



Document No.	GP 60-10
Applicability	Group
Date	16 December 2005

Guidance on Practice for Cooling Water Systems and Treatment

GP 60-10

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 60-10. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

BP

RP 60-1	Cooling Water Treatment
RP 6-1	Corrosion Monitoring
GS 126-1	Shell and Tube Exchangers
GS 140-2	Chemical Dosing Package

Amoco

A A FE-CTWR-00-E	Fabricated Equipment-Cooling Towers-Engineering Specification
A FE-CTWR-00-G	Fabricated Equipment-Cooling Towers-Guide
A PN-PLT-UTIL-G	Piping Plant Utility Guide
RE-PUMP-73H-P	Rotating Equipment-Pumps-ASME B73.1 Horizontal Centrifugal Procurement Specification
A RE-PUMP-73V-P	Rotating Equipment-Pumps-ASME B73.2 Vertical Centrifugal Procurement Specification

Copyright © 2005, BP Group. All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organization. None of the information contained in this document shall be disclosed outside the recipient's own organization without the prior written permission of Director of Engineering, BP Group, unless the terms of such agreement or contract expressly allow.



Table of Contents

	Page
Foreword	2
1. Scope.....	4
2. Normative references	4
3. Symbols and abbreviations	4
4. Cooling water systems	5
4.1. Safety awareness	5
4.2. Process and mechanical design considerations.....	5
4.3. Treatment	7
5. Types of cooling water systems.....	8
5.1. General.....	8
5.2. Once-through systems.....	8
5.3. Recirculating systems.....	9
6. Dosing facilities (all systems)	12
7. Pre-service cleaning.....	12
7.1. Flushing.....	12
7.2. Chemical Cleaning and Passivation.....	12
7.3. In-Service Passivation and Cleaning.....	12
8. Chemical additive suppliers.....	12
9. Contamination of cooling systems.....	12

List of Tables

Table 1 - Cooling water monitoring schedule	12
Table 2 - Guidelines for assessing corrosion.....	12

List of Figures

Figure 1 - Cooling system types.....	12
Figure 2 - Withdrawable type corrosion tester	12
Figure 3 - ASTM (D2688) pattern corrosion coupon holder	12



1. Scope

This GP document provides a guide to cooling water systems and the treatment of cooling water to render it suitable for use in once-through and recirculating cooling systems. This includes guidance on the general basis for design and on the quality control of the operating system.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP Engineering Technical Practices (ETP)

GIS 26-101	Shell and Tube Heat Exchanger
GP 42-20	Piping Component Specification Application
GIS 60-501	Chemical Dosing Package

HSE Guidance Note (UK)

HS (G) 70:	The Control of Legionellosis Including Legionnaire's Disease
------------	--

Health and Safety Commission Approved Code of Practice (UK)

The Prevention or Control of Legionellosis (including Legionnaire's disease)

American Petroleum Institute (API)

API 570	Piping Inspection Code Inspection, Repair, Alteration, and Rerating of In-Service Piping Systems
API E5	Environmental Guidance Document: Waste Management in Exploration and Production Operations

International Organization for Standardization (ISO)

ISO 16784-2	Industrial Cooling Water Systems-Testing and Performance - Part2: Evaluation of the Performance of Cooling Water Treatment Programmes
-------------	---

National Association of Corrosion Engineers (NACE)

NACE 25001	Cooling Water Treatment Manual, TPC 1
------------	---------------------------------------

3. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

ASTM	American Society for the Testing of Materials
pH	A scale indicating the acidity of a solution



4. Cooling water systems

4.1. Safety awareness

- a. Material Safety Data Sheets (MSDS) for cooling water treatment chemicals shall comply with all relevant regulations where the equipment will be located. If any chemical is exempt from regulations, a statement to that effect shall be included on the MSDS.
- b. Chemicals shall be stored, handled, utilised, and disposed of in accordance with the recommendations of the manufacturer and local regulations.
- c. All personnel at the work sites shall be informed of the hazards and chemical handlers provided with training and protective clothing.
- d. For systems associated with air conditioning, treatment shall be designed to prevent development of organisms which, apart from causing fouling, are a risk to health.

Generally a system effectively treated with biocide to prevent physical fouling is a 'safe' system.

- e. Cooling systems, in particular closed loop systems associated with air conditioning, shall be designed to minimise the likelihood of legionellosis development. The specific advice of the Health and Safety Executive booklet HS (G)70 and the Health and Safety Commission's approved code of practice shall be considered.

The use of liquid chlorine is common practice particularly on large systems. Potential hazards and concerns during transport, storage and coupling operations such as handling, secure storage, potential risk, addition to site emergency plans and training of staff must be considered when selecting equipment. Electrolytic generation of chlorine from sea water or prepared brines will offer a potentially safer alternative but capital costs are generally higher.

- f. Safety showers of an approved pattern with eyewash facilities shall be readily accessible from, or specifically provided at, each chemical dosing preparation area.
- g. Where chlorine is dosed from a liquid gas unit, additional strict safety procedures shall be established. Automatic leak detectors and alarms shall be provided where there is a risk of leakage of chlorine gas, e.g., storage room and/or gas supply pipework to chlorinator. Emergency self-contained breathing apparatus shall be readily available.

Note: Many dosing chemicals used are toxic. The effect of residual amounts of these materials in the cooling water, when discharged into receiving water systems, shall be fully considered. Also, local or national environmental legislation may prevent the use of otherwise appropriate materials. Many of the dosing chemicals contain components which may significantly affect site effluent discharge permits if spills occur. Adequate facilities for containment of spills shall be provided.

4.2. Process and mechanical design considerations

4.2.1. Water supply

- a. When necessary for a project, the quality of untreated water, its availability and supply conditions must first be established.

Normally, BP will advise a vendor of the above.

- b. Cooling water systems shall always be segregated from potable water systems as the possibility of back flow exists. The cooling water make-up supply should have a separate connection to the supply source.



4.2.2. Heat exchangers

- a. As a general principle, cooling water treatment should be provided to permit the use of carbon steel heat transfer surfaces where process conditions allow. There is a need to consider alternative materials for where the water is corrosive and where small bore tubing is in use. A minimum uninterruptible cycle of several years should be guaranteed. Such use should allow capital cost reduction.
- b. Ensure API 570 is referenced regarding piping inspection, repair, alteration and rerating of in-service piping systems.

General requirements for pipework can be found in BP Group GP 42-20 of which the piping specifications cover a large proportion of the services within the BP Group requiring various materials.

- c. To reduce the potential for water side fouling, cooling water should in general be on the tube-side of heat exchangers.
- d. To maintain heat exchangers and distribution system surfaces in a clean and uncorroded condition, cooling water treatment facilities should be provided to render the cooling water:
 1. Non scale-forming.
 2. Non-fouling.
 3. Non-corrosive. (See Table 2)
 4. Hostile to promotion of biological growth.
 5. Such provision will minimise the pumping system power requirements and reduce stoppages for cleaning, maintenance and replacement operations.
- e. When abundant water supplies are available, such as offshore or near shore, using corrosion resistant metals in the heat exchangers such as copper alloys, stainless steel or titanium and once through cooling water may prove to be the most cost effective solution in the long term.

4.2.3. Piping

- a. Cooling water piping shall be designed in accordance with GP 42-10 and ASME B 31.3.

Cooling water piping is often designed for 125% of normal flow to accommodate variations in cooling water system, if variations are defined, a lower design flow rate may be considered.

- b. In sub freezing climates, dead ends shall be piped and valved to ensure constant flow to prevent freezing.
- c.

4.2.4. Cathodic protection

- a. When corrosion inhibitors are not used, e.g., in large systems, cathodic protection should be considered for appropriate locations in the cooling system.
- b. For shell and tube heat exchangers, application shall comply with BP Group GIS 26-101.

4.2.5. Corrosion monitoring provisions

- a. Provision shall be made for on-line insertion and removal of specimen material corrosion coupons. These shall be located in the outlet pipework of the hottest heat exchanger unit or system. The insertion point shall be such that electronic corrosion probes can be substituted for specimen coupons if necessary. (See arrangement detail Figure 2).

