

DEP SPECIFICATION

**PRESERVATION OF NEW AND OLD EQUIPMENT
STANDING IDLE**

DEP 70.10.70.11-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies technical requirements and recommendations for preservation of both new and old equipment. The following equipment categories are covered:

- static equipment and piping;
- rotating equipment;
- mixing and extruding equipment;
- civil engineering items;
- instrumentation equipment; and
- electrical equipment.

The preservation of transmission pipelines is excluded from the scope of this DEP.

This is a revision of the DEP of the same number dated February 2011; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Preservation procedures recommended for general guidance have been developed for what are considered to be the three principal requirements, which are defined as follows:

Term	Definition
Active	status of equipment and piping when it is operating on either continuous or intermittent basis and is needed for operations to maintain unit production
Idled	status of equipment and piping when it is to be isolated and decommissioned from the process for more than six months, but to be preserved for future use.
Long-term preservation	for a plant which is to be shut down for recommissioning 1 year or more in the future (2 years or more for civil engineering items).
Old	status of equipment and piping that has been and will remain in service.
Oxygen service	A service containing at least 23.5 vol% oxygen with the balance being inert
Retired	status of equipment and piping when it is to be shut down with no plans for future use.
Short-term preservation	for a plant which is to be shut down for two months or more, and recommissioned within 1 year (2 years for civil engineering items).
Temporary preservation	for a plant operating on a cyclic programme, i.e. where the period of idleness between operating periods may be about 2 months (1 year for civil engineering items).

1.3.3 Abbreviations

Term	Definition
CS	Carbon Steel
MIC	Microbiologically Induced Corrosion
MOC	Management of Change
OCTG	Oil Country Tubular Goods
PTA SCC	Polythionic Acid Stress Corrosion Cracking
SS	Stainless Steel
VPI	Vapour Phase Inhibitor
VSI	Vapour Space Inhibitor

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (8).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2011. The following are the main, non-editorial changes.

Section/Clause	Change
Entire DEP	Restructured and clarified requirements, enforced use of shall / should / may for normative statements.
Appendices 2 through 7	Removed from DEP Specification

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://sww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL

2.1 IDLE PERIOD

The length of the idle period affects every aspect of planning and costs because the longer the equipment will be idle, the more protection is required. An inaccurate prediction of idle time will affect the cost of maintaining the equipment and the ability to restart in the future.

Preservation programs are divided into three categories:

- *Temporary preservation;*
- *Short-term preservation;*
- *Long-term preservation.*

2.2 SAFETY AND SECURITY

1. The normal operating work permit system (e.g., for welding and other hot work) should apply to plant standing idle.

Once the preservation procedure is completed, the Principal is responsible for ensuring that the plant is completely safe and secure during the idle period

2. Control rooms, switch houses and analyser houses should be locked up to ensure that there is no unauthorized use of the building or contents unless required to be used for other operating units.
3. Fire-fighting equipment shall be available for plant standing idle.
 - a. All reasonable precautions should be taken to ensure that a fire hazard can be contained and that the fire-fighting services are adequate for such purpose.
4. Provision should be made for tagging all equipment after preservation, and for fixing the tags in a prominent position.
5. A schedule shall be prepared listing the safety and security checks.
6. A schedule shall be carried out at intervals throughout the period the plant is standing idle. See (7)
 - a. The condition of the rust preventives shall be checked at specified intervals.
7. If an item standing idle and unprotected would become unsafe, and repairs cannot be justified on economic grounds, measures shall be taken to prevent access to the equipment.

2.3 DECISION ON THE EXTENT OF PRESERVATION

1. Preservation should be adequate for the purpose intended and at the same time it is equally necessary to ensure that it is justified economically.

The extent of preservation is primarily a function of the time for which a plant is to be standing idle, there are other factors which have to be considered simultaneously and it is recommended that this is best achieved through inter-functional discussions at local management level.

Preservation will not be required where:

- *the item will remain in a safe and satisfactory condition in the local environment without internal and external protection;*
- *the cost of preserving the item exceeds, 25% of its estimated replacement value at some forward point in time.*

This is approximately equivalent to 15 years' maintenance costs. This applies typically for:

- o *Small bore piping that is DN 50 (2 in) and less;*
- o *Small pumps, blowers and fans than can be replaced readily;*
- o *Small motors – experience suggested that it is uneconomical to protect motors of less than 10 kW;*
- o *Small waste treatment tanks which can be replaced quickly and inexpensively;*
- o *Inexpensive instrumentation such as small pressure gages, level gages, small control valves.*

Many preservation procedures require some services or attention during the period of idleness, and provision needs to be made for these on-going requirements. These may include engineering, maintenance and inspection, operational shift responsibilities, provision for lighting and minor power requirements, instrument air and some utilities. See (7).

2. A preservation procedure should be drawn up for each individual item of equipment, or group of similar items, based on the recommended preservation procedures for special materials in (6), and on the preservation procedures recommended for specific items in (3 & 4).

It is a matter for local judgement as to how much detail is recorded, bearing in mind the problems of recommissioning.

3. Since a wide variety of equipment is involved, some form of tabulation should be done, listing each individual item, its duty, the identity of the preservation procedure and any on-going requirements linked to it.

Such tabulation is also a useful means of showing the costs involved. A suggested format is given in (Appendix 1).

4. The preservation required for the exterior of an equipment shall be determined by the information recorded in the inspection post shutdown report, and by the corrosiveness of the local environment.
 - a. Recommendations for the external insulation are given in (3) and (4).

3. PRESERVATION PROCEDURE FOR NEW EQUIPMENT

3.1 GENERAL

1. Since the equipment has not been taken in operation, draining and cleaning to remove operational deposits is normally not required.
2. Small items, components, sub-assemblies, instruments and high-value equipment should be stored in a warehouse and special provision may have to be made for this, including air conditioning.
3. If not installed, large items such as ducting may be stored in the open, on wooden sleepers, providing there is good drainage and the protection will withstand mechanical damage.
4. Ingress of water into refractory lined equipment, including stacks, shall be prevented.
5. Every item should be prominently and effectively tagged.
 - a. Alternatively, items may be identified by marking with paint, stencilled or stamped.
6. If tags are used, then each tag shall show the order number and cross reference the Suppliers drawings approved for construction.

3.2 NEW STATIC EQUIPMENT AND PIPING

3.2.1 General requirements

1. Equipment should be stored in a safe place so that it will not be damaged or misused during idle period and if possible, stored in a fenced warehouse area.

Further measures other than the ones described in (3.2) might be necessary depending on local climate conditions (e.g., in areas with high humidity, in coastal areas containing a lot of salt in the air, desert area, where sand or dust may occur, arctic areas where the equipment might be affected by very low temperatures and snow).

It is important that these conditions and the effect they can have on various types of equipment are analysed before determining which preservation procedures and methods of protection will be applied.

2. Refer to DEP 30.48.00.31-Gen. for the requirements for painting or coating new equipment.
3. Any coating damages shall be repaired.

3.2.2 Pressure vessels

3.2.2.1 Temporary preservation

1. If vessels are not shipped with inert gas purge, the vessels should be opened and its internal visually inspected for ingress of water and condition of preservative.
2. Preservative shall be renewed if necessary and flange covers reinstalled.
3. Vessels shall be thoroughly dried, with the required preservation applied and then sealed using metal flange covers and rubber gaskets on all flanges.
4. Temporary preservation should be done by using desiccants, VPI powder, or by spraying the internal surface with corrosion preventive fluids, e.g., Shell ENSIS OIL grade N (depending on what is more economical).
5. Oil, grease and organic materials shall not be used for pressure vessels in oxygen service.
6. If vessels are shipped with inert purge, then pressure shall be checked and maintained per preservation procedure.

7. Visible weep holes in reinforcing pads and corrosion plates shall be packed with grease.
8. Machined surfaces, like flange faces other than those furnished with permanent blinds, and other finished or delicate parts shall be well-greased and protected against rusting and damage.
9. Bolts and nuts shall be coated with a suitable thread lubricant to prevent galling or corrosion.
 - a. The lubricant shall be removable with mineral spirits or a solvent.
 - b. Copper or molybdenum disulfide containing thread lubricants shall not be used.
10. Stainless steel equipment (SS exterior surface) shall be stored separately from CS equipment to prevent getting into contact with CS, CS scales or rust. See (6).
11. Service gaskets and spare parts shall be packaged separately and stored in warehouse.
 - a. All packages shall be separately identified by package number with the vessel tag number clearly indicated.

3.2.2.2 Short/long term preservation

1. With the following exception, the same actions as for temporary preservation (3.2.2.1) shall be taken for short and long term preservation:
 - a. For short and/or long term preservation vessels shall be purged and filled with a dry inert gas such as nitrogen at a pressure of not less than 35kPa (5psi).
2. Pressure gage should be installed at the pressure vessel in order to check the pressure during idle period.
3. Air reservoirs and pulsation dampeners shall be protected from internal corrosion damage by suspending bags of vapor phase inhibitor (e.g., Shell VPI 260), in the vessel before it is sealed.
 - a. Warning labels shall be attached externally and the quantity of inhibitor bags noted.
4. For vessel with an internal corrosion resistant cladding (e.g., SS, Nickel-alloys, plastic and rubber or glass-lined equipment) no further measures are required other than as for temporary preservation.

3.2.3 Furnace and Boilers

3.2.3.1 Temporary preservation

1. Tubes and headers shall be purged and filled with dry inert gas such as nitrogen at a pressure of not less than 35kPa (5psi).
2. A pressure gage should be installed in order to check the pressure during idle period.
3. The refractory should be protected against water ingress.
4. In order to avoid condensation at the flue gas side and fire box, the flue gas side should be well ventilated by leaving open access doors and dampers; the stack draft should also be utilized if possible

3.2.3.2 Short/long term preservation

1. In addition to temporary preservation (3.2.3.1) the burners should be removed and stored in the warehouse.

3.2.3.3 External protection

1. For periods of up to 5 years, external insulation should be left in place and inspected and repaired where necessary to prevent the ingress of water.
2. Where the lay-up period is for 5 years or more, insulation should be removed and a complete paint system should be applied in accordance with DEP 30.48.00.31-Gen.

3.2.4 Shell-and-tube heat exchangers and air –cooled heat exchangers

3.2.4.1 Temporary preservation

1. If exchangers are not shipped with inert gas purge, the exchangers should be opened and its internal visually inspected for ingress of water and condition of preservative.
2. Preservative shall be renewed if necessary and flange covers reinstalled.
3. Exchangers shall be thoroughly dried, required preservation applied and sealed using metal flange covers and rubber gaskets on all flanges.
4. Temporary preservation should be done by spraying the internal surface with ENSIS OIL grade N or blowing VPI powder into the tubes and hanging small bags of the powder strategically in the channel (depending on what is more economical).
5. The exchanger shall be properly closed at tube and shell side to prevent entry of water and other foreign material.
6. Before spraying and/or flushing with ENSIS Oil grade N all internal parts should be sprayed and /or flushed with de-watering fluid e.g., SHELL ENSIS Fluid grade C.
7. One end of the exchanger needs to be tilted up greater than 10 degrees and held to ensure water is completely drained from all the tubes.
8. If exchangers are shipped with inert purge, then pressure shall be checked and maintained per preservation procedure.
9. Visible weep holes in reinforcing pads, corrosion plates, etc., shall be packed with grease.
10. Machined surfaces, like flange faces other than those furnished with permanent blinds, and other finished or delicate parts shall be well-greased and protected against rusting and damage
11. Bolts and nuts shall be coated with a suitable thread lubricant to prevent galling or corrosion.
 - a. The lubricant shall be removable with mineral spirits or a solvent.
 - b. Copper or molybdenum disulfide containing thread lubricants shall not be used.
12. Chloride protection shall be provided for external stainless steel surface.
13. Service gaskets and spare parts shall be packaged separately and stored in warehouse.
14. All packages shall be separately identified by package number with the vessel tag number clearly indicated.

3.2.4.2 Short/long term preservation

1. With the following exception, the same actions as for temporary preservation (3.2.4.1) shall be taken for short and long term preservation:
 - a. For short and/or long term preservation vessels shall be purged and filled with a dry inert gas such as nitrogen at a pressure of not less than 35kPa (5psi).
2. Pressure gages (shell and tube side) should be installed at the heat exchanger in order to check the pressure during idle period.

3. For heat exchangers not made of carbon steel (bundle and internal cladding of shell and channel) no further measures are required other than for temporary preservation (3.2.4, Item 1).
4. The bundle of air-coolers shall be completely covered to prevent debris settling within fins and to avoid any circulation of humid air through the bundle which could cause corrosion of the bonds between fins and tubes.

3.2.5 Piping and fittings

3.2.5.1 Temporary preservation

1. Installed piping should be cleaned, dried and sealed.
2. Fittings and flanges shall be stored in shelter / warehouse so as to minimize ingress of rainwater and other foreign matter.
3. New piping and fittings (as delivered from vendor) shall be stored appropriately to prevent corrosion.

If these items are in protective coverings (as delivered from vendor) then no further preservation is required.

3.2.5.2 Short/long term preservation

1. For installed piping constructed of material other than carbon steel or clad with corrosion resistant material no further measures are required than for temporary preservation.
2. Carbon steel lines larger than DN 50 (2 in) should be filled with dry air, and then sealed up.
3. For oxygen and chlorine lines, filling with dry inert gas should be done in order to ensure that no solid particles or traces of oil can get into the air or inert gas.
4. Where considered justified, the smaller carbon steel lines may be similarly preserved.
5. Underground lines shall be purged and filled with dry inert gas such as nitrogen at a pressure of not less than 35kPa (5psi) at the shell and tube side.
 - a. Pressure gauges should be installed in order to check the pressure during idle period.
6. Metallic underground piping shall be protected by cathodic protection.
7. Fittings and flanges shall be spray coated over the entire body using SHELL Ensis Fluid.
 - a. Fittings and flanges of less than DN 200 (8 in) shall be stored in shelter / warehouse so as to minimize ingress of rainwater and other foreign matter.
8. Fittings DN200 and larger may be stored outside for up to 6 months in their delivery crate or a suitable crate supplied at the storage site.
9. The crates used for fittings that are DN200 or larger shall be lined with bituminous heavy gauge brown paper.
 - a. The crates shall be clearly marked with their contents and be raised at least 0.5m (19 in) clear of the ground on timber or other suitable material to avoid immersion in mud and water.
 - b. A tarpaulin or similar waterproof covering shall be placed over the crates and be securely fastened down.
 - c. Ventilation shall be permitted at the base and between the crates.
10. The contents of the crates shall be inspected periodically to check the protective coverings and for any ingress of water.

11. Pipes stored outside warehouse or shelter (as delivered from vendor) shall be stored on a slope to promote drainage.
 - a. Stored pipe and fittings shall be aligned so that the prevailing winds will blow through the equipment to dry it.

3.2.6 Other static pressure vessel equipment

1. New static pressure vessel equipment other than those specified in (3.2.2) through (3.2.5), such as the following, shall be preserved as specified for old equipment (4.2.7) through (4.2.12):
 - a. valves and attachments;
 - b. stuffing box packings;
 - c. relief valves;
 - d. flare and flare lines.
2. The equipment in (3.2.6, Item 1) should be stored in sheltered locations (indoors) e.g., warehouse.
3. New gaskets, bolts and nuts shall be stored in sheltered locations e.g., warehouse (indoors) above dew-point temperature.
 - a. If these items are in proper original wrapped up condition (as delivered from the vendor) no further preservation is required.
 - b. Only large or special bolts and nuts (which are very expensive or have long delivery time) should be coated with SHELL ENSIS Oil H, SHELL Engine Oil R30 or similar SHELL approved oil.

3.3 NEW ROTATING EQUIPMENT

1. New rotating equipment shall be preserved as specified for old equipment (see section 4.3); though cleaning to remove operational deposits and encrustation will not be required.

3.4 NEW MIXING AND EXTRUDING EQUIPMENT

1. New mixing and extruding equipment shall be preserved as specified for old equipment (see section 4.4); though cleaning to remove operational deposits and encrustation will not be required.

3.5 NEW CIVIL ENGINEERING ITEMS

1. New installed civil engineering items shall be preserved as specified for old civil engineering items (4.5), though cleaning to remove operational deposits and encrustation will not be required.

3.5.1 General structural steel goods.

1. Steel Plates shall be stacked vertically with plastic or treated wood spacers to avoid damage to protective coatings.
2. The bottom rows of tubular, I-beams etc. shall be laid on wooden lined steel racks with a minimum ground clearance of 0.5m (19 in) to avoid contact with water, mud, or sand, in order to prevent corrosion.
3. Separate each item and each row by using preservative treated rope/treated wood spacers to prevent metal-to-metal contact, the build up of water/debris and also to allow a passage of air for circulation.
4. Where possible, materials should be stored under shelter.
5. Goods shall be arranged and stored according to their size, grade, type with the preservation date and heat number clearly stencilled in a visible location.
6. Rotation of stock materials shall follow a "First-in First-out" system.

3.6 NEW INSTRUMENTATION EQUIPMENT

1. New instrumentation equipment shall be preserved as specified for old equipment (see section 4.6); though cleaning to remove operational deposits and encrustation will not be required.

3.7 NEW ELECTRICAL EQUIPMENT

1. New electrical equipment shall be preserved as specified for old equipment (see section 4.7); though cleaning to remove operational deposits and encrustation will not be required.

4. PRESERVATION PROCEDURES FOR OLD EQUIPMENT

4.1 GENERAL

1. Specialist advice shall be sought from the Principal on the preservation of items not specifically covered in (4).
2. For static equipment, piping and civil items it is recognized that the requirements for short-term preservation can be, in many cases, the same as would be needed for long-term preservation; therefore the requirements for short-term and long term are combined under the single heading of 'short/long-term preservation'.
 - a. In the respective sub-sections the purpose of temporary preservation remains as defined in (1.3.2).
3. For rotating equipment, plant-mounted instruments and electrical equipment, recommendations are given for temporary, short-term and long-term preservation as defined in (1.3.2).
4. Winterization or electrical trace heating shall be done whenever equipment and piping are preserved by filling with water.
5. All idle and retired pressure vessel equipment including piping and tanks, spheres and boilers shall be isolated / separated from remaining active process.
 - a. If the equipment remains in the process unit it should not be connected to any piping or valves that would allow it to be accidentally placed back in service, without following the appropriate MOC procedures or re-inspection.