

C AND D VEHICLES

INSPECTION FOR USEABILITY

This instruction is authorised for use by command of the Chief of Army. It provides direction, mandatory controls and procedures for the operation, maintenance and support of equipment. Personnel are to carry out any action required by this instruction in accordance with EMEI General A 001.

GENERAL

Introduction

1. This instruction is issued as a guide to the formulation of C and D vehicle inspection standards and includes a general guide for inspectors of C and D vehicles.
2. This EMEI does not cover the requirements for enhanced mechanical and structural inspections of Cranes, Tele-handlers or Mobile Elevating Work Platforms.

Associated Publications

3. This instruction is to be read in conjunction with the following references:
 - a. EMEI Engr Equip A 019-1 – Oil Sampling;
 - b. EMEI Workshop M 019-1 – Torque Wrenches;
 - c. EMEI Misc Equip O 008 – Lifting Tackle Components;
 - d. EMEI Misc Equip Q 208 – Inspection of Portable Fire Extinguishers;
 - e. EMEI Vehicle D 108 – Inspection of Recovery Equipment;
 - f. EMEI Engr Equip D 008-1 – Structural Integrity Inspection of Mobile Cranes, 10 Tonnes and Over – Inspection of Useability;
 - g. EMEI Engr Equip T 008 – Structural Integrity Inspection of Telehandlers – Inspection of Useability;
 - h. EMEI Engr Equip T 008-1 – Structural Integrity Inspection of Mobile Elevating Work Platforms – Inspection of Useability;
 - i. Equipment-specific EMEI;
 - j. Electronic Supply Chain Manual (ESCM);
 - k. Technical Regulation of ADF Material Manual-Land (TRAMM-L);
 - l. Australian Standards – Cranes hoists and winches – 1418 series;
 - m. Australian Standards – Powered industrial trucks, 2359 series;
 - n. Australian Standards – Cranes, hoists and winches – Safe use, 2550 series;
 - o. Australian Standards – AS3998 – 2006 Non Destructive Testing – Qualifications and certification of personnel; and
 - p. Relevant equipment operator and repair manuals.
4. A thorough inspection of C and D vehicles can only be achieved if the inspector possesses the necessary knowledge, technical judgement and common sense required to determine the condition of the equipment.

APPLICATION

Inspection Guidance

5. The inspector's guide, which commences at paragraph 23, is not exhaustive and will assist inspectors to arrive at common conclusions.

6. Items found to be Fully Functional (FF), ie fulfilling the requirements of being safe to use, are to be classified FF. Items which are not FF are to be classified in accordance with paragraph 3.j.

Clarification of Observations

7. During the inspection of a vehicle, inspectors occasionally detect components which, although appreciably worn, do not (in the opinion of the inspector) warrant immediate repair/replacement action. To indicate the worn condition of the components, the words “keep under observation” are often written in the appropriate column of the Technical Inspection Report. However, it is considered that generalised entries such as this:

- a. cause confusion to the user as to the exact degree of serviceability of the item; and
- b. do not list any particular criteria concerning the observation and are unlikely to result in checking of the item between inspections.

8. The inspector is to classify the components FF or Restricted Use (RU), at the time of the inspection. The decision on the classification should be influenced by:

- a. the inspection data available in EMEI;
- b. OEM technical publications, handbooks and manuals; and
- c. the effect of the worn component on the overall quality of the vehicle in relation to its role.

Definitions

9. The following definitions are to be applied to this document:

- a. **Competent Person.** A person who has acquired through training, qualification, experience or a combination of these, the knowledge and skill enabling that person to correctly perform the required task.
- b. **Third Party.** A third party person is the person responsible for the inspection or assessment of the crane who has not been involved in the ongoing maintenance of the crane. They must be independent of the crane maintenance team.
- c. **Third party Inspectors.** Due to the required experience and competencies, third party inspectors are normally civilian engineers/contractors as directed by local JLU BU.
- d. **Design Life.** Design life is dictated by the OEM in accordance with AS Standards and is the period the crane may be worked (number of lifts) without breakdown extensive maintenance, or continual replacement of parts.
- e. **Periodic Inspection.** Visual inspection and testing of operation of the equipment; confirmation of equipment is safe to use. This equates to an Annual Technical Inspection.
- f. **Major Inspection.** Detailed mechanical inspection, measuring, testing and Non-Destructive Testing (NDT) of all structural components to ascertain equipment is safe to use.
- g. **Mechanical Inspection.** Mechanical inspection includes detailed stripping of components, NDT conducted as required, visual inspection of structural members and NDT testing to be conducted when cracks are present or if in doubt.
- h. **Structural Inspection.** Structural inspection includes NDT of all structural members.
- i. **Oil Seepage.** Does not exceed a film of oil on the casing around the seal, shaft or inspection cover after a short run (casing to be cleaned before testing).
- j. **Oil Leak.** Oil loss, but not sufficient to reduce the quality in the assembly to a dangerous level between normal maintenance periods.
- k. **Noisy.** Indicates a noise which is not normal to the assembly/vehicle and, in the opinion of the inspector, indicates a condition which might lead to failure.
- l. **Pitting.** Corrosion on metal surfaces by local chemical or electrical action.
- m. **Scoring.** Scratch marks caused by a foreign body or lack of lubrication and varying from light to heavy.
- n. **Chatter or Shudder.** Vibration, as caused by wear, maladjustment or insufficient rigidity of parts.

- o. Brake Fade.** The falling off of brake efficiency due to prolonged or heavy and frequently repeated application of brakes. This condition should not normally occur during testing.
 - p. Spongy Brakes.** An indication that air has entered a hydraulic brake system causing inefficient braking.
 - q. Replace.** Removal of an unserviceable item and fitting of a fully functional item in its place.
 - r. Rebuild.** To restore an equipment to a standard as close as possible to original or new condition in appearance and life expectancy.
- 10.** Defence inspections which equate to required inspections as detailed in AS 2550.1 are as follows:
- a.** pre-operational inspections (First/Last Parade) by trained operators;
 - b.** routine inspections (unit Non Technical Inspections) by trained operators;
 - c.** periodic inspection (Annual Technical Inspection) by fully qualified ECN 229 or civilian equivalent;
 - d.** safe use inspection by third party inspectors through local JLU BUs (Annual Crane Safe Inspection); and
 - e.** major inspection by third party inspectors through local JLU BUs.
- 11.** Examples of intangible terms which are to be stated more specifically, relative to the exact repair action required, are shown in Table 1.

Table 1 Intangible Terms

Serial	Intangible Comments	Specific Comment
1.	Universal Joint (U/J) worn	Replace Universal Joint (U/J)
2.	Excessive play in clutch pedal	Adjust clutch
3.	Play in splines	Replace shaft
4.	Hour meter not working	Replace cable/lead/instrument
5.	Exhaust pipes or silencer blowing	Replace gasket/pipes/silencer
6.	Brakes pull badly	Adjust brakes
7.	Tail lamp broken	Replace globe/glass/light assembly
8.	Paintwork poor	Touch up/repaint (state each major location)
9.	Fan assembly insecure	Replace/tighten rivets and bolts
10.	Pivot joints rusty	Clean, replace/rebuild pivot joints
11.	Steering notchy	Adjust/replace bearings or gears
12.	Engine knocks	Replace engine (inspector to locate and specify exact nature of knock)

Non-Destructive Testing (NDT)

- 12.** The intent of the NDT inspection is to locate cracks in load bearing and structural members that may have developed during the operation of the equipment. Any defect interpreted to be a crack, irrespective of length, will deem the component unsafe and is to be classified XX until repaired.
- 13.** For the conduct of NDT, Australian Standards state that the quality, shape and size of welding, such as minor surface porosity, weld undercut, irregular weld cap, weld roll over and minor lack of fusion, shall not be considered for the purpose of this inspection requirement.
- 14.** As a minimum, the dye penetrant testing method is to be used. Other NDT testing methods may be utilised, depending on testing equipment available and the qualifications of inspector in accordance with paragraph 3.o.

Standards

- 15.** The standards of inspection are defined in paragraphs 3.f to 3.h.

- 16.** The quality requirements for a vehicle is that it is fully functional, which is defined as:
- a.** it meets all safety requirements;
 - b.** its appearance is satisfactory;
 - c.** it does not cause any environmental damage; and
 - d.** it is capable of carrying out its allocated role.

Frequency

- 17.** All C and D vehicles, including attachments and CES, are to be inspected every 12 months.
- 18.** In addition to the periodic technical inspections, cranes, telehandlers and mobile elevating work platforms require the following inspections:
- a.** safe use certification;
 - b.** enhanced mechanical inspections; and
 - c.** structural inspections.

Safe Use Certification

- 19.** A safe use certification is to be conducted on all cranes, telehandlers and mobile elevating work platforms by an authorised inspection body as detailed in paragraphs 3.f, 3.g and 3.h. The certification is to include the following:
- a.** testing and calibration off all load limiting and indicating devices;
 - b.** checking hydraulic cylinders for hydraulic creep; and
 - c.** checking all safety signage and labels for readability.

Enhanced Mechanical and Structural Inspections

- 20.** An enhanced inspection is a detailed inspection of the mechanical operating systems of all cranes, telehandlers and mobile elevating work platforms, and a visual inspection of the structural components, welds and joints. Cracks, when detected or suspected, are to be subject to NDT. Check critical dimensions. Testing of safety interlocks and devices is also to be carried out.
- 21.** The conduct of the enhanced periodic and major inspection is a seven-stage process as detailed in paragraphs 3.f, 3.g and 3.h.

Critical Components

- 22.** Table 2 details the critical components of C and D vehicles. Table 3 details items to be checked during static inspections. Paragraphs 47 to 64 detail checks to be made during road testing.

Table 2 Critical Components on C and D Vehicles

Serial	Component	Inspection Requirement
1.	Elevated basket	Visual inspection for damage, wear and cracks Safety harness points secure and undamaged
2.	Boom	Visual inspection for wear damage and cracks Check for smoothness of operation Check adjustment and clearances, eg wear pads
3.	All functions and controls	Check for smoothness of operation Limits of motion
4.	Emergency and safety devices including interlocks and emergency lowering devices	Check operation Check for smoothness of operation
5.	Base and ground controls	Check operation Check provision for overriding upper controls
6.	Chain and cable mechanisms	Check adjustment wear and damage
7.	Structural members	Visual inspection of all welds for cracks
8.	Brakes	Operate
9.	Gears, pivot pins and shafts	Visual inspection for cracks and measure for wear
10.	Fasteners	Tightness and security
11.	Guards and guard rails	Visual inspection for cracks and damage
12.	Signage including warning signs, decals and control markings	Visual inspection for clarity and readability
13.	Documentation user handbooks, operators manuals and log books, etc	Check currency of issue and completeness

TECHNICAL INSPECTIONS

23. Paragraph 24 and Table 3 provide a guide for the conduct of a technical inspection and should be referred to by all inspectors. It will assist in formulating a procedure for inspections, based on current policy.

24. The vehicle, together with all its attachments and CES, is to be checked for the following points:

- a.** All bolts/nuts, screws and other fasteners devices used on the vehicle are to be tight or locked.
- b.** There are no fuel/coolant leaks.
- c.** Oil leaks are not to exceed those defined in sub-paragraph 9.j.
- d.** Oil levels and grades are to be correct, and all indicators and plugs are to be tight.
- e.** Noise is not to exceed that defined in sub-paragraph 9.k.
- f.** Acceleration/deceleration and braking are to be above the minimal standards detailed in the OEM manuals.
- g.** Paintwork, sign writing and stencilling is to be in accordance with service requirements with particular attention to corrosion prevention. Patch painting, neatly done, is acceptable.
- h.** Filters are to be clean and correctly fitted.
- i.** Fuel or oil pipes are to be free from kinks.
- j.** Metalwork is to be free from rust (or other corrosion), particularly where water is likely to be trapped. Any rust is to be reported and action taken to ensure rectification.
- k.** Hydraulic systems are to be filled with the correct fluid, and are to be free from water, dirt and corrosion.
- l.** Non-destructive testing, eg dye penetrate, is to be used on all nominated critical areas for evidence of cracking due to fatigue and excessive stress.

- m. Critical components, eg Boom Wear pads where required, are to be measured for wear as detailed in OEM manuals.

Table 3 Static Inspection

Serial	Item or Function	Standard
ENGINE and CLUTCH		
1.	Engine tuning	When running, free from unusual noise and vibration within the normal operating ranges. The idling speed set correctly with all controls properly adjusted and the acceleration/deceleration smooth.
	Drive belts and pulleys	Adjusted and tight, not torn or stretched. Pulleys not cracked.
	Mounts	Secure, not damaged.
	Engine transmitters and pressure switches, main and auxiliary engine	Operating effectively with components serviceable.
2.	Governors (other than those already specified)	Secure, serviceable and operating effectively.
3.	Valves guides and seats	Compression even.
	Conduct compression test if required	Maximum variation between cylinders not to exceed that laid down in the appropriate standard.
4.	Camshafts and bearings Connecting rods and bearings	No abnormal tapping or rattling from chains, hum of gears, piston slap or knocks from bearings.
	Cylinder bores/liners/pistons/rings	No squeaks from dry glands or bearings.
	Cylinder head and gaskets	No leaks past plugs, washers or points. Exhaust emission acceptable.
	Flywheel ring gear	Flywheel ring gear must enable a clear start of the engine to be made without drag on the starter motor. Check for wear at engagement points.
	Mountings	Mounting correctly located, sound and locked.
	Rocker side and push rod covers and gaskets	Covers gaskets and bearings not leaking or damaged.
	Timing case/drive gears/bearing/seals and vibration dampers	Function correctly. Not noisy.
5.	Clutch assembly	Pedal free travel correct. Pedal stop adjustment correct. Linkage wear within limits laid down in appropriate standard. Hydraulic master/slave cylinder correct fluid level, type and condition. Filler cap and gasket fully functional and tight. No leaks in system.
6.	Lubrication systems Filters elements	Oil consumption and life of filter to be confirmed from documents.
	Filter head or manifold gaskets	Oil seepage and leaks to be within limits of paragraph 15.
	Gauges pressure and temperature connections	Oil pressure normal, warning light operative. Gauges operate correctly scales legible and secure with fully functional glass.
	Oil coolers and connectors	Coolers, tanks, reservoirs free from damage, rust, corrosion or leaks.
	Oil pipes	Associated pipes and connections in sound condition.
	Oil tanks and reservoirs	Do not leak.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ENGINE and CLUTCH (cont)		
6. (cont)	Sump drain plug taps	Tight, not leaking.
	Sump gasket	Not leaking.
	Valves by pass pressure and relief	Test settings of pressure relief and bypass valves.
	Main bearing oil seals	Not leaking.
7.	Cooling systems Coolant including antifreeze or inhibitor	Coolant levels correct if dilution of coolant is suspect check specific gravity.
	Core plugs	Not leaking.
	Ducting and louvers	Free from obstruction and rust; not damaged to the extent that free flow of air is impeded.
	Fan belts	Serviceable with all pulleys in line; for amount of adjustment remaining refer to standard. NOTE Belts must be changed in matched sets
	Fan control unit Fan drives other than fan belts	True and free from vibration.
	Gauges, sensing devices and connections	Operating correctly, dials legible with fully functional glass, connections sound and free from leaks.
	Fans and mountings	Secure.
	Heat exchangers excluding radiators	See radiator assembly.
	Hoses, pipes, connectors, stopcocks	In sound condition, properly secured with correct pattern clips and free from leaks.
	Pump gaskets	Pump secure firmly attached and in good condition, no leaks, gaskets serviceable.
	Radiator assembly	No abnormal rust deposits, free from leaks, clean, correctly positioned, secure and mounting rubbers not split or perished.
	Thermostats	When a thermostat is fitted, the thermostat should be checked for operation at the normal temperature in accordance with the technical handbook.
	Valves by pass pressure relief and vacuum	Valves should be serviceable and function correctly.
8.	Fuel systems Complete fuel system	Free from dirt leaks and damage.
	Fuel injection pumps and controls	Pumps relief and cut off valves fully functional.
	Fuel pipes switches taps and connectors	All connections sound and free from leaks.
	Fuel pumps	To be clean internally and gauge, if fitted, to be secure and functioning correctly.
	Injectors	Free from cracks, leaks, holes and evidence of fuel weeping.
	Fuel tanks	Connections sound and no leaks at flange of fuel gauge tank unit.
	Fuel gauges	Read correct fuel level.
9.	Air systems Air cleaners snorkel tubes	Secure, clean and free from obstructions. All connections, nuts, bolts and screws tight and securely locked. Joints and gaskets serviceable. Pipes free from kinks and adequately clipped. Controls and settings adjusted to operate effectively. Secure gaskets effective.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ENGINE and CLUTCH (cont)		
10.	Exhaust systems Exhaust pipes/silencers	The system is free from cracks, loose baffles and leaks or holes (except drain holes for silencer).
	Flame suppressors	The general condition is such that the free flow of exhaust gas is not impeded.
	Manifolds exhaust/inlet/gaskets	Operation effective, secure free from leaks.
	Heat shields	Not damaged, insulation not torn or damaged.
	Supercharging systems	No leaks.
11.	Hydraulic systems	System free from noise, chatter, blockages, air and fluid leaks.
	Emergency control	Correct functioning of emergency stops and overrides.
	Filters	Clear from obstructions and damage.
	Hydraulic oil	Sample oil condition.
	Gaskets and seals	Do not leak.
	Manifolds	No cavitation.
	Motors	Correct functioning of motors, pumps, cylinders and actuating mechanism. Motor free from noise, chatter, blockages, air and fluid leaks.
	Pumps	Correct functioning of motors, pumps, cylinders and actuating mechanism. No cavitation. Pumps free from noise, chatter, blockages, air and fluid leaks.
	Pipes and couplings hoses	Inspect entire length of hoses pipes and couplings for cuts, wear and kinks. Free from noise chatter blockages air and fluid leaks.
	Hydraulic hose pipe cover and sheathing	Protective sheathing and covers are to be removed to inspect hoses. Inspect hose for leaks, damage, wear, kinks and cracking.
	Connections	Inspect channels for build up of dirt, debris and corrosion. Check connections for damage. Ensure all connections are tight and do not leak.
	Pressure relief valves	Pressure relief valves setting correct.
	Directional valves	Directional valves switching when engaged and returning to set positions.
	Hydraulics systems solenoids and switches	Connections, cables solenoids and switches serviceable.
	Ride control system	Check correct operation break off.
HYDROSTATIC DRIVE SYSTEM		
12.	Hoses	Check for leaks, security of hoses and kinks.
	Motors	Correct functioning of motors cylinders and actuating mechanism. Motor free from noise, chatter, blockages, air and fluid leaks.
	Pumps	Correct functioning of pumps, cylinders and actuating mechanism. No cavitation. Pumps free from noise, chatter, blockages, air and fluid leaks.
	Hydrostatic tank	Check breathers are clean. Oil level. Check for leaks in fittings and hoses connections.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
HYDRAULIC RAMS		
13.	Hydraulics cylinders	All connections to be secure. Cylinders to be tested through full range of movement. Cylinder movement is not erratic or binding. Creep test all cylinders.
	Rams	No scoring pitting or corrosion on rams.
	End caps and wiper seals	End caps to be secure. Wiper seals to be clean and free from cuts. Small oil weeping are permissible pass wiper seals.
TRANSMISSION SYSTEM		
14.	Transmission Complete assembly	Operate correctly with no undue movement when engaging any gear.
	Clutch pack	Operate correctly with no undue movement when engaging any gear. Noise level is consistent with age of equipment.
	Casing covers	Not damaged or distorted.
	Input/output coupling flange	The end play/side play in the output shaft should not exceed figure stated in the appropriate technical manuals.
	Oil pumps and filters, bearings, gaskets and oil seals	Filled to the correct level with the specified grade of oil. Oil leaks should not exceed those defined.
	Hosing and pipe work	Not damaged frayed or worn. Not blocked and positively retained.
	Levers linkages control and selector mechanism, excluding electro operating gear	Gear lever selectors' synchromesh and linkage adjusted to give smooth positive operation.
	Transmission brake bands and operating gear	Brakes correctly adjusted.
	Transmission shafts, including prop shafts	Shafts not bent and correctly aligned.
	Transmission shaft universal joints	Universal joints installed correctly, pins, bearings and yokes do not seize and are undamaged.
SUSPENSION		
15.	Axles (front, centre and rear) Axle and pivots	End float to be within limits laid down in technical handbook.
	Axle drive shafts centre assembly	Filled with correct grade of lubricant and seals serviceable.
	Differential/ gearing, other differential boxes	Filled with specified grade of oil as specified in the technical documents. Check for oil leaks and noise. If inspection plate is fitted, it should be removed and gears examined for rust, pitting, damage or corrosion.
	Final drive assembly and sprockets	Item secure.
	Engine drive and output couplings	Casings and seals are sound.
	Power take off	Oil leaks.
	Main transmission casing, flanges and seals	Filled to correct level with specified grades of oil. Operation effective and not unduly noisy.
	Overdrive units and control gear	Drive correctly assembled and operative. No lost motion in couplings.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
SUSPENSION (cont)		
15. (cont)	Propulsion units, including controls	Out of true running of shafts.
	Speedometer/rev counter drive	Radial movement in needle bearings or joints (particular attention should be paid to locking of attachments bolts and to correct assembly).
16.	Road springs	Secure.
	Spring shackles, pins and bushes	Clearances and wear limits within the tolerance detailed in the technical manuals. Bushes not perished, free from oil and grease with bonding intact. Lubricator position and effective.
17.	Road wheels Wheel station complete	Wheel positioned correctly, with locking ring outside (where applicable or as specified).
	Wheel hubs bearings and seals and studs	Hub play within limits laid down in technical handbook.
	Rims	No appreciable distortion of or flats on rims and wheels are true. Nuts securing the two halves of two-piece wheels should be painted red. Wheel stud holes free from cracks and elongation. Threads to be clean and in good condition.
	Torque indicators	Torque indicators, if fitted, correctly adjusted and set.
	Wheel balanced and alignment	Check wheels balanced and aligned.
18.	Shock absorbers	Secure and free from leaks.
	Suspension pivot joints	Correctly fitted bushes and pins not worn or perished.
	Rubber suspension units	Rubber suspension units, piping and connectors in sound condition and free from leaks.
	Independent suspension units	Coil springs, arms attachments bolts and bushes not damaged and operating effectively. Not damaged; settings as laid down in the technical handbook.
	Torsion bars anchors	Check torsion bar anchor bushing.
19.	Tyres (tubed and tubeless)	Tyres on driving front and rear axles fitted as matched pairs directionally and tyre pressures as detailed in the operators manuals or service schedule. Pneumatic tyres must show tread pattern from shoulder to shoulder over the circumference and be free from cuts or cracks that reach the fabric, and clear of bulges on the walls or rotten or torn beads. Depth of tread must satisfy local minimum requirements, but must not be less than 1 mm at any point. Solid tyres must be free from deep cuts, cracks, base separation or other damage likely to bring about an early failure. If the rubber tears easily and has lost its ability to stretch, it is unacceptable. Tyre valves pointing outwards unless otherwise specified and not projecting beyond wheel rims. Dust caps should be fitted with serviceable valves/caps.
20.	Guide rollers	Not damaged and rotate freely.
21.	Idler sprockets wheels axles and brackets	Check idler wheel alignment with road wheels and lubrication. Brackets and sprockets serviceable.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
SUSPENSION (cont)		
22.	Tracks and drives Torsion bar assembly	Check minimum operating number of links before condemnation of track as laid down in the technical manual. Adjusting mechanism secure, undamaged and track tensions equal.
	Beam axle	Straight and secure.
	Tracks complete, track links, pads, pins, tensioners and adjusters	Retaining devices intact and not damaged. Pins, pads and guide horns serviceable.
	BRAKES and STEERING	
23.	Brakes (complete system)	It is important that brakes are safe. Maximum use must be made of brake testing instruments during inspection. The aim will be to achieve effective and even braking on all wheels or tracks. Check fluid condition.
	Foot pedal linkages levers and cables	Pedal stops adjustment correct. Pedal pads, where fitted, in good condition. Linkages serviceable and correctly adjusted.
	Master slave and wheel cylinders	Operation effective, items secure free from leaks with rubber gaiters in good condition.
	Handbrake linkages levers and cables	Rods, cables and linings serviceable, operate freely and are positively applied at third to fifth notch on the ratchet.
	Disc calliper assembly Disc pads Disc drums and back plates	Disc drums revolve freely when brake is fully released, are concentric and do not rub in any position.
	Shoe linings and brake bands	Linings pads free from foreign material, securely attached and within limits specified in relevant technical manuals; pad retaining clips and pins secure and serviceable.
	Vacuum servo systems	Servo linkage operates. There are no leaks.
	Steering brake and interlock units	There is no apparent damage and road test is satisfactory. Correctly fitted and operating effectively.
	Steering/brakes linkages and levers	Linkages, levers and cross shafts secure and lubricated.
	Transmission brakes linkages and levers	Check operation and adjustment as laid down in the technical manuals.
	Power cut out valves	Operation in accordance with technical manuals, secure and not leaking.
Accumulators and air pack unit	No detectable leaks. Pipes and connectors secure, undamaged and operating correctly. Wear within limits specified in the technical manuals.	
24.	Pipes hose and connectors	Free from damage or deterioration and do not leak at their connections.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
BRAKES and STEERING (cont)		
25.	Air pressure system complete	Acceptable providing that: <ul style="list-style-type: none"> a. Air leakage does not exceed a drop in pressure of 34.5 KPA in 10 minutes or such other rates as may be laid down in relevant technical manuals. b. Air pressure gauge functions properly. c. Audible and or visual pressure warning indicators are fully functional. d. Air supply tanks are in sound condition and drain taps operative. e. Air pressure shown at the gauge should not be less than those figures given in the EMEI.
26.	Tillers linkages	Linkages not damaged or worn.
	Vanes	Not damaged or worn. Operate through full range.
	Rudders	No damaged or worn. Operate through full range.
STEERING		
27.	Complete assembly	Secure free from cracks or distortion, slight endplay is permissible in non-adjustable steering linkages provided the cumulative total does not exceed the steering wheel free movement laid down in the technical manuals.
	King pins and bushes	Not damaged. Correctly lubricated. To be gauged in accordance with OEM directions.
	Linkages, drop arms, drag links, cross levers, track rods and joints	Rubber dust excluders are serviceable. Minor cracks or superficial damage is acceptable.
	Power-assisted steering assembly Control levers	Leaks are not acceptable on power steering. System operating in such a way that it furnishes assistance to the steering in the manner described in the technical manuals.
	Cross shafts	Free movement, not rusted or damaged.
	Hydraulic pumps	Operate smoothly not noisy.
	Operating cylinders	Operate over full range. Do not leak.
	Steering boxes	Correctly mounted, secure and filled to the correct level with the specified lubricant. Replacement is only to be recommended if it is apparent that the box is beyond repair, or in need of major repair.
	Steering geometry	Toe-in and toe-out correct and those other measurement dimensions, which produce corrects steering geometry, within limits given in the technical manuals.
	Steering idlers	Operate smoothly, do not bind.
	Steering units	Free from damage, all joints secure and lubricated correctly.
	Steering wheel columns shafts and bushes	Steering wheel not bent or cracked. Minor cracks on the rim covering acceptable. Columns shaft linkages, etc, not damaged and tolerances within the limits in the technical manuals.
Articulation locks	Operate smoothly. Not seized or damaged.	

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
AIR COMPRESSOR		
28.	Air pressure system complete	Free from damage or deterioration and do not leak at their connections. Acceptable providing that: a. Air leakage does not exceed a drop in pressure of 34.5 KPA in 10 minutes or such other rates as may be laid down in relevant technical manuals. b. Audible and or visual pressure warning indicators are fully functional.
	Receivers	Air supply tanks are in sound condition and drain taps operative.
	Gauges	Air pressure gauge functions properly. Air pressure shown at the gauge should not be less than those figures given in the technical manuals/EMEI.
	Pipes hose and connectors	Free from deterioration and leaks. Connections secure.
	Air compressors	Operates correctly, unloader valves cut in and out at the pressure shown in the technical manual and are not noisy. No leaks, maintains operating pressures cut off switches work. The oil level pressure correct and free from leaks.
	Compressor belts	Belts in sound condition, no frays, nicks or cuts.
	Accumulators	Connections sound and serviceable with drain taps operating effectively.
	Pressure relief valves	Pressure relief valves operate at designated setting.
	Compressor belts	Compressor belts in sound condition.
	Air couplings	Couplings free from distortion likely to affect efficient mating with hoses.
HULL or BODY		
29.	Access covers shutters and hull plates	All rust damage should be considered relative to its position and depth. Rust pitting and tool marks are acceptable providing they do not materially weaken the part and are filled before painting. Normal distortion caused by forming or spot welding is acceptable. Metalwork should be free from cracks and sharp edges. Patches are acceptable if the overall contour is maintained and welds are ground smooth on the exterior. Special fittings, ie cleats, tool boxes, bins, racks and carriers, should be serviceable and secure.
	Hull panels	Hull panels are to be removed/lifted to ensure visual inspection of underlying components. Panels are to be free from rust and corrosion.
	Aerial base	Secure.
	Bins, brackets and racks	All rust damage should be considered relative to its position and depth. Rust pitting and tool marks are acceptable providing they do not materially weaken the part and are filled before painting. Normal distortion caused by forming or spot welding is acceptable. Metalwork should be free from cracks and sharp edges. Patches are acceptable if the overall contour is maintained and welds are ground smooth on the exterior.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
HULL or BODY (cont)		
29. (cont)	Guards, skirting plates and rigger brackets	All rust damage should be considered relative to its position and depth. Rust pitting and tool marks are acceptable providing they do not materially weaken the part and are filled before painting. Normal distortion caused by forming or spot welding is acceptable. Metalwork should be free from cracks and sharp edges. Patches are acceptable if the overall contour is maintained and welds are ground smooth on the exterior. Special fittings, ie cleats, tool boxes, bins, racks and carriers, should be serviceable and secure.
	Bumpers	Secure, of correct contour and free from protrusions and sharp edges.
	Engine cowl bonnet and side panels	Of correct contour; sealing, weather strip and clips correctly fitted and serviceable.
	Mudguards wings	Overall contours correct and all large dents removed, beading sound and mudflaps not torn.
	Radiator grille	Appearance to be up to that of the remainder of the vehicle, air passage not restricted by extra fittings or damage.
	FOPS/ROPS	Free from rust and corrosion. Dents in upper and lower channels must not affect alignment. To be inspected and repaired in accordance with current EMEI. Bends should be considered for economical repair or replacement. Bends that do not affect the side members and that can be satisfactorily straightened out are acceptable.
	Canopy frame tree guards	Secure, no cracks and freely adjustable. Small dents in tubes and bends, which do not reduce the appearance below that of the rest of the vehicle, are permissible.
	Spare wheel carriers	Secure, not bent or damaged to the external that the function of the carriers not impaired.
	Steps	Secure; not bent or damaged to the external that the function of the steps are impaired.
	Number plates	Adequately secured and numbers legible.
	Chassis	Not deformed, bent or dented. No rust is acceptable. Not cracked around rivets or bolt heads. Dumb irons and mounting brackets secure and not distorted.
	Fire extinguisher equipment	Ensure that portable and static extinguisher are charged, free from leaks, rust or corrosion, and that quick action release devices are operating effectively. Check inspection tag to ensure it is dated, check safety pins are correctly fitted.
30.	Cabin	Secure, all brackets and fitments complete, and serviceable dents smoothed out. Patch repairs are acceptable.
	Trims	Trims and seals not split or loose. Check under trims for rust and corrosion.
	Electrics	Circuit protector's lights operating.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
HULL or BODY (cont)		
30. (cont)	Seats	Seat frame assemblies, sliding anchor rails and racks free from cracks or breaks.
	Upholstery carpets and trims	Not torn or worn through.
	Head and brow pads	Adjusting mechanism operating correctly. Squib, head and brow pads having minor repairs and or patching with self adhesive material are acceptable.
	Safety belts including anchorages	Safety belts, harness and buckles are serviceable. Attachments anchorages sound and secure.
	Windows	Minor scratches around the edge of the glass, cracks and chips on other areas, with the exception of the driver's immediate vision area, are acceptable. Sealing and beading serviceable.
	Locks and catches	Lock and catch mechanisms operate freely and lock positively.
	Winding mechanism	Winding mechanisms operate freely and lock positively.
	Windscreens	Minor stains on the co-driver's side only of the windscreen are acceptable. Milky or fogging conditions are not acceptable. Delimitation of glass is unacceptable.
	Mirrors/brackets	Interior and exterior mirrors freely adjustable and serviceable.
	Door locks and catches	Operate freely, lock positively, have serviceable sealing and beading and do not sag on hinges. Metal patching is acceptable.
	Flooring	Metalwork should be free from cracks, corrosion and sharp edges; patches are acceptable if overall contour is maintained. Special fittings should be serviceable and secure.
	Weapon racks	Secure positively retain weapon.
ELECTRICAL		
31.	Starter and solenoids	Secure, sufficient torque to start engine under normal conditions. Solenoids serviceable.
32.	Charging system	To be securely mounted.
	Alternators	Charging correctly, with connectors serviceable.
	Generators Generator drive, including belts (main and auxiliary engine)	To be securely mounted. Charging correctly, with connectors serviceable. Check that generator drives are not noisy.
33.	Control equipment regulator	Secure, clean and functioning in accordance with technical manuals.
	Control panel	Secure, clean and functioning in accordance with technical manuals.
	Distribution link box	Secure, clean and functioning in accordance with technical manuals.
	Rectifier	Undamaged; cabling and terminations serviceable.
	Switchboard junction (main and auxiliary engine)	Panels, switchboard and distribution boxes undamaged, cabling and terminations serviceable Warning light operative.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ELECTRICAL		
34.	Batteries	Casing sound, electrolyte clear and level correct. Terminals make good electrical contact and are lightly smeared with silicone grease. Vent holes and pipes clear and sealing washers fitted to plugs.
	Earth points and straps	Earthing straps in good condition and securely fixed to chassis.
	Battery balancing – control equipment	Balancing and control equipment operating in accordance with technical manuals.
35.	Air cleaner extractor fan Heaters – cab motor and fan	Secure, motors/fan not noisy and functioning at normal speed without overheating. Controls and interior heaters operating effectively.
36.	Direction indicators	Securely mounted.
	Flasher type lamps units and switches Semaphore type	Flashing type lamps must be of correct wattage and the light is to occur within one second of switching on. Flashing rate to be 60 to 120 times per minute. Mechanical self-cancelling types must cancel when steering is returned to straight ahead position from half revolution in the direction indicated. Time switches to cancel after 10 to 15 seconds.
37.	Horn contact mechanism	Secure and to sound immediately switch is pressed. NOTE To be loud and clear while switch is pressed at all voltages down to 2 V below rated figure.
38.	Windscreen wipers	Blades and arms correctly adjusted and serviceable. Drive units securely mounted. With windscreen wet and motors not noisy or overheating, giving at least 20 sweeps per minute.
39.	Lighting Bulbs and lamps	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable. Waterproof sockets covers chained and fitted when not in use.
	Exterior and interior lights	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable.
	Warning lights, rotating beacons	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable.
	Door contact switches	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable.
	Instrument panel cluster	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable.
	Trailer sockets/connectors	Sockets secure and serviceable.
	Starting socket, inter vehicle	Switches and sockets secure and serviceable.
	Emergency switches	Switches secure and serviceable.
	Reversing switches	Switches secure and serviceable.
40.	Vehicle master switch	Lights and switches, sockets, instrument panel, cluster reflectors and lenses secure and serviceable
41.	Power tools units	Check that cables, connectors and sockets are serviceable.
42.	AML computer	Connector cables and units serviceable. Check accuracy of indicator system as laid down in technical manuals.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ELECTRICAL (cont)		
43.	Engine transmitters and pressure switches, main and auxiliary engine	Operating effectively with components serviceable.
44.	Hydraulics systems solenoids and switches	Connections, cables, solenoids and switches serviceable.
45.	Control pane and lead	Wiring connections and switches serviceable; check operation in accordance with technical manuals.
46.	Governor – electrical	Wiring connections and switches serviceable; check operation in accordance with technical manuals.
47.	Solenoid assembly	Wiring connections and switches serviceable; check operation in accordance with technical manuals.
AIRCONDITIONERS HEATERS and VENTS		
48.	Air cleaner extractor fan	Secure, motors/fan not noisy and functioning at normal speed without overheating.
	Heaters – cab motor and fan	Controls and interior heaters operating effectively.
	Air-conditioners	Function correctly, fins clean of debris, no refrigerant leaks in system and filters clean.
INSTRUMENTS and GAUGES		
49.	Temperature oil	Secure, gauge glass clear, scale readable counter operates effectively.
50.	Hour meter	Secure, gauge glass clear, scale readable counter operates effectively.
51.	Revolution counter	Secure, gauge glass clear, scale readable counter operates effectively.
52.	Speedometer	Secure, gauge glass clear, scale readable counter operates effectively.
53.	Revolution counter, drive cables Speedometer drive cable	Drive and spindle correctly assembled, operative, free from sharp kinks or bends and securely clipped throughout its length.
STABILISER and OUTRIGGERS		
54.	Stabiliser legs	Free from damage and cracks.
	Overrides and limits switches	Operate correctly.
	Stability	Stability tests conducted.
JIBS and HOISTS		
55.	Jibs hoists and associated gear	Should be tested under working conditions using appropriate test loads. Hydraulic gear operating correctly with no leaks in the system. Ropes free from frayed or rusted strands, kinks, flats or damaged eyes. Wear plates adjusted correctly Gearing serviceable securing devices functioning correctly.
	Booms	No cracks, fatigue, wear or damage.
	Elevating systems	Not jerky during operation. Creep test hydraulic cylinders.
	Counterbalance valves	Operate correctly.
56.	Cranes, hoists and winches Structural integrity inspections	Inspection conducted and recorded report in GM 120. (Cranes must also have the annual safe use certificate)
	All cranes electronic mechanical indicators	All indicators, warning devices function.
	SWL labels charts	SWL labels attached. SWL chart clean, correct and readable.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
JIBS and HOISTS		
56. (cont)	Operation	Crane booms extend and retract over full range.
	Chains lifting frames, etc	Correctly tagged inspect for damaged links.
	Ropes	Ropes clear of nicks, cuts, bends and bird caging.
	Power Take Off (PTO)	PTO switch, indicator light comes on.
	Boom swing system	Cracks damage deformation. Tightness of bolts for boom pivot pin retaining plate. Scratches and lubrication of sliding surfaces.
WINCH		
57.	Winch drums and gear	The cable should pull out when the winch brake is released and when the drum is freed by the clutch (if free spool fitted). Winch casing should be filled to the correct level with the specified grade of oil. Check for oil leaks at worm shaft housing. Brake lever and pawl should operate positively. Clutch lever/switches correctly assembled and serviceable.
58.	Hydraulic motor	Does not leak, runs smoothly not noisy. Oil flow correctly set.
	Pressure relief valves	Pressure relief valve set at correct pressure.
	Hook block and sheaves	Rotation of hook deformation movement of trunnions, rope guard, damage, cracks and wear of sheaves.
	Guide pins	Guide pins should not be damaged or rusted and serviceable, lubricating nipples should be fitted. Clearance and wear on the components within the limits given in the appropriate technical manual.
	Power Take Off (PTO)	PTO switch, indicator light comes on.
59.	Winch ropes	Inspect for frayed or rusted strands, kinks or damaged eyes. Clean, lubricated and not less than 80% of original length. The adjustment of the control trip gear should be such that the engine or winch cuts out when the specified pull (quoted) is reached. Only steel core ropes are to be used for recovery (unless specified in the relevant EMEI). Rope to be correct diameter and type of equipment. When cable is wound in against a light resistance, it should wrap correctly round the drum.
TYRE INFLATORS		
60.	Tyre pumps inflators Non-power and power driven	Union connectors in good condition and pipelines serviceable. Power pumps operate up to maximum pressure required. Filters clean and system free from leaks.
TOWING DEVICES		
61.	Pintal hooks	Gauge and inspect pintal hook as detailed in EMEI for the equipment.
	Lock devices	Check operation of lock safety pins and security of safety chains.
	Mounting	Check mountings for tightness of bolts and security of cross member cracks, etc.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
CRUSHER UNITS		
62.	Crusher jaws	Teeth and jaws not damaged or broken.
63.	Belts	Adjusted correctly, not frayed or split.
64.	Feeders and hoppers	Not damaged, sharp edges removed. Fitted securely to crusher.
65.	Cylinders and actuators	Operate entirely over range. No leaks or cavitation. Hose not cut, kinked or damaged. Mountings secure pins not damaged. Hydraulic oil correct type and condition.
OTHER ITEMS		
66.	Modifications	The modification state of the vehicle should be in accordance with the current EMEI.
67.	Painting	The paintwork should be such that it covers all exposed ferrous surfaces with an unbroken protective cover of sufficient depth to withstand the weather whilst presenting a good appearance. No stripping of parts to paint should be undertaken, or recommended, which will entail dismantling beyond the stage necessary to carry out the required repairs. Recommendations for repainting must be considered on an economic basis, taking into consideration the value, the remaining life and the role of the vehicle.
ATTACHMENTS		
68.	Attachment locking devices	Check locking devices securely hold attachments in place.
	Hydraulic and mechanical locks	Hydraulic hoses free from cracks, fittings clean and do not leak.
	Operation	Check attachment works through its range of movement.
	Pivot pins safety chains	Check all pivot connections pins connection points for damage secure and corrosion. Check safety retaining chains not damaged and secure.
	Hydraulics drives motors hoses	Check hoses, motors and drives for leaks and damage
69.	Buckets	Operate through full range of movement. Check bolts for security and correct torque setting.
	Bucket teeth cutting edges	Teeth not broken. Cutting edges not damaged with chips, broken edges or missing.
70.	Rock hammer	Operate through full range of movement. Check bolts for security and correct torque setting.
	Points and bits	Cutting edges not damaged. Shafts straight.
71.	Augers	Operate through full range of movement. Check bolts for security and correct torque setting.
	Motors	Correctly lubricated. Secure, no leaks, free movement.
	Drill bits	Cutting edges not damaged. Shafts straight.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ATTACHMENTS (cont)		
72.	Fork carriages	Operate over full range ensure not binding or jerky movements.
	Hydraulic cylinders	Operate smoothly over full range. Do not leak.
	Hydraulic hoses	Check hoses and connections for kinks damage and leaks.
	Roller locking pins	Check wear and operation.
	Top hook support faces	Check for wear and deformations.
	Fork arm and blade	Check for wear on blade heel (not to exceed 10% of thickness). Check for cracks. Measure angle from blade top face to shank. If angle exceeds 3 degrees from original. Replace fork arm.
	Blade upper face	Check for straightness (not to exceed 5% of blade length).
	Fork arm shank	Check straightness.
	Fork arm tip height	Measure tip height of fork arms when mounted on fork carriage. Where difference exceeds 3% of blade length, replace.
	Markings (located on side of fork arm)	Check legibility of: a. fork arm capacity in kilograms; b. specified load centre in millimetres; c. manufacturer's mark; and d. week and month of manufacture or serial number.
73.	Plate compactors	Pads fitted correctly, not damaged.
74.	Drive belts	Belts correctly adjusted.
	Rippers	Teeth not damaged and are secure.
75.	Ripper bar	Not damaged. Welds not cracked. Retaining pins and chains secure.
	Connection hoses	Hydraulic hose and fittings do not leak. Hoses not damaged.
	Trencher Arms and panels	Operates over full range of movement. Not bent or damaged.
76.	Buckets	Bucket/teeth not damaged and are secure.
	Hydraulics	Cylinders operate over full range. Hydraulic hose and fittings do not leak.
	Back hoe Arms and panels	Operates over full range of movement. Not bent or damaged.
77.	Buckets	Bucket/teeth not damaged and are secure.
	Hydraulics	Cylinders operate over full range. Hydraulic hose and fittings do not leak.
	Cement mixer Hydraulic motor	Motor operates.
78.	Cement bowl	Bowl rotates freely, no sharp edges or cracks.
	Grader Front blade assembly	Grader blades cutting edges not damaged.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
ATTACHMENTS (cont)		
79.	Height indicators	Indicate set height. Calibrate.
	Hydraulic adjustment cylinders	Hydraulic cylinder hoses not damaged; no leaks. Operate freely over full range without seizing or locking.
	Rock profiler	Operate freely over full range without seizing or locking. Correctly lubricated.
80.	Bearings	Bearing not worn.
	Hydraulic hoses and connections	Hydraulic cylinder hoses not damaged, no leaks. Operate freely over full range without seizing or locking.
	Baskets	Operate over full range.
81.	Floor	No cracks or damage.
	Safety harness connections points	Secure and not damaged.
	Guard rails	Damage and cracks.
	Controls	Function correctly. Overrides operate when activated.
82.	Hydraulic cylinders	Operate smoothly over full range. Do not leak.
	Hydraulic hoses	Check hoses and connections for kinks damage and leaks
	Roller locking pins	Check wear and operation.
	Top hook support faces	Check for wear and deformations.
	Fork arm and blade	Check for wear on blade heel (not to exceed 10% of thickness). Check for cracks. Measure angle from blade top face to shank. If angle exceeds 3 degrees from original, replace fork arm.
	Blade upper face	Check for straightness (not to exceed 5% of blade length).
	Fork arm shank	Check straightness.
	Fork arm tip height	Measure tip height of fork arms when mounted on fork carriage. Where difference exceeds 3% of blade length, replace.
Markings (located on side of fork arm)	Check legibility of: a. fork arm capacity in kilograms; b. specified load centre in millimetres; c. manufacturer's mark; and d. week and month of manufacture or serial number.	
EXTENSION SLIPPERS		
83.	Locking pins	Check wear and operation.
	Extension blade	Check for wear on blade (not to exceed 10% of thickness). Check for cracks.
	Blade upper face	Check for straightness (not to exceed 5% of blade length).
	Markings	Check legibility of: e. manufacturer's mark; f. serial number with year of manufacture; g. rated capacity and load centre; and h. blade cross section and minimum blade length.

Table 3 Static Inspection (Continued)

Serial	Item or Function	Standard
CES		
84.	Jack and jacking plate	Check for damage and operation, no hydraulic oil leaks corrosion of rams. Correctly filled operate over entire range. Conduct creep test.
85.	Torque wrench (if supplied)	Calibrate.
86.	Lifting chains and shackles refer EMEI Misc Equip O-008 for specifications	Check tags for currency.
87.	Hook blocks	Correctly labelled. Wear within specified tolerances. Not damaged.
88.	CES	Check for damage and operation. Lubricated.
89.	Attachment pallets	SWL clearly visible. Check for damage. Tie down points and chains/straps not damaged, frayed, stretched or bent.
OIL SAMPLING		
90.	Conduct oil sampling	Sample of oils to be taken and sent for analysis in accordance with EMEI Engr Equip A 019-1. Review oil analysis report for equipment recommendations.
DOCUMENTATION		
91.	Log books	Documents are correctly filled out.
92.	Operator manuals	Manuals are up to date and with machine.
	User handbooks	Manuals are up to date and with machine.
	GM 120	Manuals are up to date and with machine.
	EMEI, CES, RPS and ILSI	Up to date.

TYRES AND TUBES INSPECTION FOR USEABILITY, CARE AND MAINTENANCE

General

25. This EMEI details the criteria for the inspection for useability of any approved C or D class vehicle tyre.

Causes Contributing to Tyre Failure

26. The factors which contribute to tyre failure during operation are as follows:

- a. Heat.** Heat is generated in tyres due to the friction effects caused by flexing of the tyre wall material. As flexing of the tyre wall is increased, so does the amount of generated heat within the tyre. Extremely hot tyres reduce tyre life and can cause rubber compounds in the tyre to become brittle and susceptible to chunking.
- b. Overloading.** Incorrect load distribution or exceeding load limits increases the load normally placed on tyres. This causes excess heat generation and failure.

WARNING

The rated load carrying capacity of a tyre cannot be increased by inflating the tyre above the maximum recommended pressure.

- c. Impact Break.** A tyre can be damaged by striking or running over rocks, kerbs, jagged road edges or pot holes. When tyres contact these obstacles the extreme impact forces on the casing cords can result in internal casing damage. This failure occurs more readily with over inflated tyres.

WARNING

Bleeding of air from a tyre while it is still hot will cause the tyre to be under inflated when cold. This can lead to tyre failures due to under inflation.

- d. Under-Inflation.** Running tyres below the recommended pressure for the load being carried generates excessive heat, causing deterioration of the tyre casing, thereby reducing the tyre strength. This can ultimately result in ply and/or tread separation resulting in tyre failure.

Factors Affecting Tyres Tread Life

27. Factors which affect tyre tread life are:

- a.** poor driving technique;
- b.** mechanical faults;
- c.** under inflation / over inflation;
- d.** incorrect wheel and/or axle alignment; and
- e.** adverse operating conditions.

28. Inflation Pressure. Correct inflation pressure is critical to the handling and wear performance of a tyre.

29. Under-Inflation. Tyres that are continually used in an under inflated condition will not wear evenly. Under-inflation of tyres can cause the following:

- a.** poor vehicle handling;
- b.** shoulder wear;
- c.** heel and toe wear;
- d.** heat build up;
- e.** upper sidewall cracking;
- f.** breaks around the edge of the tyre;
- g.** loose inner cords;
- h.** bead area separation;
- i.** ply separation;
- j.** tread separation; and
- k.** tyre failure.

30. Over-Inflation. Tyres that are continually used in an over inflated condition will not wear evenly. Over-inflation of tyres can cause the following:

- a.** rapid centre tread wear;
- b.** reduced bruise resistance;

- c. reduced traction; and
 - d. rapid wear of suspension components.
- 31. Tyre Balance.** There are two distinct ways a tyre may be out-of-balance. These are generally known as either static or dynamic out-of-balance. Both conditions of unbalance contribute to mechanical wear and cause spot or cupping wear of the tread.
- 32. Cornering.** Fast cornering causes the tyre to slip on the road surface and may result in abnormal shoulder wear, particularly on the front tyres.
- 33. Braking/Acceleration.** Sudden braking and/or acceleration can drastically reduce tread life.
- 34. Speed.** Sustained high speed can markedly increase tread wear.
- 35. Mechanical Faults.** The following mechanical faults can result in irregular tread wear patterns;
- a. loose wheel bearings;
 - b. loose or worn suspension components;
 - c. faulty shock absorbers;
 - d. incorrect fitting of the tyre to the wheel rim; and
 - e. sagging springs.
- 36. Alignment.** Incorrect wheel alignment can contribute to abnormal tyre wear such as excessive camber, toe-in and toe-out. Once an alignment wear pattern is apparent, wheel alignment is to be checked and adjusted. This may include checking axle alignment on single or multi-axle vehicles to ensure thrust angles are within manufacturer's specifications.
- 37. Tyre Rotation.** Tyre rotation ensures that tyres share the different wear rates that occur between the steering and non-steering axles. Rotation of tyres is to be carried out in accordance with the user handbook for the particular vehicle.
- 38. Matching of Dual Tyres.** When changing dual tyres, every precaution must be taken to properly match tread design, ply rating and overall tyre diameter. Mismatching of dual tyres forces the larger tyre into an overloaded condition causing over-deflection and over-heating. The smaller diameter tyre, lacking proper road contact, will experience accelerated wear.
- 39. Other Factors.** Other factors which can affect tread life are the type of road surfaces, hills, winding roads or climatic conditions.

Safety

WARNING

Failure to replace tyres when beyond useable limits can cause serious injury to personnel and damage to equipment.

WARNING

When a wheel assembly has a rim that displays damage from impact or similar cause, the fitted tyre is not to be fitted to another rim but is to be disposed of in accordance with the ESCM.

Inspection Frequency

- 40.** Tyre inspections are to be carried out as follows:
- a. inspect tyres in accordance with Table 3, and paragraphs 43 and 44, noting that the speed of degradation may increase with age and thus may occur more rapidly under the same conditions as a newer tyre;

- b. tyres fitted to a vehicle are to be inspected in accordance with extant technical and non-technical inspection procedures;
- c. annual inspection by a suitably qualified tradesman as part of the scheduled / specified vehicle servicing task;
- d. inspection by qualified vehicle operators as part of the vehicle non-technical inspection;
- e. inspection during first, last and halt parade services; or
- f. when the useability of a tyre is in question.

Recording

41. Tyres deemed “XX – Do Not Use” are to be recorded on the inspection report.

Age

42. In order to reduce the likelihood of tyre failure as a result of age and environmental degradation, perform:
- a. inspections as per paragraph 40.
 - b. in addition to the static inspection requirements, for crane tyres that are beyond five years of age with less than 15mm (at the most worn point) of tread depth remaining, replace the tyres; and
 - c. tyres that exceed seven years from date of manufacture on the vehicles listed in Table 4 or any other vehicle capable of speeds greater than 45 km/h are not to be used. Any of these vehicle types fitted with tyres that are/or exceed seven years from date of manufacture are to be classified “XX – Do Not Use”.

Table 4 Tyre Age Restricted Vehicle Types

VEHICLE DESCRIPTION	MODEL	NIIN
CRANE, WHEEL MOUNTED HEAVY DUTY, ROUGH TERRAIN, 80 TONNE, GROVE GMK 4080-1 AU ARMY NON BP, CES STOCKED, C/W CES ITEMS	GROVE GMK4080-1	661603984
CRANE, WHEEL MOUNTED HEAVY DUTY, ROUGH TERRAIN, 80 TONNE, BALLISTIC & MINE PROTECTION, GROVE GMK 4080-1, C/W CES	GROVE GMK4080-1	661582661
CRANE, WHEEL MOUNTED HEAVY DUTY, ROUGH TERRAIN, 80 TONNE, GROVE GMK 4080-1 NAVY WITH FLY JIB, C/W CES ITEMS	GROVE GMK4080-1	661610820
CRANE, WHEEL MOUNTED 50 TON, DEMAG AC 50, 40MTR TELESCOPINGBOOM, DIESEL ENGINE, SIX WHEEL STEER, HYDRAULIC OUTRIGGERS, AUTO LEVELLING, 24V ELEC SYSTEM, STD SAFETY DEVICES	DEMAG AC 50	661443755
CRANE, TRUCK MOUNTED TADANO, 30T, BOOM 4SECT 10.5 TO 33M	TADANO TG-300E	661534564
CRANE, WHEEL MOUNTED 30 TONNE, TADANO FAUN ATF 30-2L, C/W CES ITEMS	TADANO FAUN ATF 30-2L	661507917
CRANE, TRUCK MOUNTED FULLY HYDRAULIC, ROUGH TERRAIN, KR-250, 25 TONNE	KATO KR-250	661481892
CRANE, WHEEL MOUNTED HEAVY, ALL TERRAIN, 20.0 TONNE LIFT , NISSAN DIESEL ENGINE, 360DEG ROTATION, W/DRUM TYPE WINCH AND OUTRIGGERS	TADANO AR200M	661302057
LOADER, BACKHOE TRACTOR WHEELED EARTHMOVING MEDIUM HIGH MOBILITY ENGINEER EXCAVATOR (PROTECTED) C/W CES ITEMS	JCB HMEE	661596527
MINE DETECTOR SYSTEM, VEHICLE MOUNTED HUSKY TOWING MINE DETECTING VEHICLE, MK3C/W CES ITEMS	HUSKY	661617041

Criteria for Tyre Inspection – Tyres not Fitted to a Rim

43. The following criteria must be met for a tyre not fitted to a rim to be deemed fit for purpose and safe for use:
- a. **Tyre Age.** The tyre age must be consistent with the policy detailed in paragraph 42.
 - b. **Wear Limit.** As per Table 3, Serial 19. Tread depth should be determined using a vernier caliper.
 - c. **Tread and Shoulder Integrity.** Inspect the tyre for tread and shoulder integrity, paying particular attention to the following:

- (1) no severe cracking caused by UV exposure/ozone degradation;
 - (2) no severe cuts;
 - (3) no holes/piercings, bumps or swelling/bumps;
 - (4) no embedded foreign bodies;
 - (5) the tread wear is even; and
 - (6) there are no signs of premature tread wear.
- d. **Sidewall Integrity.** Inspect the tyre for sidewall integrity, paying particular attention to the following:
- (1) no severe cracking caused by UV exposure/ozone degradation;
 - (2) no severe cuts;
 - (3) no holes/piercings, bumps or swelling/lumps; and
 - (4) no embedded foreign bodies.
- e. **Tyre Bead.** Inspect the tyre bead to ensure that there is no damage from poor fitting techniques or incorrect storage.

Criteria for Tyre Inspection – Tyres Fitted to a Rim

44. The following criteria (in addition to the criteria detailed in paragraph 43) must be met for a tyre fitted to a rim to be deemed fit for purpose and safe for use:

- a. **Inflation Pressure.** The inflation pressure must be in accordance with vehicle documentation.
- b. **Tyre Fitting.** The tyre must be fitted to the correct rim.
- c. **Stem.** Inspect the tube stem (if tubed tyre) or the valve stem (if tubeless tyre) as follows:
 - (1) check that the valve cap is present and undamaged;
 - (2) check there is no damage to tube/valve stem; and
 - (3) check that there is no air leaks from tube.

Failure to Meet Any Criteria

45. Tyres that fail to meet any of the criteria detailed in paragraph 43 or 44, are to be classified “XX – Do Not Use”, rendered unserviceable (eg drill hole in sidewall or cut the bead) and disposed of in accordance with the ESCM.

Vehicles Fitted with Tyres Classified “XX – Do Not Use”

46. A vehicle with one or more tyres classified “XX – Do Not Use” is to be classified “XX – Do Not Use” until the tyres, so classified, are replaced.

FUNCTION ROAD TEST

General

47. Check:
- a. oil and coolant levels (if this has not been done during the static inspection) and clean off the points and areas at which leaking seepage is likely to occur;
 - b. tyre pressure, lights, signals, screen wipers and accumulator pressures;
 - c. safe operation of all hydraulics; and
 - d. air pressures in the case of vehicles with air-assisted brakes or steering systems.



Excess oil in transmission assemblies may cause overheating.

48. The vehicle is to be operated in such a way that the conditions laid down in state laws, local registrations or other safety orders are observed.

Engine

49. Warm up engine and check:
- a. for unusual noises;
 - b. that the throttle control works smoothly and the engine responds;
 - c. for neutral of gearbox and transfer box;
 - d. neutral start switch operation; and
 - e. for operation of selector gears and gear engagement pedal.

Moving Off

50. Check:
- a. hand and foot brake operation;
 - b. that application of either lever gives immediate response;
 - c. that the steering is free in operation and does not pull to the left or right or wander;
 - d. that the steering has no symptoms of wheel wobble and, where assisted, the steering effort can be felt;
 - e. that the driving mirrors give proper rearward vision;
 - f. the suspension units, by driving slowly over obstacles; and
 - g. for unusual noise (some whine will occur in bevel gearboxes on overrun).
51. Drive the vehicle over a selected distance which, where possible, should include one uphill section, one downhill section and one obstacle section. If two fuel tanks are fitted, the supply should be changed from one tank to the other during the test. During the test, attention should be paid to the functions detailed in paragraph 47 to 59.

Brakes

NOTE

The prescribed braking performance is detailed in the OEM workshop manuals, and should be obtained with the engine disengaged and no deviation of the vehicle from its course greater than 300 mm (12 inches).

NOTE

Every vehicle under all load conditions, with or without a trailer, should be capable of being stopped on a dry smooth level road free from loose material with one sustained application of the service (foot) brake control.

52. Check that the brakes pull the vehicle evenly, and that the braking performance is within the limits specified in the appropriate technical manual.
53. The secondary brake means of stopping the vehicle should any part of the main system fail. It may be:
- a. the handbrake;
 - b. any other brake with separate control; or
 - c. either half of a split footbrake system, which can readily be checked independently.

Clutch

54. Check that the clutch does not slip on gradients and that the drive is completely disengaged when the pedal is fully depressed. Engagement should be smooth and the effort required to depress the pedal should be normal for the type of vehicle.

Coolant

55. Engine temperature should not fluctuate, but should rise gradually during the initial part of the road test until normal operating temperature is reached. Maximum temperature reached is not to exceed that laid down in the technical manuals.

Engine Vehicle RPM and Hour Meters

56. The engine governed revolutions is laid down in the technical manuals, ie the revolutions meter shows a reading within $\pm 10\%$ at 1 500 RPM). Check the hour meter is operating correctly, ie within accuracy of $\pm 4\%$.

57. Check that there is no mechanical difficulty in gear changing and that gears are quiet on drive and overdrive. Gear jumping should not occur when pulling at maximum torque in each gear or when descending slopes at governed speed.

NOTE

The characteristics of each vehicle under test must be taken into account when checking for noisy operation.

Radio Control System

58. Check system in both on and off positions at speed.

Suspension

59. Test the vehicle's performance over rough terrain and check that the suspension smooths out variations of the surface.

Tracks

- 60.** Check:
- a.** tension of tracks;
 - b.** that link and pads are undamaged; and
 - c.** that washers and circlips are intact.

Engine Compartment

61. Check for oil leaks, that there are no fuel or coolant leaks or signs of overheating, and fasteners have not loosened due to vibration.

Brakes and Steering

62. Check there are no signs of leakage and brakes do not bind or overheat.

Final Drives and Gear Cases

63. Check for leaks, signs of overheating and that sprocket bolts are tight.

Suspension

- 64.** Check that:
- a.** axle arms are not leaking, idler wheel and road wheel nuts are tight and there are no signs of overheating;
 - b.** spring leaves are in line, and sound and movement has not taken place between spring and saddles;
 - c.** there is no settling down of camber below limits given in the appropriate technical manual; and

- d. shock absorbers are free from fluid leaks.

Braking Requirements

- 65. Every vehicle under all load conditions, with or without a trailer, should be capable of being stopped on a dry smooth level road free from loose material with one sustained application of the service (foot) brake control.
- 66. The prescribed braking performance is detailed in the OEM workshop manuals, and should be obtained with the engine disengaged and no deviation of the vehicle from its course greater than 300 mm (12 inches).

Local Modifications

- 67. Check all local modifications have been recorded and approved. If not approved, the vehicle is to be classified XX until they are removed or approved.

Funding

- 68. The crane safe and major inspection (enhanced mechanical and structural inspection) are to be funded from regional allocations using local crane safe accredited inspecting agencies.

Technical Documentation

- 69. Check that technical documentation (GM 120) is complete and correctly filled out, all modifications have been entered and completed.
- 70. Check MSE600 record for completion of nameplate tab data and that modifications have been entered.
- 71. Check crane annual inspections have been conducted and certificates have been entered.
- 72. Check oil sampling data, if conducted, is recorded and report enclosed.

Recording

- 73. The following inspection reports are required to be raised when conducting an inspection of C and D vehicles:
 - a. complete inspection report on main item and all attachments; and
 - b. special inspection report for each attachment.
- 74. The complete inspection report is to include a list of all attachments that were inspected, its serial numbers, classification and, if RU or XX, the fault. For example:
 - a. back hoe, serial 256xx25, FF/NOM;
 - b. auger assembly, serial 257xx25, XX/YMDM/5.0, main drive pump;
 - c. bucket 600 mm, serial 258xx25, FF/NOM; or
 - d. bucket 900 mm serial 259xx25, FF/X /2.0 replace bucket teeth caps.
- 75. To accurately record the inspection within Defence, the technical inspection is include the following:
 - a. reference to the inspecting authority certification;
 - b. reference to the oil analysis report;
 - c. reference to any other reports, eg NDT reports;
 - d. list of any major assemblies that were overhauled, eg winch, slewing mechanism etc;
 - e. list of items calibrated;
 - f. results of all tests conducted; and
 - g. list of outstanding repairs.

Reporting Requirements

- 76. On completion of the annual inspection, the original inspection certificate issued by the inspecting authority deeming the equipment fully functional is to be kept with the equipment GM 120 – Record Book for Service Equipment.

Standard Jobs

77. Standard Jobs have been raised for all equipments and attachments. Refer to principle equipments servicing instructions for listing of relevant Standard Job numbers.

Conclusion

78. The inspection of C and D vehicles is a mandatory requirement by the TRAMM-L. Defence must ensure that all equipment is maintained and inspected in accordance with the standards to maintain the equipment in a safe condition to use.

END

Distribution List: **ENGR A 01.1 – Code 1** (Maint Code)
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