settings Nm	kgf m	lbf ft
M5	(5)	8	7	0.7	5
M6	(6)	10	12	1.2	9
M8	(8)	13	28	3.0	21
M10	(10)	17	56	5.7	42
M12	(12)	19	98	10	72
M16	(16)	24	244	25	180
M18	(18)	27	350	36	258
M20	(20)	30	476	48	352
M24	(24)	36	822	84	607
M30	(30)	46	1633	166	1205
M36	(36)	55	2854	291	2105

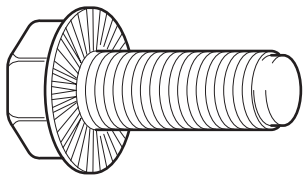
Metric - All Internal Hexagon Headed Cap Screws

Diameter mm	Torque Nm	kgf m	lbf ft
M3	2	0.2	1.5
M4	6	0.6	4.5
M5	11	1.1	8
M6	19	1.9	14
M8	46	4.7	34
M10	91	9.3	67
M12	159	16.2	117
M16	395	40	292
M18	550	56	406
M20	770	79	568
M24	1332	136	983

Metric Grade 10.9 Bolts

Bolt size Dia.	(mm)	Hexagon (A/F) mm	Torque Settings Nm	kgf m	lbf ft
M6	(6)	8	16	1.6	12
M8	(8)	13	39	4	29
M10	(10)	17	78	8	57
M12	(12)	19	137	14	101
M16	(16)	24	343	35	253
M20	(20)	30	657	67	485
M24	(24)	36	1157	118	853

Verbus Ripp Bolts



A343780

Torque settings for these bolts are determined by the application. Refer to the relevant procedure for the required settings.

Hydraulic Hose to Adapter Connections

BSP Size (inches)	Torque Settings Nm	kgf m	lbf ft
1/8	14	1.4	10
1/4	24	2.5	18
3/8	33	3.3	24
1/2	44	4.8	35
5/8	58	6.0	43
3/4	84	8.6	62
1	115	11.8	85
1 1/2	244	24.9	180

Hydraulic Adapter into Component Connections with bonded washers

BSP Size (inches)	Torque Settings Nm	kgf m	lbf ft
1/8	20	2.1	15
1/4	34	3.4	25
3/8	75	7.6	55
1/2	102	10.3	75
5/8	122	12.4	90
3/4	183	18.7	135
1	203	20.7	150
1 1/2	305	31	225

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Diagnostic Error Code Tables

In the following tables, the possible causes for each error code are listed in order of probability, and should always be checked in the order given.

* **Note**: Error codes having a letter E prefix are for the electronically controlled engine fitted to 3190, 3190 Plus, 3220 and 3220 Plus. They do not apply to the 3170 or 3170 Plus machines. Error codes having a letter Q prefix are for the electronically controlled engine fitted to 3200, 3200 Plus, 3230 and 3230 Plus. These appear after the Z prefix codes.

Error codes are able to identify individual faults within the system. It is unlikely that individual error codes will be generated erroneously by either the EMS or the transmission ECU. In the unlikely event that either of these units should fail, there will be a major failure.

Before any diagnostic work is carried out, it is recommended that the initial start up sequence is watched closely to ensure that both the EMS and the Transmission ECU are functioning correctly.

To check both units, turn the starter key to 'ON'.

For a period of approximately 3 seconds the display is tested. Ensure that each of the display segments on the EMS display are functioning. Check that all of the display lamps are also illuminated.

Ensure that the external buzzer sounds following display test; if not check the buzzer.

If any of this does not happen, suspect a fault within the EMS. Reprogramming the EMS may cure this; if this fails, change the EMS.

Following directly on from this, the centre display will display "HI THERE" for approximately 2 seconds. This is done to inform the operator that the data link between the Transmission ECU and the EMS has been established correctly.

If this does not happen, suspect the Transmission ECU is disconnected, or has an internal fault. Check all connections between the EMS and Transmission ECU, particularly the CAN bus. Turn the ignition off and on again to retest; if the fault persists, change the Transmission ECU.

The dashboard will then revert back to its normal operation mode.

Non-displayable Fault Codes

There are certain fault codes that are not displayed to the driver but are recorded by the EMS. These are all numbered 200 or above regardless of the letter prefix.

For example, codes D224 - D236 and T230 are used for datalogging purposes but are not displayed to the driver. This is because these codes represent "abuse" information as opposed to an actual failure of the vehicle electrical system. E.g. If the oil pressure warning lamp is on for more than 10 seconds of engine running, a fault code will be generated inside the EMS for datalogging purposes. The driver does not see this code as it is already supported by the warning lamp. Remember that the codes are historical data and oil levels, etc., may have been corrected since the faults were recorded.

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Checking the Fluid Level

⚠ WARNING

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help quickly.

INT-3-1-10/1

⚠ CAUTION

Using incorrect fluid could damage the system. See Fluids, Capacities and Lubricants for the correct fluid. The fluid can harm your skin. Wear rubber gloves. Cover cuts or grazes.

2-3-5-1/2

1 Park the machine on level ground. Apply the parking brake. Lower any mounted implements to the ground. Stop the engine. Remove the starter key.

2 Look at the fluid level in the sight gauge **A**. The level should be between the two marks on the gauge. If the fluid is cloudy, water or air has entered the system. Water or air in the system could damage the hydraulic pump.

3 If necessary, add recommended fluid at tank cap **B**.

Changing the Filter Element

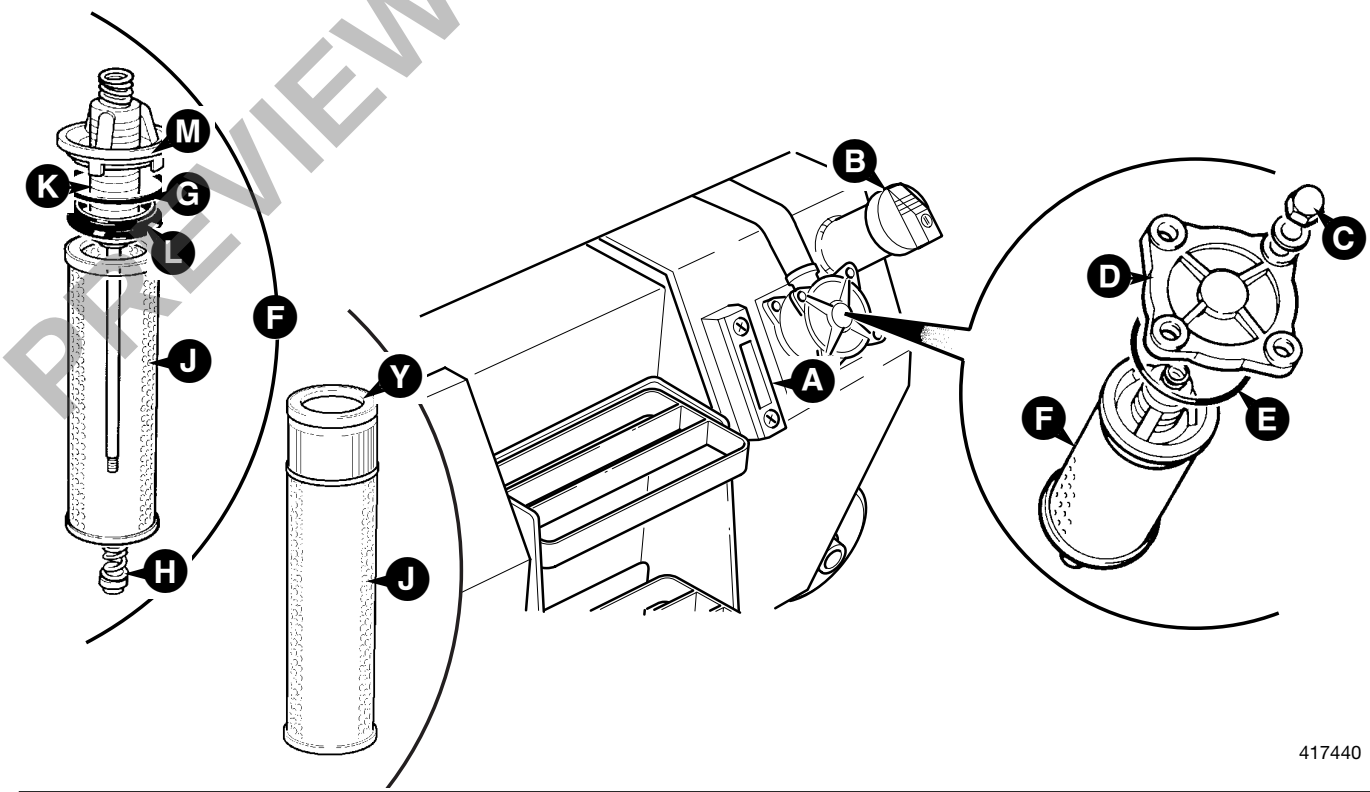
1 Park the machine on level ground. Apply the parking brake. Lower the rear linkage to the ground. Stop the engine. Remove the starter key. Wash off all dirt from around the tank cap **B** and element cover plate **D**.

2 Remove the element as follows:

- **a** Remove tank cap **B.**
- **b** Remove nuts **C**, cover plate **D** and 'O' ring **E**.
- c Remove the element assembly **F** and 'O' ring **G**.
- **d** Remove the nut and spring assembly **H**. Remove the element **J** from its spindle.
- **e** Remove and discard the paper insert **Y** from metal outer element **J**.
- **f** Clean the metal outer element **J**.
- **g** Clean the magnets **K**.

3 Fit the new element as follows:

- **a** Fit a new paper insert **Y** into metal outer element **J**.
- **b** Assemble the refurbished element **J** on to the spindle, using a new seal **L.** Ensure that the top lip of the seal locates in the groove inside the filter head **M.** Fit and tighten the nut and spring assembly **H.**
- **c** Fit the element assembly **F** using a new 'O' ring **G.**
- **d** Refit cover plate **D** and nuts **C** using a new 'O' ring **E.**
- **e** Tighten nuts **C** to 7 Nm (5 lbf ft).
- **f** Top up fluid level at tank cap **B** and refit cap.



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Main Connectors

Connector	Description	Mating Connector
A2	Rear bulkhead	**ABS 2**
ABS1	ABS trailer socket	---
ABS2	Rear bulkhead	**A2**
AHL1	Auxiliary lights connector	---
AHL2	Auxiliary lights connector	---
C1 (8-pin)	Trailer socket	---
C1 (10-pin)	Control module	**CP3**
C2	Control module	**CP2**
C4	Rear diffferential lock solenoid	**CR64**
C5	Rear bulkhead	**CR1**
C28	Front bulkhead	**CR51**
C72	Transmission	**TH1**
C74	Engine Bulkhead	---
C75	Engine ECU	---
C78	Engine Bulkhead	**CR104**
CR1	Rear bulkhead	**C5**
CR43	R.H. Column switch	---
CR49	Powershift ECU 1 (Black)	---

Connector	Description	Mating Connector
CR50	Powershift ECU 2 (Red)	---
CR51	Front bulkhead	**C28**
CR65	Instrument cluster 1 (Black)	---
CR66	Instrument cluster 2 (Red)	---
CR73	Panel - auxiliary light interconnect	---
CR74	Panel - auxiliary light interconnect	---
CR87	Instrument cluster	**E4**
CR89	Diagnostic connector	---
CR104	Engine Bulkhead	**C78**
E1	EDC ECU	---
E2	Control panel	---
E4	Instrument cluster	**CR87**
E15	Bulkhead	**E16**
E16	Bulkhead	**E15**
ECU1	ECU Connector A	---
ECU3	ECU Connector C	---
ECU5	Spool Valve Bulkhead	**ECU20**
TH1	Transmission	**C72**

Connector Terminals

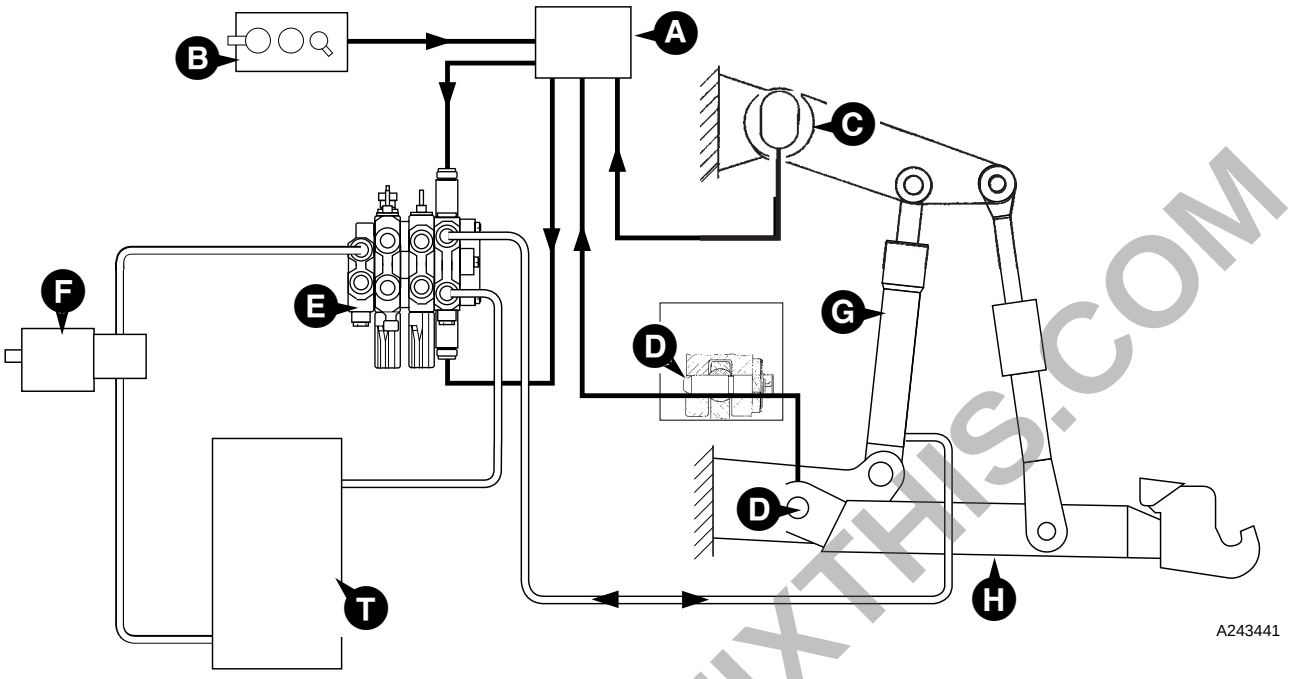
Instrument Cluster
CR65 (Black)

Terminal	Wire	Function
1	406	Low air pressure - 2
2	409	Brake malfunction splice
3	408	Low air pressure - 3
4	434	Low transmission oil pressure
5	-	
6	440	ABS trailer socket
7	899A	Differential lock solenoid
8	415	Area cut-out selection switch
9	-	
10	-	
11	-	
12	-	
13	420	2WD/4WD switch (4WD indicator)
14	880B	L.H. Side lights splice
15	511	EDC Earth splice
16	-	
17	405	Transmission oil filter blocked
18	444	540 PTO range selected
19	445	1000 PTO range selected
20	440	Trailer ABS warning
21	-	
22	857B	Rear PTO drive selected
23	477B	Low range selected
24	-	
25	861G	Right turn signal
26	418	Main beam
27	419	2nd trailer turn signal
28	417	1st trailer turn signal
29	-	
30	407	Low air pressure - 1
31	-	
32	-	
33	404	Air filter blocked
34	480B	Reverse range selected
35	848B	Front PTO drive selected
36	509B	EDC lower signal

Instrument Cluster
CR66 (Red)

Terminal	Wire	Function
1	479B	High range selected
2	512	Fuel feed signal
3	502	Fuel return signal
4	414A	Transmission speed signal
5	-	
6	411	Fuel level
7	500A	Radar speed signal
8	517	RS232 RX
9	423	Buzzer out
10	898	<20 kph speed trigger
11	485	>3 kph speed trigger
12	505	Increase wheel slip output
13	-	
14	859G	Left turn signal
15	-	
16	478B	Medium range selected
17	403A	Alternator charge
18	510	Wheel slip setpoint
19	516	RS232 TX
20	486	>1 kph speed trigger
21	518	Decrease wheel slip output
22	416	Differential lock cut-out
23	514F	CANL
24	515F	CANH
25	501	Radar presence signal
26	497	Transmission speed sensor presence
27	827A	Flow divider ON splice
28	499	Column switch button
29	448	Tractor ABS warning light
30	-	
31	513	Diagnostics connector (program
32	498	Column switch button
33	300B	+ 12V Battery permanent feed splice B9
34	160B	+ 12V ignition PISC4
35	710C	Battery earth PES1
36	626	Chassis earth RF

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System Description

The electronic control unit **A** receives the preselected set-point values from the control panel **B** and the actual values from the position sensor **C** and the two draft sensors **D**.

These values are processed by the electronic control unit and then transmitted as electrical signals to the raise and lower solenoids of the draft control section of Draft Control/External Hydraulics Valve **E**.

Hydraulic oil is fed from pump **F** to the control valve which then directs oil to or from the lift cylinders **G** in order to raise or lower the 3 point linkage arms **H**.

Position Sensor

The position sensor is a rotary type which consists of two main parts, a differential coil and an iron core which moves inside the coil without actually touching it. The core is therefore wear-free. One part is fixed to, and rotates with, the linkage arm boss. Consequently, depending upon the angular position of the linkage arm, the iron core moves inside the coil, varying the inductive reactance in the coil and therefore the output voltage to the electronic control unit.

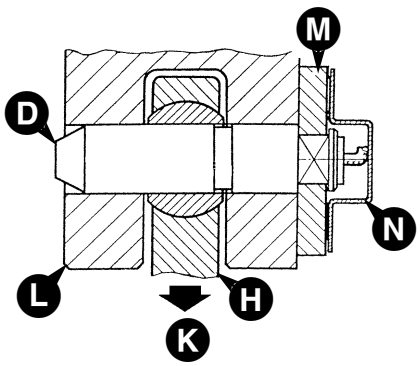
Draft Sensors

The draft sensors **D** act as bearing pins fo the arms **H**. The draft force **K** of an attached implement is converted into an electrical signal which is then transmitted to the electronic control unit.

A transformer in the core of the draft sensor generates a magnetic field which encompasses the sensor casing. If the sensor casing is subjected to positive or negative shear forces (caused by the push or pull of the attached implement on the arms **H**), the resultant changes in the magnetic field are then transmitted as an amplified signal to the electronic control unit.

The draft sensors have a precise mounting position and are held in position by a retaining plate **M**.

The electrical cable feeding the sensor is protected by guard **N**.



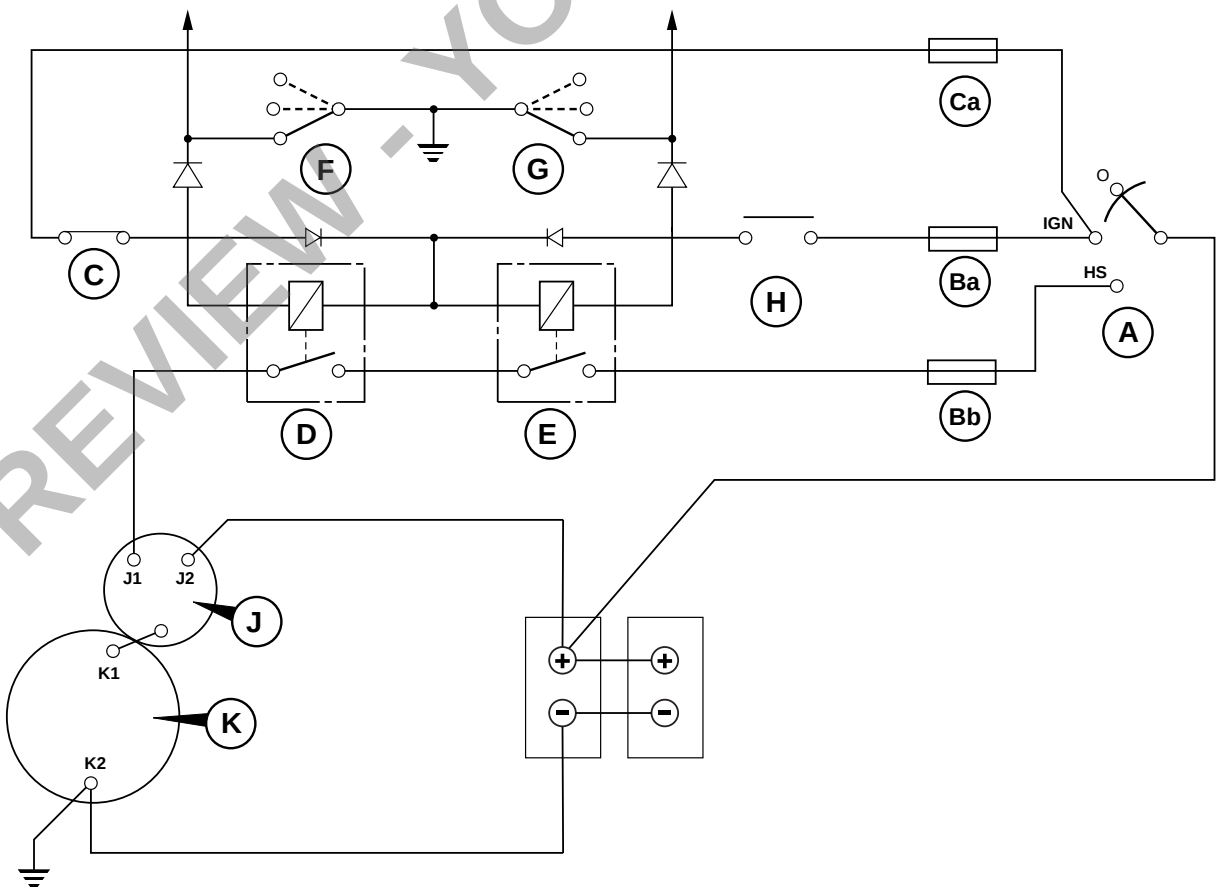
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Starting Circuit

Circuit Description

With the 6-speed gearbox lever set to neutral and starter switch **A** turned to 'IGN', the battery supply is fed via fuse **Ca** and the 6-speed gearbox neutral switch **C** (now closed as shown on the diagram) to the solenoids of the two inhibit start relays **D** and **E.** To eliminate the need to select neutral in the 6-speed gearbox, an alternative supply route to the solenoids of the start inhibit relays is provided via **Ba** the clutch depressed switch **H**. With the front and rear power take off (PTO) switches **F** and **G** turned to the braking position, as shown in the diagram, an earth return is provided for the inhibit start relay solenoids, causing them to energise.

When the starter switch is turned to the start ('HS') position, the battery supply is fed via fuse **Bb** and the relay contacts of the inhibit start relays **D** and **E** to the starter solenoid **J**, which energises and connects the battery supply to the starter motor **K**.



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General

Machine Model	**3170, 3170 Plus**		**3190, 3190 Plus 3220, 3220 Plus**		**3200, 3200 Plus 3230, 3230 Plus**	
Engine Model	B5.9, 6-cylinder Turbocharged		QSB, 6-cylinder Turbocharged, charge air cooled.		QSB6.7, 6-cylinder Turbocharged, charge air cooled.	
Bore	102 mm	(4.02 in)	102 mm	(4.02 in)		
Stroke	120 mm	(4.72 in)	120 mm	(4.72 in)		
Swept Volume	5883 cm^3	(359 in^3)	5883 cm^3	(359 in^3)	6702 cm^3	(409 in^3)
Dry Weight	519 kg	(1144 lb)	519 kg	(1144 lb)	485 kg	(1069 lb)
Firing Order	1, 5, 3, 6, 2, 4		1, 5, 3, 6, 2, 4		1, 5, 3, 6, 2, 4	
Compression Ratio	17.5 : 1		16.5 : 1		17.2 : 1	
Valve Clearance						
Inlet	0.25 mm	(0.010 in)	0.25 mm	(0.010 in)	0.31 mm	(0.012 in)
Exhaust	0.51 mm	(0.020 in)	0.51 mm	(0.020 in)	0.56 mm	(0.022 in)
Oil Pressure at idle (minimum allowable)	0.7 bar	(10 lbf/in^2)	1.03 bar	(15 lbf/in^2)	0.52 bar	(7.5 lbf/in^2)
Oil Pressure at rated speed (minimum allowable)	2 bar	(30lbf/in^2)	3.1 bar	(45 lbf/in^2)		
Oil Pressure, regulated	4.5.bar	(65 lbf/in^2)	4.1.bar	(60 lbf/in^2)	3.8 bar	(55 lbf/in^2)
Idling Speed	800-900 rev/min		700-800 rev/min		750 rev/min	
Maximum No Load Speed	2410-2510 rev/min		2470-2570 rev/min		2520 rev/min	

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Powershift and Master Clutch Calibration

Calibration

All machines will have been calibrated before leaving the factory. During normal operation recalibration will not be required. Recalibration will however, be required after any of the following service procedures:

a Replacement of the transmission ECU.

b Transmission rebuild or replacement.

c Clutch pedal potentiometer (position sensor) adjustment or replacement.

After carrying out any of the above procedures calibrate the transmission **before moving the machine** using the procedure below. When the initial calibration has been completed successfully the machine should be driven for at least 15 miniutes to ensure that the transmission oil is hot. The transmission should then be recalibrated using the procedure below.

The calibration procedure includes the following elements:

a Overlap time for the Powershift clutches (Snail, Hare and Tortoise).

b Clutch pedal calibration. This sets the operating range of the clutch pedal and its potentiometer (position sensor).

c Master clutch bite point calibration. This sets the bite point of the clutch by detecting a reduction in engine speed as the clutch is engaged.

Note 1: During the calibration procedure the transmission control module detects the precise point at which the clutches start to engage. This engagement is detected by virtue of a reduction in engine speed. It is therefore essential during calibration that no action is taken which might cause the engine speed to vary. To this end, make sure that the air conditioning and all electrical equipment is switched off and do not operate the PTO or any hydraulic controls.

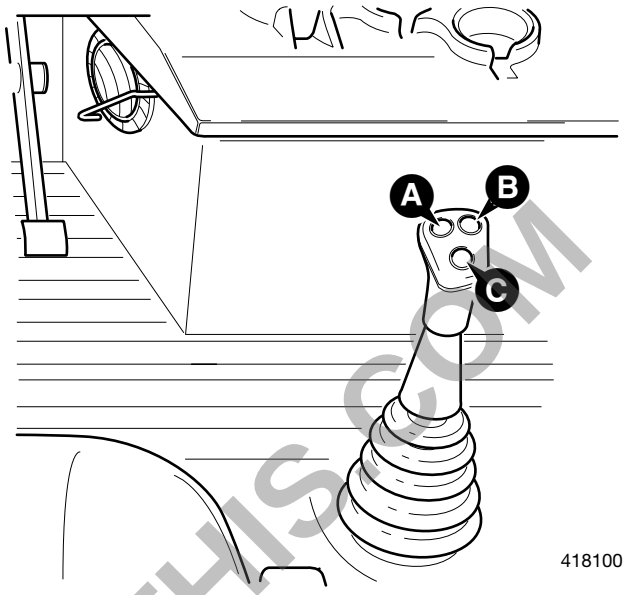
1 Apply the handbrake and switch off the engine.

⚠ WARNING

During the calibration procedure, the machine should remain still. However, to avoid the possibility of accidents due to inadvertent, unexpected movement, make sure that personnel and equipment are kept well clear of the machine, especially to the front or rear.
ELEC 5-2

2 Press and hold all three buttons (DOWN change **A**, UP change **B**, AUTO **C**) on the top of the speed box gear change lever.

3 Switch on the ignition, but do not start the engine. Release the gear change lever push buttons **A**, **B**, **C**.



4 The Fastrac transmission software number is now shown on the centre display of the instrument cluster.

5 If the calibration mode has been successfully accessed the Hare, Tortoise, Snail and Auto icons will flash quickly and continuously.

Note 2: If the calibration mode has not been accessed, switch off the ignition and repeat from step 3.

6 Start the engine.

7 A two minute countdown (in 1 second steps) starts and is shown on the centre display e.g. TCAL 95.

8 When the countdown reaches zero the Hare, Tortoise, Snail and Auto icons will stop flashing. CPED will appear with a 3 digit number. Depress the clutch pedal fully and then release fully. Values relating to the pedal position will be displayed. Record the maximum and minimum values. The values must be within the range as follows:
Minimum value = not less than 30
Maximum value = not greater than 225

9 Depress and release the clutch pedal fully twice more to ensure that the pedal has reached the full range of travel. Recheck the maximum and minimum values against the range given in step 8. If the values displayed are outside this range then further investigation will be required.

10 Press the AUTO button (**C**). The display will now indicate the type of range box fitted as detected by the new ECU i.e. MAN RANGE for manual range box or SEL RANGE for Selectronic range box. If the range box display is wrong press button **A** to choose SEL RANGE or button **B** to choose MAN RANGE.

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⚠ WARNING

Maintenance must be done only by suitably qualified and competent persons. Before doing any maintenance make sure the machine is safe. It should be correctly parked on firm level ground.

To prevent anyone starting the engine, remove the starter key. Disconnect the battery and chock the wheels when you are working beneath the machine.

If you do not take these precautions you could be killed or injured.
9-3-1-1

Every 10 Operating Hours or Daily whichever occurs first

Clean
1 Machine generally.

Drain
2 Empty hydraulic coupling drain reservoir (if fitted).
3 Fuel filter.
4 Trailer air tank.

Check (Engine Stopped)
5 Generally for damage.
6 Engine oil level and condition.
7 Check radiator and coolers for blockage and clean if required.
8 Engine coolant level and condition.
9 Fuel system for leaks and contamination.
10 Air cleaner and air inlet hose condition and security.
11 Fan belt condition.
12 Crankcase Breather Condition.
13 Hydraulic fluid level.
14 Hydraulic system for leaks.
15 Machine generally for oil leaks (axles, engine, transmission).
16 Gearbox oil level.
17 Tightness of wheel nuts.
18 Windscreen washer level.
19 Tyre pressures and condition.
20 Security of front weights (if fitted).
21 Seat belt condition and security .
22 Brake fluid levels.

Check (Engine Running)
23 Instrument readings and warning lights.
24 Operation of all electrical equipment.
25 Exhaust for excessive smoke.
26 Operation of clutch and footbrakes.
27 Operation of steering.
28 Operation of transmission.
29 Operation of 3-point linkage
* 30 Operation of front linkage (optional equipment).
31 Parking brake operation.
32 Throttle and stop controls.

Every 50 Operating Hours or Weekly whichever occurs first

Do the Daily jobs plus:

Drain
1 Fuel pre-filter.
***Note**: Some machines have a one-piece pre-filter which cannot be drained.*

Clean
2 Air filter dust valve.

Check (Engine Stopped)
3 Air conditioning compressor drive belt.
4 Front PTO transfer gearbox oil level (optional equipment).
5 Brake pad condition.
6 Cab air filter (clean if required).
7 Propshaft security.

Grease
8 Rear PTO drive shaft splines and universal joints.
9 Rear PTO drive shaft bearings.
10 Rear axle propshaft.
11 Front axle propshaft.
12 Front PTO drive shaft (if fitted).
13 Rear anti-roll bar joints.
14 Rear hydraulic lift cross-shaft.
15 Rear hydraulic lift ram pivots.
16 Front agricultural 3 point linkage cross shaft (if fitted).
17 Front agricultural 3 point linkage lift ram pivots (if fitted).
18 Steering swivels.
19 Steering column universal joints.
20 Suspension cylinder pivots.
21 3-point linkage lift rods and top link.
22 Automatic trailer coupling (if fitted).
23 Roller drawbar (if fitted).

Note: It is essential that drive shaft and propshaft joints are lubricated as specified.

First 100 Hours Dealer Service

Change
1 Engine oil and filter.
2 Fuel filters.
3 Transmission oil filter.
4 Hydraulic oil filter.
5 Front axle oil.
6 Front hub oil.
7 Rear axle oil.

Drain
8 Fuel pre-filter (early machines only).
***Note**: Later machines have a one-piece pre-filter which cannot be drained.*

Check (Engine Stopped)
9 Coolant level/leaks and antifreeze strength.
10 Fuel system for leaks and contamination.
11 Intercooler hose clamp security.
12 Air cleaner and air inlet hose condition and security.
13 Fuel system pipework routing and security.
continued over page

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All construction and agricultural equipment can be hazardous. When a JCB Fastrac is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

BE CAREFUL
BE ALERT
BE SAFE

GEN-1-6

As well as the warnings in the following pages, specific warnings are given throughout the book. This section is designed to give a safety code for use of the machine generally and for operation and maintenance practices.

Note: This section includes a certain amount of operating safety information. But remember that whenever you drive the machine or operate its controls you are in effect a machine operator. Therefore you should read and understand the information given in the Operator Handbook before driving the machine or operating its controls.

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General Safety

⚠ WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained.

INT-1-3-6

⚠ WARNING

Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or whilst operating the machine or attachments. Be aware of medicines which can cause drowsiness.

INT-1-3-9

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Raised Equipment

Raised equipment can fall and injure you. Do not walk or work under raised equipment unless safely supported.

13-1-1-6

⚠ WARNING

Machine Modifications

* Parts of this machine, for example the braking and fuel injection systems, are manufactured in compliance with legislative and other requirements. The machine should not be altered in any way which could affect or invalidate any of these requirements. Failure to observe this instruction may be illegal or invalidate the manufactuer's warranty. For advice consult your JCB Distributor.

⚠ CAUTION

Electronic Control Unit

The electronic control unit under the passenger's seat is protected by a cover. Do not use the machine with the cover removed.

0111

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General Data

System Type	12 Volts, negative earth
Battery	
Cold crank amps for 1 minute to	
1.4 Volts per cell at -18 deg C (0 deg F)	800
Reserve capacity (minutes) for 25 Amp load	200
Alternator	150 Amp

Light Bulbs (12V rated unless specified otherwise)

Headlights main/dip	60W/55W (Halogen)
Working lamps	55W (Halogen)
Front side lamps	4W
Tail lamps	10W
Stop lamps	21W
Indicator lamps	21W
Indicator side repeater lamps	5W
Reversing lamps	21W
Number plate lamps	10W
Fog lamps	21W
Interior lamps	10W
Panel/Warning lamps	1.7W
Beacon	55W (Halogen)

Note: This machine is fitted with a “CAN-BUS” system which links certain Electronic Control Units (ECUs) on the vehicle. This stands for “Controlled Area Network” and uses a special cable in the vehicle harness which carries two (2) twisted signal wires. These carry digital messages and are covered by a metal foil casing called a “screen” to help prevent corruption from electrical interference. The CAN-BUS is used to send text and fault codes from the transmission controller to the instrument cluster as well as to share information between each other, such as vehicle set-up.

Set-up values from VIN or Vehicle Type

When the ‘Set-up from VIN’ or ‘Set-up from Vehicle Type’ options are used the factory defaults are used as a basis for the set up. After this specific items are set-up that are peculiar to that machine (e.g. tyres).

The language is set depending upon country of use.

* Configuration Values for Setup of EMS (early machines)

Machine Type	Rated Speed km/h	PTO 1000	PTO 540	Speed Sensor pulses/ wheel rev	Max Bar Graph Speed km/h	Alternator Setup † Hz/1500rpm	VIN code prefix	VIN code engine	VIN code trans	nominal max speed km/h
3190	80	2196	2002	430	85	450	SLPFT	17	9	75
3190	65	2196	2002	581	75	450	SLPFT	17	8	65
3190	50	2196	2002	581	55	450	SLPFT	17	8	50
3190	40	2196	2002	581	45	450	SLPFT	17	8	40
3220	80	2196	2002	430	85	450	SLPFT	18	9	75
3220	65	2196	2002	581	75	450	SLPFT	18	8	65
3220	50	2196	2002	581	55	450	SLPFT	18	8	50
3220	40	2196	2002	581	45	450	SLPFT	18	8	40

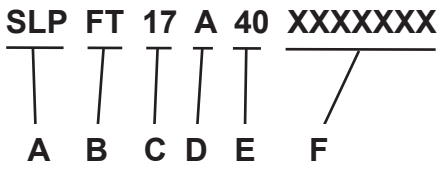
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Serial Number Plate

Each machine has a serial number plate located at **X**. The 17 digit Vehicle Identification Number (VIN), and the serial numbers of the engine and transmission are stamped on the plate.

*** Typical Vehicle Identification No. (VIN)**



Original VIN Configuration



Later VIN Configuration

A = Manufacturing Code
B = Machine Range
FT = Fastrac
* **C** = Engine Type
17 = 3190 or 3190 Plus
18 = 3220 or 3220 Plus
19 = 3170 or 3170 Plus
23 = 3200 or 3200 Plus
24 = 3230 or 3230 Plus

* **D** = Transmission Type (Gearbox and axle combination)

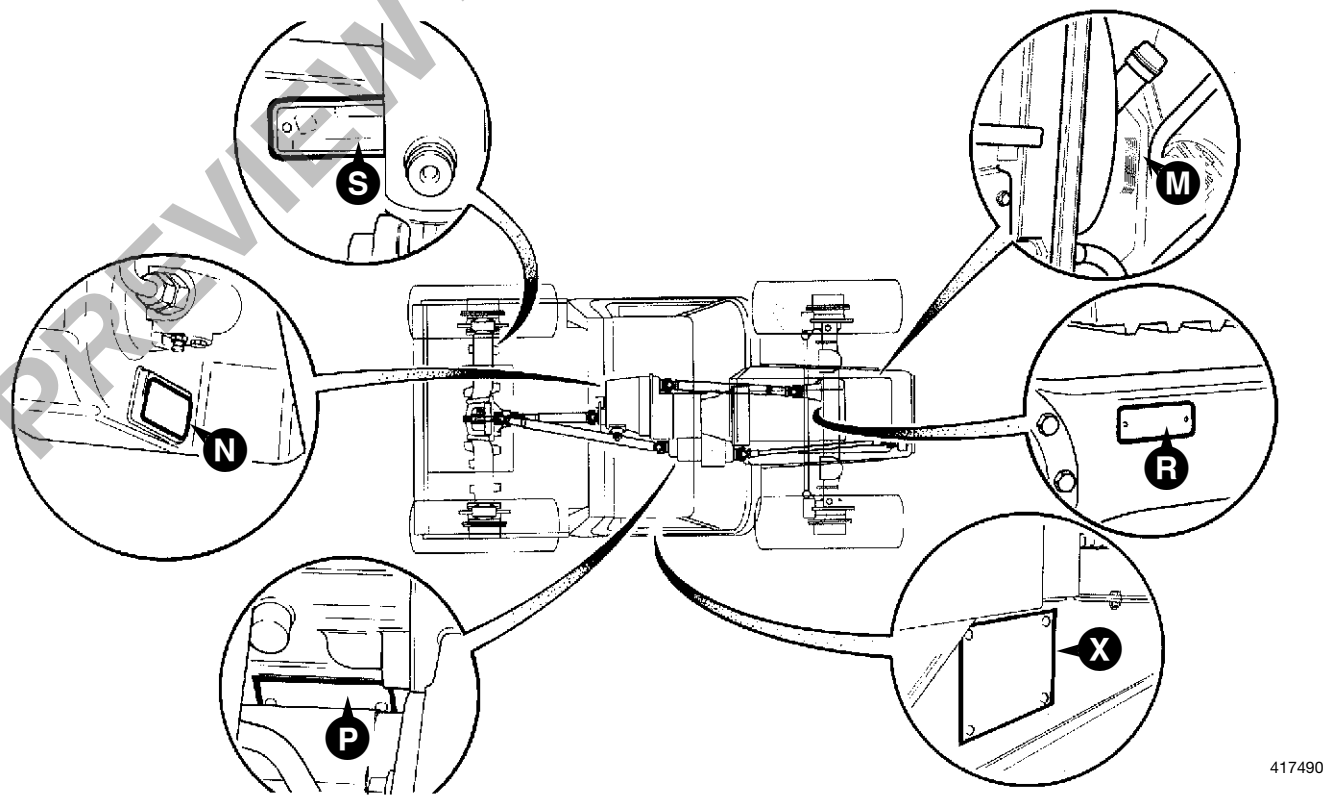
3170, 3170 Plus	**All other machines**
A = 75 km/h	8 = Standard (40, 50 or 65 km/h)
B = 65 km/h	9 = High Speed (75 km/h)
D = 50 km/h	
E = 40 km/h	

E = Vehicle Max. Speed
40 = 40 km/h
50 = 50 km/h
65 = 65 km/h
75 = 75 km/h
F = Serial Number
* **G** = Authenticity Code
* **H** = year Code (e.g. 6 = 2006)

Unit Identification

The serial number of each major unit is also stamped on the unit itself as shown below. If a major unit is replaced by a new one, the serial number on the plate will be wrong. Either stamp the new number of the unit on the identification plate, or simply stamp out the old number. This will prevent the wrong unit number being quoted when replacement parts are ordered.

Engine	**M**
Gearbox Assembly (assembly of all three gearboxes)	**N**
Speed Gearbox	**P**
Front Axle	**R**
Rear Axle	**S**



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Checking the Coolant Level

⚠ WARNING

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.
2-3-3-3

1 Prepare the Machine

Park the machine on firm, level ground. Apply the parking brake. Lower any mounted implements to the ground. Turn the front wheels to full left hand lock.

2 Stop the Engine

Remove the starter key

3 Open the Bonnet

4 Check the Level

Visually check that the level of the coolant is up to the line marked '**COLD MIN**' but below the line marked '**HOT MAX**'. If the level is low, then continue with steps **5** to **7.**

5 Top-up the Expansion Tank

⚠ WARNING

Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.
7-3-4-4/1

Remove filler cap **A** and add pre-mixed water/antifreeze solution (see **Coolant Mixtures**) until the level is up to the line marked '**COLD MIN**'. Do not overfill.

Note: Check the quality of the antifreeze mixture every year before the cold weather starts. Change it every two years.

6 Refit the Filler Cap

Make sure it is tight.

7 Check for Leaks

Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and check for leaks.

Coolant Mixtures

The protection provided by JCB Four Seasons Anti-freeze & Summer Coolant is shown below. If any other anti-freeze is used, refer to the manufacturer's instructions and ensure that a corrosion inhibitor is included.

DO NOT use solutions of more than 60% or less than 50% or damage to the cooling system will occur.

Solution	Maintains circulation down to		Protects against damage down to	
	deg C	deg F	deg C	deg F
55%	-36	-33	-41	-42

The strength of the anti-freeze solution must be checked at least once a year, preferably at the beginning of the cold period.

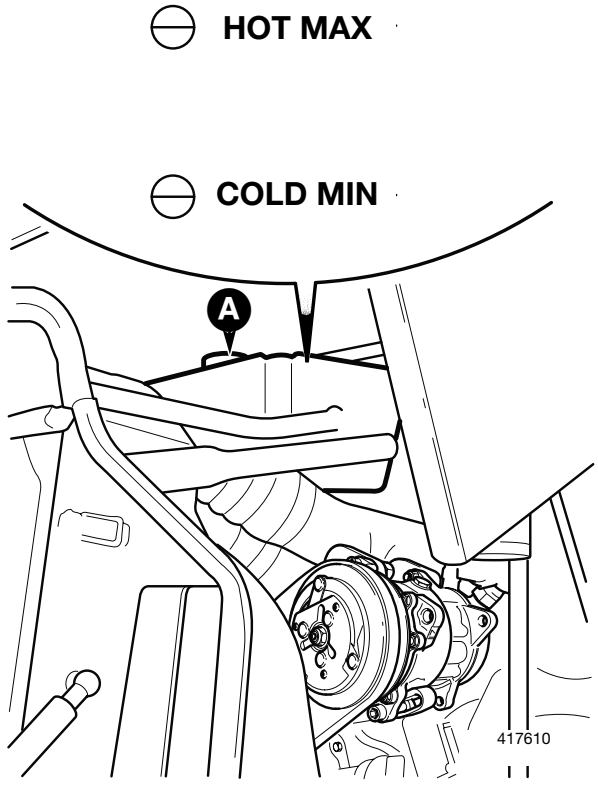
It is an advantage to leave the anti-freeze in all the year round as it gives continued protection against corrosion. Always renew the anti-freeze every two years.

A 50% anti-freeze mixture must be used even if frost protection is not needed. This gives protection against corrosion and raises the coolant's boiling point.

Note: In climates where antifreeze is not necessary, a reputable corrosion inhibitor must be used. Renew the mixture every 6 months.

⚠ WARNING

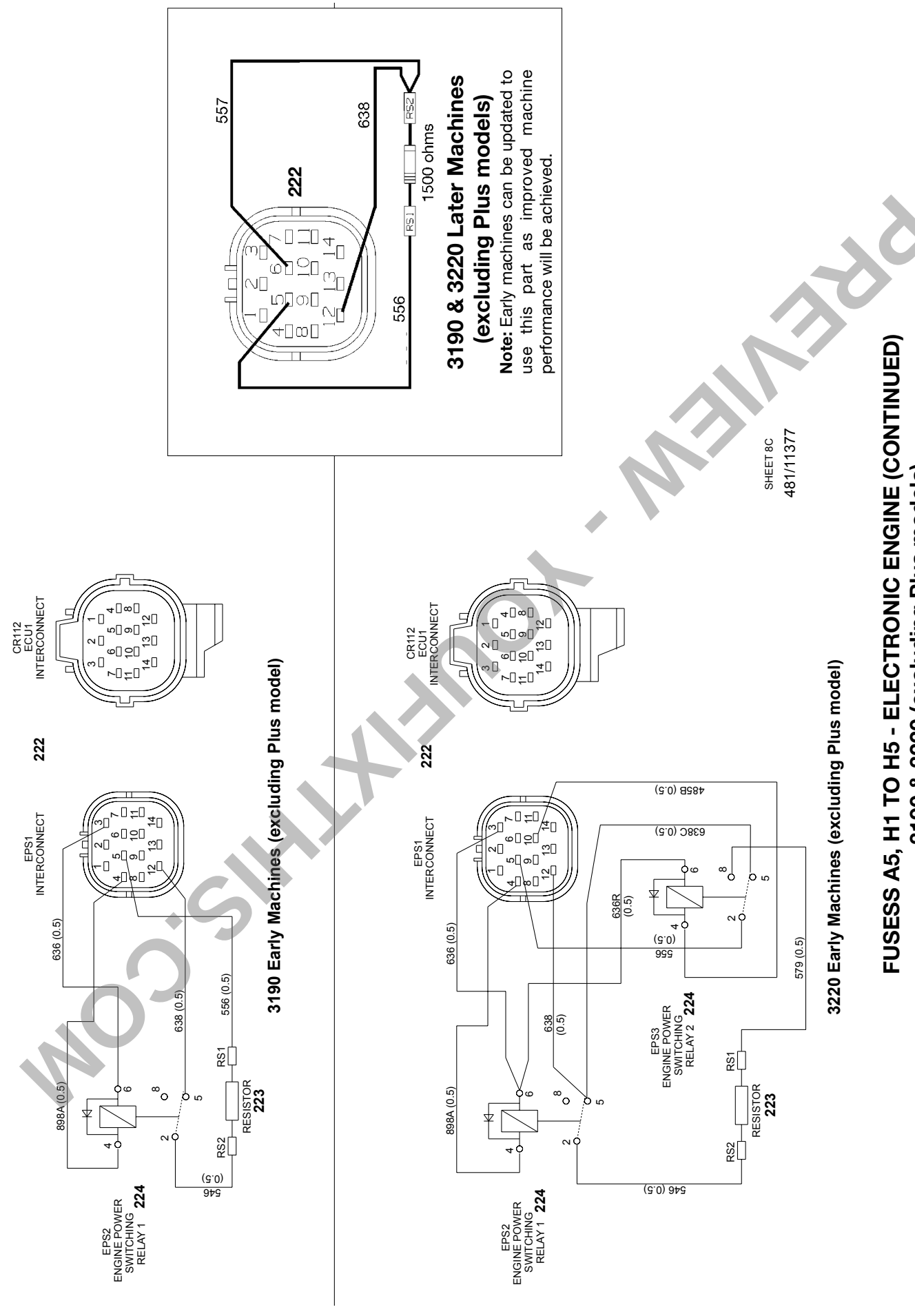
Antifreeze can be harmful. Obey the manufacturer's instructions when handling full strength or diluted antifreeze.
7-3-4-4/1



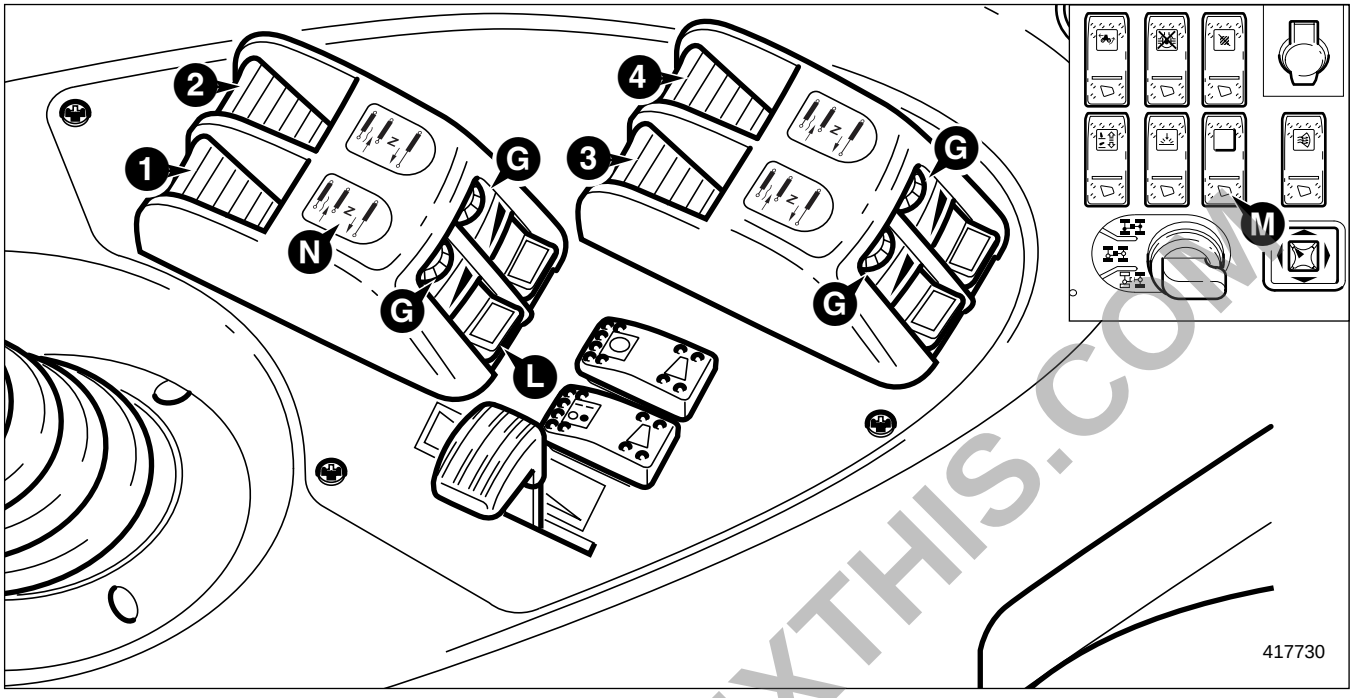
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6 Selection of Calibration or Bosch Mode.

The normal mode of operation is CAL. If necessary the spool valves can be set back to their original default values (as supplied by the manufacturer) - refer to the section **Reverting to Bosch Mode**.
If the display shows BOSCH xx and only calibration is required, put the kickout disable switch **L** for lever 1 to the kickout disable position.
The display should show CAL xx where xx is the number of seconds remaining until Calibration Mode is activated. To exit, turn the Ignition Off.
When the timer counts down to 00, External Hydraulics Rear Service Calibration can commence.

Note: If this is the first time that calibration has been entered and the machine is fitted with 4 or 5 spool valves, spool valves 4 and 5 may have their red diagnostic LED flashing. This generally indicates that the Central Controller was only expecting 3 valves. If this is the case turn of the ignition and repeat from section 4. This time all spool valves should communicate with the Central Controller.

7 Calibrating the External Hydraulics Rear Services.
Note: If the position of transport lock switch **M** is changed when calibrating the rear services, calibration will be aborted. All parameters calibrated to the point where the switch is changed will be saved into ECU1 memory.

Initial Display	Operation	Display after Data Changed	Key to Save Calibration	Key to go to next parameter	Key to go to previous parameter
RA	Move all rear spool valve levers to 'A' (ram extend) position.	RAx-790	Shuttle button	Down button	Not allowed
RN	Move all rear spool valve levers to 'neutral' position **N**.	RNx-490	Shuttle button	Down button	Up button
RB	Move all rear spool valve levers to 'B' (ram retract) position.	RBx-170	Shuttle button	Down button	Up button
RLO	Adjust all rear flow/time controls (**G**) to lowest position.	RLOx-235	Shuttle button	Down button	Up button
RHI	Adjust all rear flow/time controls (**G**) to highest position.	RHIx-860	Shuttle button	Down button	Up button
ROM	Select time or flow control for each spool (as required) by operating switch **L**.	ROMx-F for Flow ROMx-T for Time	Shuttle button	Down button	Up button

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	Code	Description	Possible Cause	Effect	Cummins Fault Code
*	E163	Sensor Supply Voltage Shorted Low (443 or 516).	Low voltage detected at accelerator position sensor supply pin 29 of the tractor (OEM) harness, or, low voltage detected at the coolant level + 5-VDC sensor supply voltage pin 49 of the engine harness.	Engine idles when accelerator is not pressed and ramps up to a default set speed when off-idle, or, no engine protection for coolant level.	443 or 516
	E164	Intake Heater Relay Fault - Circuit data incorrect (381 or 282)	Error detected in cold start air relay 1 enable circuit at pin 41 of the tractor (OEM) harness. If the error persistently occurs then replace ECU.	Intake air heater can not be energised by the electronic control module (ECM). Possible white smoke and/or hard starting in cold ambient conditions.	381 or 282

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Error Codes - Anti-lock Braking System (ABS) (continued)

JCB Fastrac ABS Error Code Explanation and Fault Finding (continued)

Error Code	Description	Possible Solution
8-1	Front modulator wiring fault Possible causes:- Modulator release solenoid wiring shorted to battery Modulator release solenoid ground wire broken	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 10 to Modulator Pin 2 (Wire No 1806) ECU Plug X2 Pin 11 to Modulator Pin 1 (Wire No 1808) ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
8-2	Front Modulator Fault Possible causes Shorted to ground release solenoid wire broken release solenoid wire	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 10 to Modulator Pin 2 (Wire No 1806) ECU Plug X2 Pin 11 to Modulator Pin 1 (Wire No 1808) ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
8-3	Broken wire on front modulator release solenoid	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 10 to Modulator Pin 2 (Wire No 1806) ECU Plug X2 Pin 11 to Modulator Pin 1 (Wire No 1808) ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
8-4	Broken Wire on Front Modulator pin 1	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 11 to Modulator Pin 1 (Wire No 1808)
8-8	Modulator Configuration error	Check ABS ECU has correct JCB Part number attached
9-5	Front modulator hold solenoid shorted to battery	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
9-6	Front modulator hold solenoid fault possible causes Hold Solenoid wiring shorted to ground Hold solenoid wiring broke	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
9-7	Front Modulator hold solenoid broken wire	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X2 Pin 4 to Modulator Pin 3 (Wire No 1807)
9-8	Modulator Configuration error	Check ABS ECU has correct JCB Part number attached
10-1	Rear Left modulator wiring fault Possible causes:- Modulator release solenoid wiring shorted to battery Modulator release solenoid ground wire broken	Check Modulator Connectors Check Pannier bulkhead connector Check continuity or for damage between the ECU and the modulator ECU Plug X3 Pin 10 to Modulator Pin 2 (Wire No 1802) ECU Plug X3 Pin 11 to Modulator Pin 1 (Wire No 1801) ECU Plug X3 Pin 12 to Modulator Pin 3 (Wire No 1800)

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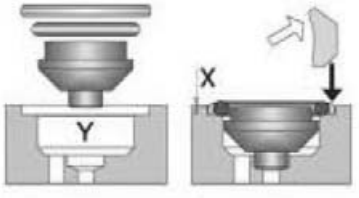
Note: Port **R** should always have a 20 mm inside diameter 'O' ring but no back-up ring.

Lubricate the seals with JCB Special Hydraulic Fluid before assembly.

Ensure that shuttle valves **S** are positioned between the spool slices as illustrated.

* **Important**: Do not tilt the shuttle valves.

* Make sure that there is a clearance of approximately 0.5 mm between the face of the valve slice and the top face of the shuttle valve at X.



Oil the tie rods and ensure that any spacing washers on the tie rods are refitted in their original positions. If any adhesive shims have been applied previously, one spacer must be threaded onto each of tie rods. If the slice face has corrugations which have been smoothed with a dressing stone, one spacer must be threaded onto each of tie rods.

Tighten the tie rod nuts in the sequence **E**, **F**, **G**.

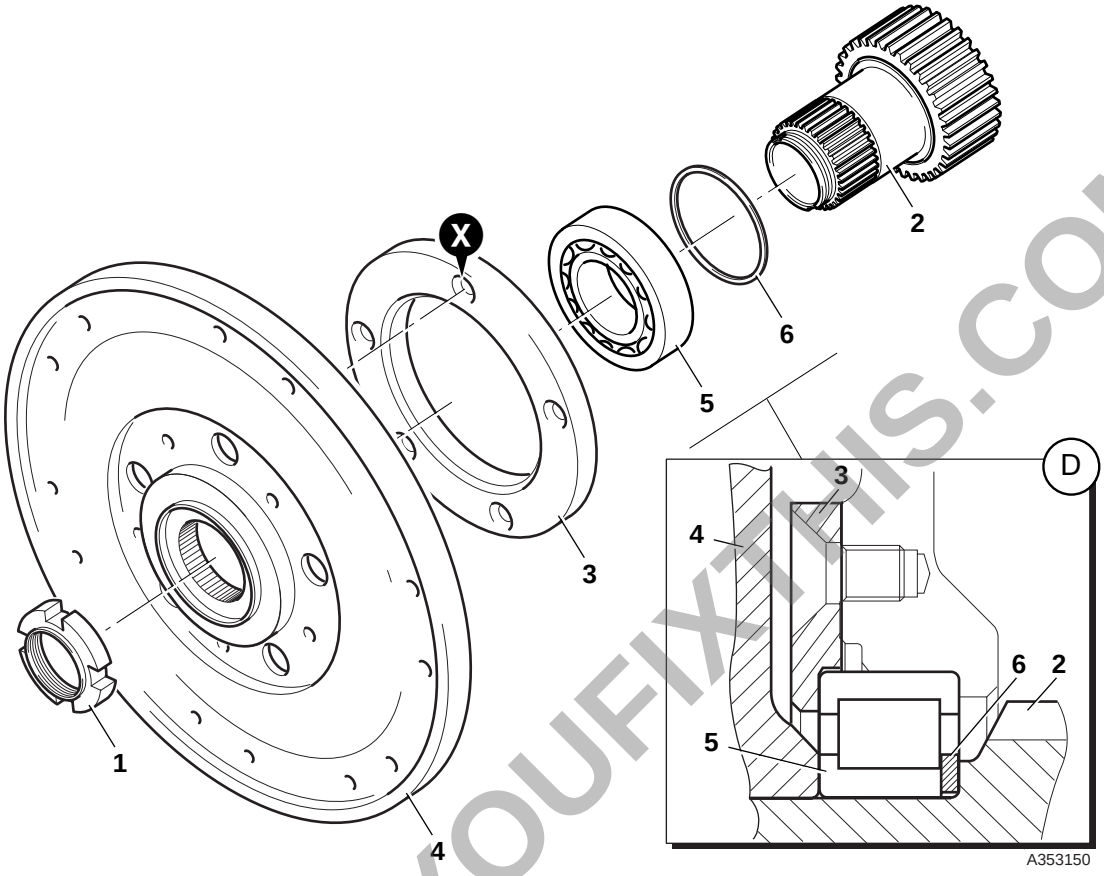
Ensure fasteners are tightened to the correct torque as overtightening could cause valve block distortion and impair spool movement.

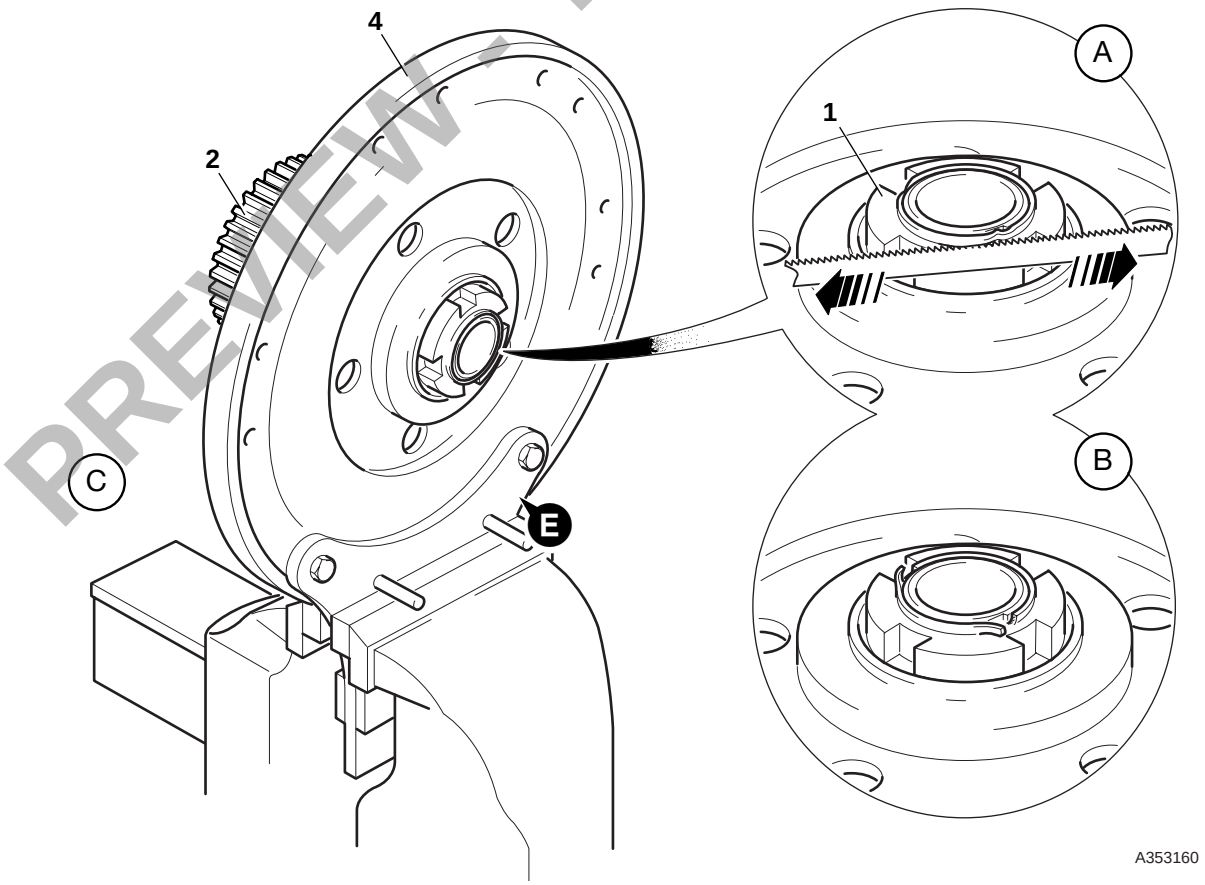
Torque Settings

Item	Nm	kgf m	lbf ft
E, F, G	25 - 33	2.5 - 3.3	18 - 24

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