

Quick Reference for Storage of MULAG Ground Support Equipment

These procedures provide a quick reference and general guide for formally taking MULAG GSE out of operational use, how to manage it while stored and the necessary steps to return it to service.

I. Preparation

1. General principles

1. Parking GSE for a long time without taking certain basic steps can lead to potential problems and downstream costs when it is needed again.
2. The primary aim of the preparations is to preserve the active GSE fleet in a safe and fully functional condition, so that it is easy and quick to return to operation and safe to use, with least possible cost.
3. If local regulations and procedures are more prescriptive or do not allow the application of these best practices, then they will have precedence over this guideline.

II. Planning of Storage and Action Planning

1. Planning

GSE storage plans can involve either:

1. Complete deactivation
2. An “exercise” regime whereby units are started and moved according to a plan
3. A planned rotation of units to distribute the utilization of the fleet, or
4. Some combination of these strategies.

* It is recommended to develop a GSE fleet storage strategy and perform the activities described below (as applicable). Ideally, it is recommended to develop a return to service plan at the same time as the storage plan. In this scenario the storage actions are paired with the corresponding actions to return the unit to service.

2. Actions

1. Park GSE in a centrally controlled area and under cover wherever possible.
2. Ensure all doors and windows are closed and secured.
3. Ensure exposed operational panels are covered to protect them from various climatic conditions such as rain, sun and dust.
4. Depending on climate, vents can be open to allow air to circulate but this should be weighed against the possibility of mould, fungus, infestations such as vermin / insects / birds, as well as ingress of sand, dust, snow or water.
5. Secure all accessories and hoses, cables, covers etc.

6. Inflate all tires to the maximum recommended pressure.
7. Ensure all fluids are at the correct level.
8. Store the vehicle on flat surface.
9. Unlock the spring-loaded brake system according to operating instructions and use chocks to prevent the vehicle from rolling away.
10. Minimize exposed lengths of hydraulic cylinder rods by moving all platforms, booms, stabilizers etc. in such a position that the rods are in fully retracted position.
11. If possible, coat exposed hydraulic rams with a preserving fluid or grease.
12. Disconnect the main batteries with the main switch to avoid draining the battery when in storage.
13. Protect against unauthorized usage by removing keys (if keyed ignition) or by appropriate kits to lock out / tag out .

3. Equipment with Internal Combustion Engines

1. It is recommended to keep fuel tanks filled as this prevents condensation and micro-bacterial growth. However, this must be a local decision based on local regulations, climatic conditions, expected duration of storage period and cost.
2. Disconnect the battery with the main switch – after checking the manual for any specific precautions.
3. Ensure DEF fluid does not freeze during prolonged periods of inactivity during cold weather. DEF fluid tanks could have heaters connected to the battery which can deplete the battery. Consider draining the DEF tank if the battery is to be disconnected.

4. Electrically powered GSE

1. Batteries need to be kept in dry, cool, frost free conditions – extremes of heat and cold are not good for batteries.
2. Where possible / available, follow the guidance of the battery manufacturer regarding storage.
3. For lithium battery powered units:
 - a. The lithium battery should be kept with a reasonable charge.
 - b. Where possible leave it plugged in.
 - c. Where not possible, turn off the master disconnect on the equipment.
 - d. If the lithium battery is provided with a power switch, that should be switched to the OFF-position to prevent discharge from the battery's electronics.
4. For lead acid battery powered units:
 - a. Disconnect from the charger system unless advised otherwise.
 - b. Turn off the master disconnect on the equipment.
 - c. Chargers shouldn't need any attention but if not in use, should be shut off at main disconnect.

5. General

Follow your storage plan.

Example 1: If rotating the fleet, swap a parked serviceable GSE with another serviceable one in operation. Do this in an organized way according to the plan. This way you can distribute the utilisation evenly within your fleet.

Example 2: If “exercising” the fleet, start equipment periodically (once a week if possible), and, taking precautions, move it around to prevent flat spots developing on tyres, (this also applies for vehicles with solid tyres). Use the hydraulic and brake systems to circulate fluids and keep seals flexible.

1. Fix units when they breakdown whenever possible. Try to avoid swapping a defective unit with a parked but serviceable one as this leads to situations where you may end up with only unserviceable units and it becomes difficult to identify which unit had what issue.
2. Avoid cannibalisation of parts as much as possible. MULAG has a 24h delivery for most spare parts within Europe. Check your stock for spare parts. Cannibalising leads to uncontrolled repair activity and duplication of effort / labour.
3. If local circumstances permit, consider using the situation to catch up on maintenance and repairs.
4. If possible, check all stored units weekly for overall state of readiness.
 - a. Monitor for leaks, flat tires, nesting birds, mice, rats and other infestations such as ants, bees, wasps etc.
 - b. Check that all drain holes are clear to prevent build-up of pools of water and accumulation of rotting vegetation leading to rust and mould.
5. If not already done as part of the preparation phase, develop a return to service plan based on the storage plan. Ensure that a sufficient stock of fluids, filters and other spare parts is on hand at the commencement of return to service so the process can run smoothly and does not cause service delays.

6. Lithium Batteries

1. Depending on the condition of the batteries and the initial charge level, these batteries could be good for up to 6 months without charging, after that period of time they should be checked for charge levels.

7. Lead-Acid Batteries

1. Check water levels and freshen the charge of the batteries at least every 3 months, if possible more frequently.
2. Check lead-acid batteries for build-up of corrosive powders at terminals and around the battery cells, clean them if necessary.

III. Return to Service

1. General

The actions necessary to return GSE to full-time service depends on what storage preparations were done, how long the unit was stored and if it was rotated or “exercised” during the storage period. A well developed return to service plan backed by an adequate stock of fluids, filters and spare parts will ease this process.

1. Walk around the equipment, check for nests, blocked intake and exhaust pipes, flat tires, chewed wires, hoses, fuel lines, evidence of leaks and any other obvious signs that the equipment is not ready for use.
2. As a minimum, perform a full safety and functional checklist prior to starting and moving the equipment to ensure it is safe to use. Where available and the storage period was long enough to trigger it, utilize the Equipment Pre-operational Checklist.
3. Ensure battery terminals are correctly connected in terms of polarity.
4. Before starting / moving the equipment, check tyre pressures and all fluid levels.
5. Clean off any sliding surfaces such as rams etc. that have been coated with preservatives.
6. Before starting the vehicle close the spring-loaded brake system according to operating instructions.
7. Once the unit is started, allow the brake system to build up operating pressure.
8. Move off very slowly and apply brakes within a meter or so to ensure the brakes are working.
9. During a short drive, check for unusual noises, unusual smells (e.g. burning), pulling to one side during pull off / driving / braking, erratic power delivery, amongst others. Stop and check for any leaks, smoke etc.
10. For GSE fitted with any proximity sensing and warning systems, check that these are operating correctly before servicing an aircraft.