

DEP SPECIFICATION

CLOSED CIRCUIT COOLING SYSTEMS

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of closed circuit cooling systems for heat rejection of process, utilities, and equipment. Domestic consumers that are inside the battery limit and that are combined with process or utility systems can also be served by plant cooling systems.

This DEP applies to closed circuit cooling systems with the circulating cooling fluid operating in the liquid phase only.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2014; 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 authorisation 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 shall 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 capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

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

1.3.2 Specific definitions

Term	Definition
black start	The operating mode bringing a facility from non-energised situation and disconnected from outside power supply into operation.
domestic consumer	A consumer inside the process plant battery limit connected to the closed circuit cooling system but serving a non-process duty e.g. the condenser of a vapour-compression system used in a heating and ventilation system.

1.3.3 Abbreviations

Term	Definition
MSD	Material Selection Diagram; a diagram based on the PFS indicating the materials of construction of all piping and equipment in the system.
N	The capital N indicates the number of operating units
N+1	This indicates that N+1 units are installed and that one (1) unit can be shut-down while the design process duty is fulfilled by the remaining N operating units.
PEFS	Process Engineering Flow Scheme
PFS	Process Flow Scheme
PS	Process Safety
PSFS	Process Safeguarding Flow Scheme
TC	Total Carbon
TOC	Total Organic Carbon

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (3).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a minor revision of the DEP of the same number dated February 2014. The following are the main, non-editorial changes.

Section/Clause	Change
ALL	Restructured and clarified requirements, enforced shall/should.
2.2 (1)	SHALL [PS] simplified.

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://swwww.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. REQUIREMENTS FOR CLOSED CIRCUIT COOLING SYSTEMS

2.1 BACKGROUND

Closed circuit cooling systems are applied as an intermediate system to reject surplus heat from consumers to the environment where direct cooling is not feasible or not recommended. These systems can serve a single consumer, such as lubricating oil coolers of rotating equipment, or a group of consumers such as a process unit. The circulating cooling fluid is in turn cooled with air, water, or a refrigeration system.

Closed circuit cooling systems are also applied for vital rotating equipment such as electric power generators and instrument air compressors.

An unreliable cooling system can result in forced plant outages.

2.2 GENERAL

1. In case of multiple consumers, the process consumers in all flammable hydrocarbon and very-toxic service SHALL [PS] be served by a dedicated closed circuit cooling system.
This is to segregate the cooling water system for flammable and very toxic service from other users.
Refer to DEP 01.00.01.30-Gen. for definition of very-toxic.
2. The closed circuit cooling system for the process consumers in all flammable hydrocarbon and very-toxic service shall be located in the same area as the consumers.
Refer to DEP 80.00.10.10-Gen. for area classification.
3. In situations where the requirement (2.2, item 2) is not feasible (due to site constraint) and some or all of the cooling system's equipment serving consumers in flammable hydrocarbon and very-toxic service reside in a non hazardous area, protection by detecting migration of hazardous substance to the non hazardous area shall be provided and detection upon release to be implemented.
Refer to DEP 32.30.20.11-Gen. for gas detection systems.
4. The Principal will specify the final cooling medium (air, water, refrigerant) to be applied to cool the circulating cooling fluid in the project specification.
5. The Principal will specify the circulating cooling fluid in the project specification.
This can be conditioned low conductivity water, water from a public utility, or another fluid such as a glycol/water mixture.
6. The design shall ensure supply of the cooling duties of all consumers in a safe, stable, and reliable manner.
7. The CONTRACTOR shall make estimates of cooling requirements in early project phases and verify these estimates when final cooling data becomes available.
Cooling requirements for rotating equipment and other consumers may become known only in a later project phase after such equipment is purchased.
8. The Principal will specify the number of separate cooling circuits or to what extent consumers could be grouped in the project specification.
9. The Design shall ensure uninterrupted supply of cooling fluid if required whilst maintenance is performed on cooling circuit components.
Such design measures are spare equipment (2.5) and (2.6) or additional valves.