

**DAP 119F-0001-5F**

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# **AIRCRAFT GROUND SUPPORT EQUIPMENT**

## **MAINTENANCE SCHEDULE (-5F)**

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2		
3		
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11		
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17		
18		
19		
20		
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22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

Issue Number	Issue Date	Details of Issue
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		
61		
62		
63		
64		
65		

**CONTENTS**

<b>PRELIMINARY MATERIAL</b>	Page
Front cover (title page).....	(i)
Issue record .....	(iii)
Contents (this page) .....	(v)

**MAINTENANCE SCHEDULE (-5F)****Chapters**

- 1 General information
- 2 Safety notes
- 3 Maintenance notes
- 4 Maintenance of GSE subject to the Pressure Systems Safety Regulations 2000
- 5 Truck forklift load arms and fork extensions - examination

**TOPIC 5F**  
**MAINTENANCE SCHEDULES**

**CHAPTER 1****GENERAL INFORMATION****CONTENTS**

## Para

- 1 Introduction
- 2 Mandatory requirements
- 3 Publications
- 4 Trades and skill levels
- 5 Additional maintenance
- 6 Glossary
- 7 Publication content

## Annexes

- A Publications
- B Glossary

**INTRODUCTION**

1 This Maintenance Schedule has been produced by the Air Commodities Team (ACT) and is authorised for use by the equipment Engineering Authority, AC GSE. It covers the scheduled preventive maintenance for the Aircraft Ground Support Equipment.

**MANDATORY REQUIREMENTS**

2 Prior to undertaking any work directed by this maintenance schedule, personnel must read the Safety and Maintenance Notes contained within this schedule. In addition, all personnel who operate or maintain Ground Support Equipment (GSE) must comply with the requirements of JAP(D) 100E-10.

**PUBLICATIONS**

3 This publication has been produced for use within the Military Air Environment and all the associated publications quoted at Chapter 1 Annex A are either of Single or Joint Service origin.

**TRADES AND SKILL LEVELS**

4 RAF trades and skill levels have been prescribed in this schedule however, both civilian and Service equivalents apply. The attention of Line Managers is drawn to AP 100B-01, JAP(D)100E-10 and MAP-01.

**ADDITIONAL MAINTENANCE**

5 The instructions contained in all parts of this schedule do not absolve personnel from responsibility for acting upon circumstances which may come to their notice indicating the need for additional maintenance.

**GLOSSARY**

6 The terms used within this schedule are defined at Annex A to this chapter.

**PUBLICATION CONTENT**

7 Queries concerning the content of this publication, or proposals for up-issue, are to be addressed to the Air Commodities Team Engineering Authority, AC GSE.



## CHAPTER 1 ANNEX A

## PUBLICATIONS

## LIST OF ASSOCIATED PUBLICATIONS

<u>Reference</u>	<u>Title</u>
MAP-01	Manual of Maintenance and Airworthiness Processes
JAP(D) 100E-10	Military Aviation Ground Support Equipment Management and Policy
DEF STAN 05-123	Technical Procedures for Procurement
JDP 0-01.1	UK Glossary of Joint and Multinational Terms and Definitions
JSP 800	Mechanical Transport Regulations
JSP 375	MOD Health and Safety Handbook
JSP 418	MOD Environmental Manual
JSP 768	Personal Protective Equipment Catalogue
JSP 515	MOD Hazardous Stores Information System (CD ROM)
JSP 426	RAF Manual, Fire Services
JSP 509	Management of Test Equipment
AP 100B-01	RAF Engineering Policy and Regulation
AP 100C-10	Manual of Quality Assurance and Continual Improvement
AP 101A-0002-1	Maintaining Aircraft and Associated Equipment in Low Temperature Conditions
AP 107D-0001-1	General Information on Aircraft Oxygen Equipment
AP 113A-0201-1	Earthing of Aircraft and Ground Support Equipment
AP 119A-0512-1	Component Cleaning Processes
AP 119A-0601-0A	Surface Finishing and Marking of Service Equipment
AP 119A-1100-2(NAR)	Personal Protective Equipment – Working at Height
AP 119A-1101-1	Personal Protective Equipment (PPE) for Working at Height
AP 119A-1501-1	Storage Equipment
AP 119F-0010-5F	Inspection, Testing and Maintenance of Electrical Equipment
AP 119K-0001-1	Lifting Equipment and Accessories for Lifting Standards and Practices
AP 119L-0001-1	Oxygen & Nitrogen-Characteristics, Associated Hazards & Safety Precautions
AP 119L-0200-1	Inspection, Testing and Charging of Ground Transport Gas Cylinders
DAP 120A-0001-1	Precautions Against Electric Shock in Maintenance Facilities
AP 120C-0001-1	Battery Charging Room Requirements
AESP 2300-A-050-13	Mechanical Transport Maintenance Regulations for RAF
MTI	Mechanical Transport Instructions
GSE Schedule 11/02	GEMS Operators Manual

## CHAPTER 1 ANNEX B

## GLOSSARY

1 The terms defined within this schedule are based upon MAA02 and JAP(D) 100C-20.

TERM (1)	DEFINITION (2)	AMPLIFYING NOTES (3)
Check	To make sure, measure or examine.	If the item does not meet the specified standard, the supervisor is to be informed. No remedial action is to be taken unless directed.
Disconnect	To cause a connection to come apart.	This task is to be performed in accordance with authorised procedures and trade practices.
Ensure	Make certain that the specified conditions are correct.	If the item does not meet the specified conditions, remedial action is to be taken to restore the item to meet the specified condition. However, such remedial action is only to be undertaken if it is within the capability of the individual concerned by virtue of his rank, trade, training, physical ability and, where appropriate, certification. If it is not within his capability, his supervisor is to be informed.
Examine	To undertake a comprehensive scrutiny, supplemented by measurement and physical testing, as necessary, to find the condition of the item. (BS3811).  Note: Physical testing is a manual activity and is to be carried out without the use of test equipment.	The item is to be cleaned as necessary prior to examination. Physical testing is a manual activity and is to be carried out without the use of test equipment. Any faults identified are to be reported to the supervisor; remedial action is not to be taken unless directed.
Examine as far as possible	Within the physical constraints of the location of the item carry out an examination to determine the condition of the item without removing or disconnecting equipment.	This term acknowledges that a detailed examination is not possible due to limited access. The item is to be cleaned as necessary prior to examination. Any faults identified are to be reported to the supervisor; remedial action is not to be taken unless directed.
Fit	The relationship between two related parts; a limit of tolerance.  To attach an item in, or to, a second item.	This task is to be performed in accordance with authorised procedures and trade practices.
Function	The operations that something must do or to operate a system or equipment.	If the item or system is found to be unserviceable or to operate incorrectly, the supervisor is to be informed. No remedial action is to be taken unless directed. The term "Function" is the preferred term for this usage but the term "Operate" still appears in schedules and has the same definition.

<b>TERM (1)</b>	<b>DEFINITION (2)</b>	<b>AMPLIFYING NOTES (3)</b>
Inspect	<p>Examination of product design, product, service or plant and determination of their conformity with specific requirements, or (on the basis of professional judgement) general requirements (BS 3811).</p> <p>Note: Within the Military Air Environment (MAE), an inspection is a quality control activity to determine that any work has been performed properly.</p>	<p>This is a quality control activity and is normally to be undertaken by a supervisor who is to determine that any work has been performed properly in accordance with the relevant authorised procedures and that the assessed condition of the item is correct. Implicit in this term is that good trade practice must be seen to have been applied to the item.</p>
Look for	Undertake a visual check for signs of a specified unserviceability.	Any unserviceability is to be reported to the supervisor; remedial action is not to be taken unless directed.
Note (also NB)	Used to convey, or draw attention to, information that is extraneous to the immediate subject of the text.	
Reconnect	Re-couple or reattach cables, pipelines or controls previously disconnected from the item.	This task is to be performed in accordance with authorised procedures and trade practices.
Refit	To reattach an item in, or to, a second item - eg an item removed to allow access.	This task is to be performed in accordance with authorised procedures and trade practices.
Remove	To take a piece of equipment from a larger assembly.	This task is to be performed in accordance with authorised procedures and trade practices.
Replace	To remove an item and to install a new or serviceable item.	This task is to be performed in accordance with authorised procedures and trade practices.
Replenish	To refill or restock a tank, bottle or other container to a predetermined level, pressure or quantity. The work required includes all actions necessary to achieve the required aircraft state on completion of the task. This may include removing and refitting caps and covers, clearing and cleaning orifices and refitting locking devices, among other tasks.	Where appropriate, locking devices and caps or covers are to be removed, orifices cleared of obstructions, the container is then to be refilled or restocked as directed and, finally, ensuring that gaskets and caps or covers are free from damage, caps or covers and locking devices are to be refitted.
Test	That which you do, when you operate or examine an item to make sure that it agrees with the applicable specifications (AECMA Simplified English). An experiment carried out in order to measure, quantify or classify a characteristic or property of an item (BS 4778).	If the item or system is found to be unserviceable or to operate incorrectly, the supervisor is to be informed. No remedial action is to be taken unless directed.

**CHAPTER 2****SAFETY NOTES****CONTENTS**

## Para

1	Health and safety at work
3	Electricity at work
5	Dangerous engineering substances and COSHH
7	Noise at work
8	Working at height
10	Manual handling
13	Personnel Protective Equipment (PPE)
14	Electric shock
16	Bonding and earthing
17	Portable electrical equipment
18	Electro-static hazards
19	Batteries
20	Hazards and precautions – safety signs
21	Cleanliness of work area
22	Control of hand tools
23	Training, testing and licensing of drivers and driving of self-propelled GSE
24	Fuelling and operation of engine driven GSE
25	Engine manual cranking
26	Starting engines with starting cord
27	Detachable flange and divided type wheel assemblies
28	Equipment safety guards
29	Oxygen equipment
32	Liquid nitrogen
34	Refrigeration equipment
36	Leak testing
37	Contractors owned (BOC) cylinders
39	Testing diesel engine injectors
40	Compressed gas and lubricating equipment
41	Filling and draining of cooling systems
42	Draining of lubrication systems
43	Towing GSE on public roads
44	Brake drums

**HEALTH AND SAFETY AT WORK**

1 All maintenance activity carried out iaw this publication is to comply with the Health and Safety at Work Act, 1974.

2 The RAF engineering organisation and responsibilities for health and safety are detailed in MAP-01.

**ELECTRICITY AT WORK**

3 All maintenance activity carried out iaw this publication is to comply with Electricity at Work Regulations (EAWR), 1989.

4 Guidance on the interpretation and application of EAWR is contained in JSP 375.

## **DANGEROUS ENGINEERING SUBSTANCES AND COSHH**

5 Maintenance operations involving the use of dangerous engineering substances such as lubricants, cleaning and protective materials are to be carried out in accordance with the relevant COSHH assessment, AP 100B-10, JSP 375, JSP 515 the MOD Hazardous Stores Information System (HSIS) and AP 119A-0512 1.

6 Before commencing any maintenance activity, a barrier compound must always be applied to the hands in order to prevent the risk of infection from dermatitis.

## **NOISE AT WORK**

7 It is MOD policy that the Noise at Work Regulations 1989 (NAWR) is to apply throughout all parts of the MOD, regardless of the exemption of the NAWR Regulation 3 pertaining to ships and aircraft, but subject to the conditions of the General Agreement between MOD and the Health and Safety Executive on the observance and audit of Health and Safety legislation within MOD.

## **WORKING AT HEIGHT**

8 Working at height is hazardous and personnel should not attempt to do so unless suitably qualified. Personnel required to work at height should be aware that falls from a height of less than 2 metres may be as hazardous as falls from a greater height. A suitable safe system of work is to be developed to remove or reduce the risk. Appropriate Fall Restraint Personal Protective Equipment (FRPPE) may be required when working at height which is below 2 metres. Guidance and interpretation on the above is held in JSP 375.

9 In the event of an accident or incident involving damage to FRPPE or other safety equipment, or an incident in which a fall is arrested as a result of being connected into a fall arrest system, the relevant equipment is to be quarantined. In addition to any reporting action required by other instructions, all such accidents/incidents are to be reported by signal to Abbey Wood ACT GSE 6. GSE 6 will arrange for the issue of disposal instructions for the equipment.

## **MANUAL HANDLING**

10 It is the duty of line managers to ensure so far as is reasonably practicable that systems of work are safe and without risk to health. They therefore have a duty to ensure that suitable and sufficient assessments of the risk to the health and safety of their staff are carried out by a competent person.

11 Manual handling operations that may be hazardous should be avoided as far as reasonably practicable by addressing the following questions:

11.1 Can the movement of the load be eliminated altogether e.g. can the workplace or task be redesigned to avoid moving loads or could delivery be arranged to the point of use?

11.2 Can the operation be automated?

11.3 Can mechanical devices be used?

12 Guidance and interpretation on the above is held in JSP 375.

## **PERSONNEL PROTECTIVE EQUIPMENT (PPE)**

13 Personnel Protective Equipment (PPE) means all equipment and products designed to be worn or held at work for the protection of personnel against risks to their health and safety. The requirement to use PPE must always be considered as a final solution when assessing a task. The Personal Protective Equipment (EC Directive) Regulations and the Personal Protective Equipment at Work Regulations 1992 places a duty of care on both Line Managers and employees. Guidance and interpretation on the above two regulations are held in JSP 375 and JSP 437.

## **ELECTRIC SHOCK**

14 Where there is a risk of Electric Shock due to the voltage levels present in some equipment, the safety precautions detailed in the DAP 120A-0001-1 and JSP 375 are to be strictly observed.

15 Personnel are to ensure that prior to working on equipment which contain suppression capacitors that the electrical potential is reduced to zero after the voltage supply has been switched off.

## **BONDING AND EARTHING**

16 Specific orders relating to the bonding and earthing of aircraft and GSE are contained in JAP 100A-01, Chapter 6.4 and AP 113A-0201-1.

## **PORTABLE ELECTRICAL EQUIPMENT**

17 The Policy for the Operation and Maintenance of Electrical Equipment is contained in AP 119F-0010-5F.

## **ELECTRO-STATIC HAZARDS**

18 Friction or other contact between the human body and synthetic fibre materials used in the manufacture of clothing and soft furnishings may cause a static electrical charge to collect on the body. The charge can increase until it is large enough to discharge in spark form. In certain circumstances, the discharge could cause a fire or explosion. Reference is to be made to AP 100B-01.

## **BATTERIES**

19 Care is to be taken when handling batteries. When removing batteries from GSE, the battery lead that is connected to the chassis or frame is to be disconnected first and reconnected last when fitting a battery. Particular care must be taken to prevent short circuit across the terminals. Charging of batteries, disposal of waste batteries and electrolyte, spillage or contamination to the body/eyes/clothing by electrolyte is to be dealt with in accordance with AP 120C-0001-1 and RAF Poster 174.

## **HAZARDS AND PRECAUTIONS – SAFETY SIGNS**

20 There is a requirement for Safety signs to be prominently displayed within work areas. These should give information for prevention of accidents, warning of health hazards and details of other emergency situations. Details of Safety signs are outlined in JSP 375.

## **CLEANLINESS OF WORK AREA**

21 It is the responsibility of all tradesmen to ensure that a high standard of cleanliness is maintained in the work area during maintenance operations. On completion of maintenance, all tools and equipment are to be cleaned and all materials and rags are to be removed from the work area. Additionally the equipment that has undergone maintenance is to be thoroughly inspected and any foreign objects are to be removed.

## **CONTROL OF HAND TOOLS**

22 Control of hand tools is an important engineering function, and is essential to flight safety. JAP 100A-01 Chapter 6.1 details the control principles and procedures that are to be followed within the Military Air Environment and AP 100B-01 for Non Military Air Environments.

## **TRAINING, TESTING AND LICENSING OF DRIVERS AND DRIVING OF SELF-PROPELLED GSE**

23 Certain items of GSE are self-propelled and carry drivers. Other items are also self-propelled but are pedestrian operated. The regulations concerning responsibilities and procedures for training, testing and licensing drivers and operators of self-propelled GSE are detailed in JAP(D) 100E-10.

## FUELLING AND OPERATION OF ENGINE DRIVEN GSE

24 Operation, handling and refuelling of engine driven GSE can be very hazardous under certain circumstances. The safety precautions to be observed when fuelling and operating engine driven GSE are detailed in JAP(D) 100E-10.

## ENGINE MANUAL CRANKING

25 Manual cranking of engines is a potentially hazardous operation. Particular care is to be taken when cranking engines manually. The starting handle is to be gripped firmly with the thumb on the top side of the grip, not around it. Additionally correct interlocking of the dog and pawl should be assured prior to cranking the engine. The Operator should ensure that all personnel are standing at a safe distance, in the event of a hand slipping off the starter handle.

## STARTING ENGINES WITH STARTING CORD

26 When starting an engine using a starting cord, the cord is to be wound a maximum of THREE times around the pulley in the direction of rotation of the engine. UNDER NO CIRCUMSTANCES is the cord to be wrapped around the hand.

## DETACHABLE FLANGE AND DIVIDED TYPE WHEEL ASSEMBLIES

27 Extreme care is to be taken during the removal, fitting and ventilation of tyres on detachable flange and divided wheels fitted to GSE. The following safety precautions are to be observed:

27.1 Do not remove a divided wheel or unscrew any nuts on the wheel until the tyre has been deflated and the valve core removed, the wheel clamping nuts (painted red) may then be removed. Failure to comply with these precautions may cause the wheel halves to blow apart and cause serious injury to personnel.

27.2 Do not attempt to remove a detachable flange or locking device from any wheel until the tyre has been deflated and the valve core removed.

27.3 Do not assemble a tyre and wheel without checking the flanges, rings and grooves are clean, undamaged and free from distortion.

27.4 Before commencing inflation of the wheel it should be placed behind an authorised guard. The wheel should be inflated slowly to not more than 1 bar (15lb/in<sup>2</sup>) ensure all flanges and rings are correctly seated before continuing to inflate, over inflation of the wheel is to be avoided.

## EQUIPMENT SAFETY GUARDS

28 Before removing a safety guard, the equipment is to be switched OFF and isolated, or the ignition key is to be removed. When it is necessary to function equipment during maintenance with safety guards removed, extreme care is to be taken by personnel directly involved in the maintenance operation. Precautions are to be taken to protect personnel that are not directly involved by displaying signs and if necessary by restricting access.

## OXYGEN EQUIPMENT

29 Due to the risks involved only personnel holding appropriate TQA's are to operate or use Liquid Oxygen (LOX). Extreme care is to be taken to obviate any risk of contact between oxygen equipment and oil or grease which are combustible materials and have a high affinity to oxygen and may ignite spontaneously under high pressure. Accidental contamination of equipment by oil or grease is to be removed immediately by an approved process.

30 Smoking or naked lights are not permitted when working in the vicinity of Oxygen equipment.

31 LOX is subject to particular regulations and precautions concerning pressure, clothing, first aid and fire risks. All tradesmen involved in the handling and maintenance of LOX and associated equipment are to be thoroughly conversant with the requirements specified in JSP 319.

## LIQUID NITROGEN

32 Extreme care is to be taken to obviate any risk of asphyxiation. Liquid Nitrogen (LIN) should only be used and stored in well ventilation areas.

33 LIN is subject to particular regulations and precautions concerning pressure, clothing and first aid. All tradesmen involved in the handling and maintenance of LIN and associated equipment are to be fully conversant with the requirements specified in JSP 319.

## REFRIGERATION EQUIPMENT

34 The principal hazard arising from the use and maintenance of refrigeration equipment is in the discharge, accidental or otherwise, of liquid refrigerant. Contact between skin and refrigerant may cause frostbite. Particular care is to be taken to prevent refrigerant coming into contact with the eyes. Should refrigerant, come into contact with the eyes, or cause frostbite then medical assistance must be obtained immediately. First Aid treatment should be carried out by applying warmth to the affected area through the medium of COLD water. Smoking is prohibited in any area in which refrigerant is in use or being stored. The user must take all precautionary measures practicable to recover the substances during maintenance and decommissioning of equipment, and minimise leakage and prevent avoidable emissions of the substances during equipment operation.

35 The deliberate venting to atmosphere of any of the substances, as a means of disposal, is a criminal offence.

### NOTE

All personnel employed in the handling of refrigerants should hold the Trade Qualification Annotation (TQA) Q-GE-ODS), in order to comply with the regulations of the Montreal Protocol.

## LEAK TESTING

36 Although leaks can be readily detected by inspection, only the soaps and solutions depicted in AP 107D-0001-1 are authorised as an aid to leak testing.

## CONTRACTORS OWNED (BOC) CYLINDERS

37 The BOC supplied cylinders utilised with this equipment are subject to a ten-year periodic test. Information on how to determine the test due date of a cylinder is detailed in DAP 119F-2743-123. The cylinders are to be examined for damage in accordance with JSP 319.

38 Before any contractors owned (BOC) cylinders are recharged by a detachment/Out of Area deployment the Front Line Command (FLC) is to apply to Defence Fuels Group (DFG) for authority to recharge cylinders.

38.1 Safeguards have to be put in place by the detachment/Out of Area deployment CFS operating staff to ensure that MoD charged contractor owned (BOC) cylinders are not mixed with contractor charged and owned (BOC) Cylinders.

38.2 On completion of the requirement for MoD charged contractor owned (BOC) cylinders, the cylinders are to be quarantined, then returned through the DFG as unserviceable assets to the contractor (BOC) clearly annotated "Requires Internal Inspection".

## TESTING DIESEL ENGINE INJECTORS

39 The testing of diesel engine injectors must be carried out with extreme caution as the spray from an injector nozzle undergoing test can, if in close proximity to the skin, penetrate the skin with subsequent risk of infection. Any such accidental penetration from an injector should receive immediate medical attention through the Station Medical Centre.



## **COMPRESSED GAS AND LUBRICATING EQUIPMENT**

40 Injection of compressed gases or lubricants can result in serious injury. Any accidental injection into the skin is to receive immediate medical attention. All personnel involved in the maintenance or use of such equipment are to comply with the regulations for the specific equipment and the procedures contained in MAP-01 and AP 100B-01.

## **FILLING AND DRAINING OF COOLING SYSTEMS**

41 Extreme care is to be taken whilst filling and draining hot cooling systems, to prevent the threat of burns and scalding. Unless operations dictate otherwise, the system should be allowed to cool and pressure dissipate before any part of the system is opened.

## **DRAINING OF LUBRICATION SYSTEMS**

42 Care is to be taken during the draining of hot lubrication systems, to prevent the threat of burns and scalding.

## **TOWING GSE ON PUBLIC ROADS**

43 The following regulations are to be strictly adhered to if it is intended to tow an item of GSE on the Public Roads.

43.1 Tyres must be checked in accordance with AESP 2300-A-050-13.

43.2 Brakes are to undergo an efficiency test in accordance with AESP 2300-A-050-13. This operation is to be carried out by the supervisor in conjunction with MT Tech/Gen Mech tradesmen during ADM/12 Monthly Maintenance. Details of the test are to be annotated on MOD Form 755G.

43.3 The lighting system, is to be fully serviceable when connected to a vehicle, otherwise, a Lighting Board is to be used in accordance with JSP 800 and MT Instructions.

43.4 Speed Restriction Sticker and Reflectors are to be fitted in accordance with JSP 800 and MT Instructions.

## **BRAKE DRUMS**

44 The shoe linings used on equipment may contain asbestos. Therefore asbestos dust may be present in the brake drum. The accumulated dust is to be removed using Cleaner Vacuum Zephyr, Type H (4G/4954491) and the brake drums cleaned using solvent (33D/1923265). Oil or grease contaminated brake shoes are to be replaced; no attempt is to be made to clean them.

**CHAPTER 3****MAINTENANCE NOTES****CONTENTS**

## Para

1	Introduction
2	Equipment function
3	Montreal protocol
4	Coolants and anti freeze solutions
5	Fire extinguishers
6	Painting of ground support equipment
7	Wheel rims
8	Engine decarbonisation
9	Bore glazing
12	Engine lubrication
14	Fuel replenishment using DIESO
15	Hydraulic fluid contamination
16	Hydraulic oil quality monitoring and filter replacement policy
17	When hydraulic oil monitoring is available
19	When hydraulic oil monitoring equipment is not available
21	Diesel engine fuel injectors
22	New equipment or equipment fitted with replacement engines
23	Fan belt tension and replacement
24	Air restriction indicators/air filter elements
25	Hydraulic reservoir replenishment – forklift trucks
26	External supply cables and hoses
27	Locally manufactured ground support equipment
28	Insulation testing
29	Circuit protective conductor testing
30	Phase sequencing
31	Ferrite rings
32	Plug security of cable retaining screws
33	Retention of locking devices and pennants
34	Storage equipment – racking, shelving, binning and pallets
35	Equipment cleaning

**INTRODUCTION**

1 The following notes are published for the guidance of trade supervisors and managers concerned with the maintenance of Ground Support Equipment (GSE). Items of equipment of the same make and type may vary in minor details. The maintenance in the schedule applies to the types current at the time of preparation. Units are to check the maintenance details against the actual equipment concerned and advise the Publication Sponsor by Unsatisfactory Feature Report of any anomalies that could require a general amendment to the schedule.

**EQUIPMENT FUNCTION**

2 The term 'Function' is used in this maintenance schedule (see glossary). In certain circumstances, personnel carrying out the maintenance of the equipment may not be able to satisfy the 'Function' requirement as they are not qualified operators. Where this situation occurs:

2.1 Under 'Preparation for Maintenance', the operator is to be directed to Function the equipment. If this is not feasible, then it is to be taken that the equipment is serviceable from its last operation and maintenance is to proceed.

2.2 Under 'Completion of Maintenance', the operator is to be directed to Function the equipment. If this is not immediately possible, the scheduled maintenance is to be signed for as complete and the Supervisory Checks are to be carried out and signed for. A MOD Form 755G is to be left with the operator detailing the requirement to Function the equipment.

## **MONTREAL PROTOCOL**

3 The Montreal Protocol on substances that deplete the Ozone Layer was signed by over 50 countries including the UK. The original objective of the Montreal Protocol was to control the production and consumption of source gases.

3.1 The following chemicals have been identified as having a significant effect on the rate of ozone depletion:

3.1.1 Chlorofluorocarbons (CFCs). There are several forms of CFCs which are used in a variety of products, eg foams, aerosols, refrigeration, solvents and air conditioning.

3.1.2 Halons. The two main halons are bromotrifluoromethane (halon 1301) which is used for total flooding applications, and bromochlorodifluoromethane (halon 1211) which is used in fire extinguishers.

3.1.3 Carbon Tetrachloride. Traditionally used as a solvent, this is now used in the manufacture of CFCs.

3.1.4 1,1,1-Trichloroethane (Methyl Chloroform). This non-flammable solvent is often used as a cleaning agent.

3.1.5 Hydrochlorofluorocarbons. These transitional substances may be used to replace CFCs, and although less potent they do have depletion potential.

3.1.6 Methyl Bromide. This is widely used as a fumigant.

3.2 Under the Montreal Protocol the following actions are mandatory and in accordance with JSP 418:

3.2.1 Venting of protocol substances to atmosphere is to cease.

3.2.2 Where and as acceptable alternative substances are identified, existing equipment is to be modified to permit introduction.

3.2.3 Future equipment designs are to eliminate the need for protocol substances.

3.2.4 Standards and specifications which provide for the use of protocol substances are to be identified and wherever possible amended to eliminate the requirement to use them.

3.2.5 Progress in reducing the use made of protocol substances.

3.2.6 When equipment containing protocol substances is withdrawn from service, action must be taken to prevent venting to atmosphere by recovering, recycling and stockpiling for future use.

## **COOLANTS AND ANTI FREEZE SOLUTIONS**

4 Information on coolant mixing and specific gravity checks is contained in Annex A to this chapter.

## **FIRE EXTINGUISHERS**

5 Details of Inspections and Maintenance Instructions for first aid fire appliances, where fitted, are contained in JSP 426.

## PAINTING OF GROUND SUPPORT EQUIPMENT

6 Information on the painting of Ground Support Equipment can be found in MAP-01, JAP(D) 100E-10 and AP 119A-0601-0A.

## WHEEL RIMS

7 Wheel rims are not subject to periodic maintenance but are to be given anti-corrosion treatment, if required, when the tyres are removed for renewal or repair.

## ENGINE DECARBONISATION

8 Engine decarbonisation has not been included as part of periodic maintenance but should be carried out only when the performance of the engine indicates that it is necessary.

## BORE GLAZING

9 Bore glazing is a condition which can occur when a diesel engine has been run for long periods on a light load. The result is a reduction of power output caused by the loss of effective sealing between piston rings and the cylinder bore. The symptoms of bore glazing are as follows:

- 9.1 Excessive blue smoke or oil emission from the exhaust.
- 9.2 Increased oil consumption.
- 9.3 A tendency for the engine to falter when full load is applied.

10 If bore glazing is suspected, progressively load the engine to full load and run it for a minimum of 30 minutes. When it is known that an engine is being run constantly on a light load, then the engine is to be run on full load for 30 minutes during the first major Hourly Servicing Maintenance.

11 Where bore glazing symptoms persist the equipment is to be declared unserviceable and the engine is to be removed and examined. Severe bore glazing can only be removed by honing out the cylinder bores. This operation would normally be carried out at 3rd/4th Line.

## ENGINE LUBRICATION

12 OMD-90 (NATO 0-1176) is suitable for ambient temperatures down to minus 20°C. However, for temperatures persistently below minus 20°C, OMD-55 (NATO 0-1178) is to be used.

13 When reverting to normal temperatures OMD 55 need not be replaced until next oil change is due.

## FUEL REPLENISHMENT USING DIESO

14 General purpose UK DIESO is suitable for use in ambient temperatures down to minus 12°C. DIESO military NATO F-54 is suitable for use in ambient temperatures down to minus 15°C. Below these temperatures refer to AP 101A-0002-1 'Maintaining Aircraft and Associated Equipment in Low Temperature Conditions'.

## HYDRAULIC FLUID CONTAMINATION

15 Tradesmen are to ensure that the hydraulic fluid is not contaminated in any way. The presence of water promotes fungal growth. If fungal contamination is noted during the internal examination of a hydraulic tank, it will be necessary to:

- 15.1 Drain the tank, fill with Solvent (33D/1923265), flush and drain.
- 15.2 Strip the hydraulic system and components, clean and flush with Solvent (33D/1923265).

- 15.3 Allow the hydraulic system to dry.
- 15.4 Reassemble the hydraulic system and replenish with clean hydraulic fluid.

### **HYDRAULIC OIL QUALITY MONITORING AND FILTER REPLACEMENT POLICY**

16 Hydraulic oil quality monitoring and filter replacement policy is dependent upon the availability of in-line hydraulic oil monitoring equipment.

#### **When hydraulic oil monitoring is available**

17 When in-line hydraulic oil monitoring equipment is available, then the quality of the output hydraulic oil is to be measured:

- 17.1 Every 3 and 12 monthly scheduled maintenance.
- 17.2 Whenever quality is in doubt.
- 17.3 After the hydraulic system has been disturbed.

18 The oil quality is to be checked until NAS Class 6 or better has been achieved under normal operating conditions on at least 2 consecutive results. Filters that have blockage warning devices are to be left in-situ until:

- 18.1 The required quality of oil cannot be achieved.
- 18.2 The output flow/pressure of the equipment is unacceptable and the cause is known to be filter blockage.
- 18.3 A full or partial filter blockage warning persists.

#### **When hydraulic oil monitoring equipment is not available**

19 When in-line hydraulic oil monitoring equipment is not available then hydraulic oil sampling is to be carried out, using the patch test, as follows:

- 19.1 Every 3 and 12 monthly scheduled maintenance.
- 19.2 Whenever contamination of the hydraulic system is suspected.
- 19.3 After the hydraulic system has been disturbed.

20 Hydraulic oil filters are to be replaced as follows:

- 20.1 When the patch test shows a contamination problem.
- 20.2 When output flow/pressure becomes unacceptable.
- 20.3 When a full or partial filter blockage warning persists.

### **DIESEL ENGINE FUEL INJECTORS**

21 Fuel injectors are not subject to routine maintenance. They should be replaced on defect, or when the performance of the engine deteriorates sufficiently to warrant replacement.

### **NEW EQUIPMENT OR EQUIPMENT FITTED WITH REPLACEMENT ENGINES**

22 Where new equipment is received, or equipment is fitted with a replacement engine, after 50 hrs engine running there is a requirement to check and tighten nuts, bolts and unions, paying particular attention to correct torque loading of cylinder heads and manifolds.

## **FAN BELT TENSION AND REPLACEMENT**

23 Fan belts are normally to be replaced every 2000 hours regardless of condition. However, where a manufacture's policy dictates otherwise, the Maintenance Schedule (Topic 5F) will reflect the alternative.

## **AIR RESTRICTION INDICATORS/AIR FILTER ELEMENTS**

24 The red indicators in the window of the gauges gradually rise as the filter elements become choked with dirt. The elements are normally cleaned or replaced when the red indicators are fully exposed. During the Hour Maintenance the opportunity should be taken to examine the elements, dependent upon condition, the elements should be cleaned or replaced as necessary. Following replacement of the filter, the air restriction indicator must be reset.

## **HYDRAULIC RESERVOIR REPLENISHMENT – FORKLIFT TRUCKS**

25 Forklift Truck forks must be in the fully lowered position prior to replenishing the hydraulic system.

## **EXTERNAL SUPPLY CABLES AND HOSES**

26 All Ground Support Equipment, with supply cables or hoses to and/or from equipment, must have them stowed correctly before being towed to another location. Hydraulic hoses, pipes and couplings are particularly prone to damage arising from misuse and care is to be exercised in their handling, storage and use. Hydraulic pumps can be damaged by cavitation caused by hoses and pipelines following routes that will impede the flow of hydraulic fluid.

## **LOCALLY MANUFACTURED GROUND SUPPORT EQUIPMENT**

27 The use of non-standard ground equipment for maintenance is prohibited, unless the regulations contained in JAP(D) 100E-10 are complied with.

## **INSULATION TESTING**

28 Prior to carrying out insulation tests on equipment, ensure reference is made to the equipment's publication and the following instructions:

28.1 Pilot or indicator lamps and capacitors are disconnected from circuits, thus averting possible damage by test voltages.

28.2 Voltage-sensitive electronic devices are disconnected, thus avoiding damage by test voltages.

28.3 There are no electrical components connected between any live conductor and earth.

## **CIRCUIT PROTECTIVE CONDUCTOR TESTING**

29 Testing of circuit protective conductors is to be carried out as directed within the main equipment publication. Where the equipment includes a Protective Earth Neutral (PEN) conductor, this conductor is to be treated as the circuit protective conductor and tested accordingly, e.g. output neutral of the 200 V 400 Hz system.

## **PHASE SEQUENCING**

30 A test is to be carried out on completion of any scheduled maintenance or rectification that may affect phase rotation or output polarity at the main output cables or auxiliary sockets. The phase sequence is to be A, B and C.

## **FERRITE RINGS**

31 The ferrite rings are for high frequency suppression and form an important part of the EMC system. They are very fragile and extreme care is to be taken when handling these components.

## PLUG SECURITY OF CABLE RETAINING SCREWS

32 Certain types of plugs used for connecting power to electrical ground equipment and electrically operated GSE have the cable cores secured by screws in pin buckets. When subject to vibration or misuse these screws can become loose, creating a safety hazard to personnel and equipment. When fitting a plug, the screws securing the cable cores are to be tightened and locked with locking compound (33H/2248425). Before using equipment fitted with this type of plug, the operator is to examine the plug pins for security of attachment.

## RETENTION OF LOCKING DEVICES AND PENNANTS

33 The following method of retention is to be used on items of GSE contained in the AP 119F publication series, or other, when specified by the relevant topic 5F, to secure the various small pins, clips, pennants etc not covered by the Talurit wire clamping process. Further, replacement of broken or worn cables is to be effected as soon as possible using the same method:

33.1 Measure and cut a piece of 18 swg wire 29H/1250098 to length allowing extra material for the formation of the loops at each end of the finished cable.

33.2 Cut a ¼ inch length of copper tube 1/8 inch x 22 swg 20B/9611032 or 1/8 inch x 20 swg 30B/9487506 and slightly flatten.

33.3 Thread the end of the wire through the tube and double back through the tube to form a loop.

33.4 Secure by the use of cable crimping machine 1M/1300399 or by hammering and soldering.

33.5 Repeat Sub-paras 33.2 to 33.4 above for the other end.

33.6 Attach finished cable to structure and pin, etc using Ring Split 29H/1250109 or 29H/4100.

## NOTE

Brazed Brass oval link chain may be used in preference to wire where appropriate to secure locking pins, pennants and clips.

## STORAGE EQUIPMENT – RACKING, SHELVING, BINNING AND PALLETS

34 Storage equipment is defined in GAI 4001 and is to be maintained in accordance with AP 119A-1501-1, AP 119A-1501-5F and JSP 886.

## EQUIPMENT CLEANING

35 Equipment is to be in a clean condition prior to and following maintenance work. Unit management is to decide the extent and method of any general cleaning necessary. Guidelines for cleaning processes are contained in AP 119A-0512-1. Specific cleaning tasks required during scheduled preventive maintenance are detailed in the relevant equipment maintenance schedule.

**CHAPTER 3 ANNEX A****SAFETY NOTES****INTRODUCTION**

1 The basic liquid used in the cooling system of all liquid cooled engines is water, this has the disadvantage of enhancing corrosion and being of a relatively high freezing point. In order to prevent damage to engines by corrosion and low temperatures, the cooling system must be protected with an antifreeze mixture of water and Fluid Miscellaneous AL-39.

**ANTIFREEZE INHIBITED ETHANEDIOL AL-39**

2 Antifreeze Inhibited Ethanediol AL-39 (34D/2250424) is supplied in 25 Litre (5 gallon) containers. The mixture ratios of AL-39 to water depends on the lowest temperature of the location that the equipment is expected to operate in. The freezing point of the antifreeze is lowered as the percentage of AL-39 is increased and the initial mixture ratios and their freezing points are as follows:

- 2.1 One part (25%) AL-39 to three parts (75%) water has a freezing point of -12°C.
- 2.2 One part (33.3%) AL-39 to two parts (66.6%) water has a freezing point of -17°C.
- 2.3 45% AL-39 to 55% water has a freezing point of -32°.

**TESTING OF ANTIFREEZE INHIBITED ETHANEDIOL AL-39**

3 The testing of antifreeze AL-39/water mixture is to be carried out using a Hydrometer (63C/2204375). The hydrometer has an integral thermometer graduated from +70°C to -40°C and a hydrometer float with graduations from 15 to 85. The float graduations represent the percentage by volume of AL-39 to water when it is at a temperature of 26.7°C.

4 A mixture of AL-39 and water has a higher specific gravity than water alone. As the proportion of AL-39 to water is increased the depth of float immersed will be less, so the float scale reading will give an indication of specific gravity. Therefore the float reading can be used to indicate the degree of frost protection given by the added AL-39.

5 The specific gravity of anti-freeze will vary with engine temperature, so a float reading taken when the coolant is at engine working temperature will differ from a reading taken when the coolant is at a ambient temperature. Float reading alone should not be relied upon for an indication of the coolant freezing point and some allowance has to be made for fluid temperature. This temperature can be read directly from the thermometer in the hydrometer. Once the float reading and fluid temperature have been obtained the freezing point of the coolant mixture can be found by reference to Fig 1.



## INSTRUCTIONS FOR USE OF THE HYDROMETER

6 The procedure for testing of antifreeze AL-39/water mixture using a Hydrometer (63C/2204375), is as follows:

### WARNINGS

**(1) ANTIFREEZE. AL-39 (NATO S-757) IS A HAZARDOUS SUBSTANCE. REFER TO THE RELEVANT COSHH ASSESSMENT AND SAFETY DATA SHEET DETAILED IN JSP 515, THE MOD HSIS.**

**(2) PRESSURISED FLUIDS. THIS EQUIPMENT PRODUCES FLUID PRESSURES HAZARDOUS TO PERSONNEL. PRESSURES ARE TO BE DEPLETED PRIOR TO MAINTENANCE.**

**(3) HOT SURFACES AND FLUIDS. THIS EQUIPMENT PRODUCES HEAT. PARTICULAR CARE MUST BE TAKEN TO AVOID BURNS AND SCALDING WHEN MAINTAINING AND OPERATING THIS EQUIPMENT.**

6.1 Draw a charge of coolant mixture from the radiator into the hydrometer, then expel it, this will equalise the temperature of the hydrometer to the coolant.

6.2 Draw a second charge into the hydrometer sufficient to raise the float, ensuring that the top of the float does not touch the rubber cap of the glass cylinder. If initially there is insufficient charge to allow the float to raise to its operating level then, lift the side of the rubber bulb to expel the air and extract more charge.

6.3 Read the figure on the float scale immediately above the top of the coolant mixture, and the temperature displayed on the thermometer.

6.4 Refer to Fig 1 with the results of para 6.3 above ie. if the float reading was 35 and the thermometer reading was 15°C, then the freezing point of the coolant is -17°C.

6.5 On completion of testing the coolant, rinse the hydrometer with water, fit the rubber tubing through the eyelet on the wire clip and stow in its box.

### WASTE AL-39 DISPOSAL

7 Waste AL-39 is to be disposed in accordance with local regulations.

		FLOAT READINGS															
		15	20	25	30	35	40	45	50	55	60	65	70	75			
THERMOMETER READINGS – DEGREES C	70	-14	-20	-25	-37	-44											
	65	-13	-16	-22	-32	-40											
	60	-12	-15	-20	-27	-36	-46										
	55	-11	-13	-18	-24	-32	-40										
	50	-9	-11	-16	-23	-30	-35										
	45	-8	-10	-15	-22	-27	-33	-43									
	40	-7	-9	-14	-20	-25	-32	-41									
	35	-6	-9	-13	-17	-22	-30	-37	-43								
	30	-5	-8	-12	-16	-20	-27	-34	-40								
	25	-5	-7	-11	-15	-19	-25	-31	-37	-45							
	20	-5	-6	-10	-14	-18	-23	-29	-35	-42	-49						
	15	-4	-6	-10	-13	-17	-21	-26	-32	-39	-46						
	10	-4	-6	-9	-12	-15	-20	-24	-29	-36	-41	-49					
	5	-4	-5	-8	-12	-15	-18	-22	-27	-33	-39	-44	-50				
	0	-4	-5	-7	-11	-14	-18	-21	-26	-31	-35	-40	-45				
	-5	-3	-5	-7	-10	-13	-17	-20	-25	-30	-34	-39	-44				
	-10			-6	-9	-10	-16	-19	-24	-26	-32	-36	-41	-47			
	-15						-15	-17	-22	-25	-30	-34	-39	-44			
	-20							-16	-20	-23	-28	-32	-37	-42			
	-25											-27	-30	-35	-40		
-30															-33	-37	

Fig 1 Freezing points of AL-39/water mixture - degrees C

**CHAPTER 4****MAINTENANCE OF GSE SUBJECT TO THE PRESSURE SYSTEMS SAFETY REGULATIONS 2000****CONTENTS**

## Para

1	Introduction
2	General summary of the PSSR 2000
3	Associated publications
4	Definitions
5	Applicability of the PSSR 2000 to GSE
6	Written Scheme of Examination (WSE)
7	Competent Person (CP)
8	Examination report
9	Pressure system categories
10	Minor system
11	Intermediate systems
12	Major system
15	Exemption
16	Written scheme of examination general information (WARNING)
17	Compressed air systems
18	Gas charging systems incorporating transportable gas containers/cylinders
19	Hydraulic systems
20	Gas loaded/hydro-pneumatic accumulators
21	Cryogenic systems
22	Refrigeration systems

**INTRODUCTION**

1 The aim of the Pressure Systems Safety Regulations (PSSR) 2000 is to prevent serious injury from the hazard of stored energy as a result of the failure of a pressure system or one of its component parts. The regulations are concerned with steam at any pressure, gases which exert a pressure in excess of 0.5 bar above atmospheric pressure and fluids which may be mixtures of liquids, gases and vapours where the gas or vapour phase may exert a pressure in excess of 0.5 bar above atmospheric pressure. Transportable gas containers are covered by the Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations 1996 as transportable pressure receptacles.

**GENERAL SUMMARY OF THE PSSR 2000**

2 The PSSR 2000 requires the user/owner of a pressure system to:

2.1 Establish the safe operating limits of the system.

2.2 Have a suitable written scheme of examination (WSE) drawn up or certified by a Competent Person (CP). The WSE must include all protective devices. Any pressure vessel, pipework section or pipeline, in which a defect may give rise to danger, must also be included. The WSE is to be reviewed at appropriate intervals by a CP.

2.3 Have examinations carried out by a CP at the intervals set out in the WSE.

2.4 Provide adequate operating instructions to ensure that equipment is operated within the safe working limits and to cover emergency situations.

- 2.5 Ensure that equipment is properly maintained modified and repaired.
- 2.6 Keep adequate records of the most recent examinations, details of modifications/repairs and any information supplied with new equipment.

### ASSOCIATED PUBLICATIONS

- 3 JSP 375 – MOD Health and Safety Handbook.

### DEFINITIONS

- 4 Throughout this chapter the following terms will be used:

4.1 Pressure System. A pressure system is defined as one of the following if it contains, or is liable to contain, a relevant fluid:

4.1.1 A system comprising one or more pressure vessels of rigid construction, any associated pipework and protective devices.

4.1.2 The pipework with its protective devices to which a transportable gas cylinder is, or is intended, to be connected to.

4.1.3 A pipeline and its protective devices.

4.2 Relevant Fluid. A relevant fluid is defined as:

4.2.1 Steam, at any pressure.

4.2.2 Any fluid or mixture of fluids which is at a pressure greater than 0.5 bar above atmospheric pressure, and which fluid or mixture of fluids is either:

4.2.2.1 A gas.

4.2.2.2 A liquid which would have a vapour pressure greater than 0.5 bar above atmospheric pressure when in equilibrium with its vapour at either the actual temperature of the liquid or 17.5°C.

4.2.3 A gas dissolved under pressure in a solvent contained in a porous substance at ambient temperature and which could be released from the solvent without the application of heat.

4.3 Protective Devices. Devices designed to protect against system failure or to give warning that system failure might occur. Bursting discs are included as well as any equipment which is essential to prevent a dangerous situation from arising. Instrumentation and control equipment is included where it has to function correctly to protect the system or it prevents safe operating limits being exceeded.

4.4 Pipework. The pipework of a pressure system – pipes, valves, pumps, compressors, pressure containing components including hoses or bellows, but does not include any protective devices.

4.5 Pipeline. A pipe or system of pipes used for conveying fluid across the boundaries of premises, together with any apparatus for inducing the flow of a relevant fluid through, or through part of, the pipe or system, and any valves, valve chambers, pumps, compressors and similar works which are annexed to, or incorporated in the course of, the pipe or system.

### APPLICABILITY OF THE PSSR 2000 TO GSE

5 Operating Instructions and Safe Operating Limits. All items of GSE which are, or which contain a pressure system, are to be categorised as Major GSE. As such, the operating instructions and safe operating limits will be detailed in the relevant equipment AP Topic 1 or manufacturer's handbook.

**WRITTEN SCHEME OF EXAMINATION (WSE)**

6 The WSE format and preparation should be as follows:

6.1 Format. The WSE for any item of GSE will be in the form of a separate maintenance schedule within the relevant Topic 5F or GSE Schedule. This will be known as the Pressure System Examination (PSE).

6.2 Preparation. The relevant equipment Support Authority (SA) is responsible for ensuring that WSE's are provided for all relevant equipment, by tasking the GSE Desk Officer, or another competent agency, to include it within the requirements of para 6.1 above. Units identifying applicable GSE for which there is no WSE are to apply, through their parent Command, to the relevant equipment SA for one to be produced.

**COMPETENT PERSON (CP)**

7 The term CP is used in connection with the following two distinct functions:

7.1 Drawing up or Certifying WSE. For the purpose of drawing up or certifying WSE, the level of expertise which is advised of the CP is detailed in the PSSR 2000 Approved Code of Practice (para 106).

7.2 Carrying out the Examination. For the purpose of carrying out the examination in accordance with the WSE, the CP is that tradesman identified in the relevant Topic 5F or GSE Schedule and will in most cases be a SNCO Gen Tech (M). The examination is only to be delegated to a subordinate on the authority of OC Eng Wg.

**EXAMINATION REPORT**

8 The format of the examination report will be a MOD F755G/JAMES Worksheet.

**PRESSURE SYSTEM CATEGORIES**

9 Pressure systems are divided into three categories. However, in practice there are no clear dividing lines. The three categories should be taken as an indication of the range of systems covered rather than providing clear cut divisions. Each system should be individually assessed and an informed decision made on which category is most appropriate.

**MINOR SYSTEM**

10 Minor systems include those containing steam, pressurised hot water, compressed air, inert gases or fluorocarbon refrigerants which are small and present few engineering problems. The pressure (above atmospheric pressure) should be less than 20 bar (2.0 MPa) (except for systems with a direct-fired heat source when it should be less than 2 bar (200 kPa)). The pressure-volume product for the largest vessel should be less than  $2 \times 10^5$  bar litres (20 MPa m<sup>3</sup>). The temperatures in the system should be between -200°C and 2500°C except in the case of smaller refrigeration systems operating at lower temperatures which will also fall into this category. Pipelines are not included.

**INTERMEDIATE SYSTEMS**

11 Intermediate systems include the majority of storage systems and process systems which do not fall into either of the other two categories. Pipelines are included unless they fall into the major system category.

## MAJOR SYSTEM

12 Major systems are those which because of their size, complexity or hazardous contents require the highest level of expertise in determining their condition. They include steam-generating systems where the individual capacities of the steam-generators are more than 10 MW, any pressure storage system where the pressure-volume product for the largest pressure is more than 106 bar litres (100 MPa m<sup>3</sup>) and any manufacturing or chemical reaction system where the pressure-volume product for the largest pressure vessel is more than 105 bar litres (10 MPa m<sup>3</sup>). Pipelines are included if the pressure-volume product is greater than 105 bar litres.

13 Pressure systems that fall below the Minor System category do not require a PSE, but must be subject to scheduled preventive maintenance.

14 It is unlikely that any GSE will be in the Major System category and with few exceptions the majority of GSE, subject to the regulations, will be in the Minor System category.

## EXEMPTION

15 Some pressure systems are fully or partially exempt from the regulations, those which could be relevant to GSE are:

15.1 Full Exemptions. These include:

15.1.1 A pressure system which forms part of any braking, control or suspension system of a wheeled, tracked or rail mounted vehicle.

15.1.2 Any tyre used or intended to be used on a vehicle.

15.1.3 Any water cooling system on an internal combustion engine or any compressor.

15.1.4 Any part of a tool or appliance (designed to be held in the hand) which is a pressure vessel.

15.1.5 Any vapour compression refrigeration system incorporating compressor drive motors, including standby compressor motors, having a total installed power not exceeding 25 kW.

15.2 Partial Exemptions. These include a pressure system, containing a relevant fluid (other than steam) where the product of pressure and volume of the largest storage vessel is less than 250 bar litres. In this case the only regulations appertaining to the user/owner are that it should be properly maintained.

## WRITTEN SCHEME OF EXAMINATION GENERAL INFORMATION

16 The periodicity, extent and detail of the examination of any pressure system, including any specific preparatory work and functional checks, will be defined in the relevant equipment Maintenance Schedule. The following paragraphs detail general information on the examination of pressure systems and components which the schedule may make reference to.

## WARNING

**PRIOR TO DISMANTLING OR REMOVING ANY COMPONENT FROM A PRESSURE SYSTEM ENSURE THAT ALL SOURCES OF PRESSURE HAVE BEEN ISOLATED AND/OR ALL RESIDUAL PRESSURE HAS BEEN EXHAUSTED FROM THE SYSTEM AND COMPONENTS.**

**COMPRESSED AIR SYSTEMS**

17 Compressed air systems are to be examined as directed below:

17.1 Air Receiver Preparation, Extension and Testing is as follows:

17.1.1 Preparation.

17.1.1.1 Where necessary isolate the equipment/system from the electrical supply.

17.1.1.2 Isolate receiver from all sources of pressure supply.

17.1.1.3 Drain receiver of all residual pressure and any drying medium.

17.1.1.4 Remove all inspection covers, plugs and fittings.

17.1.1.5 Clean all internal and external surfaces to enable a thorough examination to be carried out.

17.1.1.6 Remove all protective devices and fittings.

17.1.2 Examination.

17.1.2.1 Visually examine all accessible internal and external parts, including supports, plugs, threaded inserts, covers and their securing devices for, cracks, fractures, corrosion, distortion, chafing, damage to thread forms, loose rivets and damage due to external sources. If internal access is limited, visual aids should be utilised.

17.1.2.2 Areas of corrosion are to be noted and the degree of corrosion is to be assessed to determine if the air receiver is serviceable, requires supplementary tests or is to be condemned and a replacement fitted.

17.1.3 Supplementary Tests. If the examiner has doubts as to the serviceability of a receiver, one of the following supplementary tests is to be carried out:

17.1.3.1 Hydrostatic Pressure Test. Using water as the hydraulic medium the receiver is to be subjected to a hydrostatic pressure test. During the test the receiver is to be pressurised to the figure specified in the schedule and maintained at that pressure for at least 15 minutes. Pressurisation can be achieved using a Tangye 'Hydrapak' Hydraulic Test Pump (71BG/2073214), see AP 119L-0102-1 for details. Following the test the receiver is to be drained of all water and thoroughly dried and vented prior to refitting.

17.1.3.2 Non-Destructive Tests (NDT). Various methods of Non-destructive testing may be used dependant on the particular circumstances. Typical techniques which could be used are Ultrasonic thickness checks and crack detection. This work is normally outside the scope of units and assistance should be sought from the relevant regional NDT team via the unit NDT co-ordinator.

17.1.4 Recording. After satisfactory examination, the date of examination is to be painted on the body of the air receiver. Additionally, details of any supplementary tests are to be entered on the relevant job card and, if a hydrostatic pressure test is carried out, the date of the test is to be stamped on the body of the receiver.

- 17.2 Protective Devices (excluding gauges) are to be examined and tested as defined below:
- 17.2.1 Pressure Relief/Limiting Valve.
- 17.2.1.1 Examine. Carry out a thorough visual examination and particularly for:
- 17.2.1.1.1 Damage due to external sources.
  - 17.2.1.1.2 Corrosion, contamination, deterioration.
  - 17.2.1.1.3 Faulty or broken locking devices.
  - 17.2.1.1.4 Obstructions and signs of leaks.
- 17.2.1.2 Test. When called for in the schedule the valve is to be tested using one of the following methods:
- 17.2.1.2.1 Hydraulic Test. Hydraulically test using a Tangye 'Hydrapak' hydraulic test pump with water as the medium (if water is allowed in the valve). Ensure the gauge fitted to the Tangye pump is calibrated and of a suitable range to provide the required degree of accuracy. Ensure all traces of moisture are removed from the valve prior to re-fitting.
  - 17.2.1.2.2 Pneumatic Test. Pneumatically test using a suitable pneumatic test rig or compressed gas supply with regulator. Ensure the regulated pressure gauge is calibrated and of a suitable range to provide the required degree of accuracy. Ensure the valve is suitably restrained during the test.

#### NOTE

Valves that fail either the functional check or hydraulic/pneumatic test are to be replaced. 'L' class stores are to be scrapped locally, 'P' class stores are to be returned R3/4. No attempt is to be made to adjust the operating pressure.

- 17.2.2 Bursting Discs. Carry out a thorough visual examination and particularly for signs of deterioration and damage. Replace if suspect.
- 17.3 Gauges. Carry out a thorough visual examination and particularly for:
- 17.3.1 Damage due to external sources.
  - 17.3.2 Loose or missing nuts, bolts, screws or rivets.
  - 17.3.3 Condition of face and glass.
  - 17.3.4 Ensure calibrated, refer to the schedule for details.



17.4 Pipework. Pipework will be included in the schedule if its mechanical integrity is likely to be reduced to any significant degree by corrosion, erosion, fatigue or any other factor and the service and location are such that failure could give rise to danger. When pipework is included it is to be examined as follows:

17.4.1 Pipes and Hoses. Carry out a thorough visual examination and particularly for:

- 17.4.1.1 Correct item fitted.
- 17.4.1.2 Cracks and/or fractures.
- 17.4.1.3 Corrosion, contamination, deterioration.
- 17.4.1.4 Distortion.
- 17.4.1.5 Chafing, loose clips or packing.
- 17.4.1.6 Leaks or obstructions.
- 17.4.1.7 Damage due to external sources.
- 17.4.1.8 Correct routing.

17.4.2 Valves – Excluding Pressure Relief Valves. Carry out a thorough visual examination and particularly for:

- 17.4.2.1 Cracks and/or fractures.
- 17.4.2.2 Corrosion, contamination, deterioration and signs of leaks.
- 17.4.2.3 Damage due to external sources.
- 17.4.2.4 Ease of operation (if manually operated).

#### **GAS CHARGING SYSTEMS INCORPORATING TRANSPORTABLE GAS CONTAINERS/CYLINDERS**

18 Gas charging systems which incorporate transportable gas containers/cylinders are to be examined as follows:

18.1 Transportable Gas Containers. The internal examination and maintenance of all ground transportable gas containers is the responsibility of the authorised contractor and is carried out in accordance with the relevant specification. All ground transportable gas containers fitted to GSE are subject to a periodic test. The date of last test is stencilled on containers at the base (or plug) end and is also stamped on the collar face immediately beneath the valve, or on the neck. During the PSE the test date is to be checked and any containers due re-test are to be returned. Returned containers are to be conditioned T3/4 and have the MOD F731 annotated 'Due Re-Test'.

18.2 Where the test periodicity of a container/cylinder, fitted to an item of GSE, is in doubt, units are advised to contact the SA for the main equipment to obtain clarification.

18.3 Protective Devices. As per para 17.2 above.

18.4 Gauges. As per para 17.3 above.

18.5 Pipework. As per para 17.4 above.

## HYDRAULIC SYSTEMS

19 Pure hydraulic systems are not subject to the regulations.

## GAS LOADED/HYDRO-PNEUMATIC ACCUMULATORS

20 Gas-loaded/hydro-pneumatic accumulators which contain a relevant fluid (eg Nitrogen) are to be considered as part of a Pressure System and, as such, are subject to the controls imposed by the regulations. Hydraulic systems are to be examined as follows:

20.1 Gas Loaded Accumulators. Dependant on environmental conditions, operating temperature, susceptibility to damage and internal corrosion, the schedule will call for one of the following examinations:

20.1.1 External Examination. This is to consist of an in-situ examination of the accumulator and particularly for:

20.1.1.1 Corrosion cracks or fractures.

20.1.1.2 Damage due to external sources.

20.1.1.3 Security of mountings/fixings.

20.1.1.4 Signs of leaks.

20.1.1.5 Condition of protective devices, bursting disc, fusible plug etc.

20.1.2 External and Internal Examination. This is to consist of the following:

20.1.2.1 Isolate the accumulator from the rest of the hydraulic system.

20.1.2.2 The gas and the liquid pressures in the accumulator must be discharged to zero prior to any dismantling taking place.

20.1.2.3 Remove the accumulator and carry out a thorough external examination as per sub para 20.1.1 above.

20.1.2.4 Dismantle accumulator and carry out a thorough internal examination.

## NOTE

Accumulators that fail either the external or internal examinations are to be replaced.

## CRYOGENIC SYSTEMS

21 Cryogenic systems are to be examined as follows:

21.1 Receiver/Tanks. Cryogenic receivers/storage tanks are to be examined externally. The examination is to consist of a thorough visual examination and particularly for:

21.1.1 Cracks and/or fractures.

21.1.2 Signs of leaks.

21.1.3 Distortion.

21.1.4 Damage due to external sources.

- 21.1.5 Corrosion, contamination, deterioration.
- 21.1.6 Undue external frosting.
- 21.2 Protective Devices. As per para 17.2 above.
- 21.3 Gauges. As per para 17.3 above.
- 21.4 Pipework and Valves. As per para 17.4 above.

## **REFRIGERATION SYSTEMS**

22 Small refrigeration systems under 25 kW in capacity are exempt from the regulations. Those systems subject to the regulations are to be examined as follows:

- 22.1 Liquid Receivers. As per para 20.1 above.
- 22.2 Protective Devices. Examine as per para 17.2 above.
- 22.3 Gauges. Examine as per para 17.3 above.
- 22.4 Pipework and Valves. Examine as per para 17.4 above.

**CHAPTER 5****TRUCK FORKLIFT LOAD ARMS AND FORK EXTENSIONS - EXAMINATION****CONTENTS**

## Para

- 1 Introduction
- 2 Applicability
- 3 Glossary
- 4 Procedures
- 5 Repairs to load arms and fork extensions
- 6 Replacement of fork arms/extensions

## Annex

- A Fork load arm - checks

**INTRODUCTION**

1 Truck forklift fork load arms and fork extensions are to be examined by a competent person at the intervals specified in the Maintenance Schedule. This chapter specifies the areas to be examined with the aim of detecting damage, failure, distortion etc. which might impair safe use. Any fork load arm or fork extension found to be faulty is to be withdrawn from use and not returned for use until it has been satisfactorily repaired/replaced.

**APPLICABILITY**

- 2 Truck Forklift-all variants.

**GLOSSARY**

3 Competent Person (CP). A person deemed competent on the basis of experience, training and knowledge. For the purpose of this publication the CP is to be an NCO Gen Tech (M).

**PROCEDURES**

4 The following procedures are not to be commenced until reference has been made to Annex A of this Chapter.

4.1 Surface Cracks. The fork load arm and fork extension are to be thoroughly examined visually for cracks and, if necessary, subjected to a non-destructive crack detection process (advice is to be sought from Unit NDT NCO). Special attention is to be paid to the heel and top and bottom hooks including their attachment to the shank. The fork load arm or fork extension is to be withdrawn from use if surface cracks are detected which may impair its safe use.

4.2 Straightness of Blade and Shank. The straightness of the upper face of the blade and the front face of the shank is to be checked. If the deviation from straightness exceeds 0.5% of the length of the blade and/or the height of the shank respectively, the fork load arm is to be withdrawn from use. The rejected arm is to be re-set and tested before being returned to use.

4.3 Fork Angle. The angle between the upper face of the blade and the front face of the shank is to be checked. If this angle exceeds 93°, the fork load arm is to be withdrawn from use. The rejected arm is to be re-set and tested before being returned to use.

4.4 Tip Height Alignment. The difference in height of a set of fork load arms and/or fork extensions when mounted on the fork carrier is to be checked. If the difference in tip heights exceeds 3% of the length of the blade, the rejected arm or fork extension is to be re-set as necessary and tested before being returned to use.

4.5 Positioning Lock. The fork load arm positioning lock is to be examined to ensure that it operates correctly. If any fault is found, the arm is to be withdrawn from use until satisfactory repairs have been effected.

4.6 Legibility of Marking. Each fork shall be permanently marked with its specified capacity and the specified load centre distance 'D' in accordance with BS 5639 in the format shown in the examples at Annex A. If the fork load arm marking is not clearly legible, the arm is to be withdrawn from use until it has been re-marked. Marking of the forks is to be carried out by Gen Tech GSE/(M) tradesmen using 12.7 mm (0.5 in ) stamps and finished by light smoothing of the surface with medium grade emery cloth.

#### NOTE

Care is to be taken to ensure that, if fitted, the anti-spark pads are excluded from these calculations.

4.7 Wear of Fork Load Arm Blade and Shank. The fork load arm blade and shank are to be checked for wear. Special attention is to be paid to the vicinity of the heel. If the thickness is reduced to 90% of the original thickness, the arm is to be withdrawn from use.

4.8 Wear of Fork and Arm Hooks. The support face of the top hook and the retaining face of the top and bottom are to be checked for wear, crushing and other distortion. If these faults are apparent to such an extent that the clearance between the fork arm and fork carrier is considered excessive, the arm is to be withdrawn from use.

### REPAIRS TO LOAD ARMS AND FORK EXTENSIONS

5 Before attempting the repair of load arms and extensions the following must be considered:

5.1 All repairs/replacement of load arms/fork extensions for forklift trucks that are still under Warranty/Sale of Goods Act are the responsibility of the contractor.

5.2 Only the prime Contractor of the forklift is to decide whether a load arm or fork extension may be repaired for continued use. Repairs are only to be carried out by such agencies.

5.3 Surface cracks or wear are not to be repaired by welding.

5.4 When repairs necessitating re-setting are required, the fork load arm should subsequently be subjected to an appropriate heat treatment.

5.5 A fork load arm or fork extension that has undergone repairs other than repair or replacement of the positioning lock and/or re-marking, should only be returned for use after being tested by the repairing agency and the issue of a test certificate. Such tests are to be carried out at 3 X Rated Capacity of the truck (3W) for standard forklifts and 8 X Rated Capacity of the truck (8W) for rough terrain forklifts.

### REPLACEMENT OF FORK ARMS/EXTENSIONS

6 Fork arms/extensions are to be changed in pairs.

## CHAPTER 5 ANNEX A

## FORK LOAD ARM - CHECKS

## EXAMPLES

1 Marking of a fork arm having a specified capacity of 750 kg at 500mm specified load centre distance: 750 x 500.

2 Marking of a fork arm having a specified capacity of 1500 kg at 610mm specified load centre distance: 1500 x 610.

