



Document No.	GP 60-11
Applicability	Group
Date	16 December 2005

Guidance on Practice for Potable Water

GP 60-11

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GIS 60-111. This Guidance on Industry Standard (GIS) is based on the following heritage documents from merged BP companies:

BP

RP 60-5 Potable Water Systems

BP Gulf of Mexico Deep Water Development Program (GOMDW)

1400-20-ME-SP-3072 Reverse Osmosis Water maker
1400-0-ME-RP-2021 Water maker Systems Evaluation

Uncontrolled Copy

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	5
2. Normative references.....	5
3. Symbols and abbreviations.....	6
4. Water quality.....	6
4.1. Human Consumption	6
4.2. General industrial use.....	6
4.3. Special use	7
5. Consumers	7
5.1. Personnel	7
5.2. Safety applications.....	7
5.3. Process and general industrial use	7
6. Sources of supply	7
6.1. Onshore.....	7
6.2. Offshore or remote location.....	8
7. Descriptions of water maker systems.....	9
8. Potable water maker packages.....	11
8.1. Reverse osmosis (R.O.).....	11
8.2. Vapor compression.....	11
8.3. Waste heat systems.....	11
9. Performance	11
10. Storage facilities	12
10.1. Onshore.....	12
10.2. Offshore.....	12
10.3. Tank arrangement	12
11. Treatment	13
11.1. Re-hardening.....	13
11.2. Sterilisation	13
11.3. HVAC humidifiers	15
12. Operation.....	15
12.1. Procedures	15
12.2. Production from sea-water	15
12.3. Monitoring.....	15
12.4. Testing.....	15
12.5. Treatment	15
12.6. Cleansing and sterilising	15
12.7. Maintenance	15



12.8. Records	15
A.1. Sources of Supply.....	15

List of Tables

Table 1 - Comparison of US primary regulations with Canadian, EEC, and WHO guidelines.....	15
Table 2 - Comparison of US secondary regulation with Canadian, EEC, and WHO guidelines	15
Table 3 - Comparative data for "large scale" water maker packages	15
Table 4 - Comparative data for "small scale" water maker packages	15

List of Figures

Figure 1 - Reverse osmosis package.....	15
Figure 2 – Vapor compression package.....	15
Figure 3 – Multi-stage flash waste heat package	15
Figure 4 – Thermo compression waste heat package	15
Figure 5 – Plate exchange waste heat package.....	15
Figure 6 – Rising film waste heat package.....	15



1. Scope

This GP provides guidance regarding health, safety and environmental legislation, good design practice, and technical and economic considerations for potable water maker packages. The design information included in this specification is not intended to cover complete details. The guideline outlines regulations, design considerations, and recommends a configuration which can be scaled to adapt to the specific facilities which can differ due to layouts and production capacity

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.

American Bureau of Shipping (ABS)

Publication 63	Guide for Building and Classing Facilities on Offshore Installations
----------------	--

American Petroleum Institute (API)

RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
--------	---

American Society of Mechanical Engineers (ASME)

ASME B16.5	Pipe Flanges and Flanged Fittings
ASME Sect. VIII Div. 1	Rules for Construction of Pressure Vessels
ASME Sect. IX	Welding and Brazing Qualification

American Welding Society

AWS D1.1	Structural Welding Code
----------	-------------------------

British Standards

BS 6700	Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their surroundings.
BS MA 18	Specification for salt water piping systems in ships.

HSE

HSE HS(G)70	The control of legionellosis including Legionnaires Disease.
-------------	--

International Code Council (ICC)

IPC, Chapter 6	International Plumbing Code - Water Supply and Distribution
----------------	---

International Organization for Standardization (ISO)

ISO 3114	Unplasticized Polyvinyl Chloride (PVC) Pipes for Potable Water Supply – Extractability of Lead and Tin – Test Method First Edition
ISO 4064	Measurement of Water Flow in Closed Conduits - Meters for Cold Potable Water - Part 1: Specifications Second Edition



National Fire Protection Association (NFPA)

NFPA 70

National Electrical Code

World Health Organization

WHO

Guidelines for drinking water quality. ISBN 9241541687.

3. Symbols and abbreviations

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

GOM	Gulf of Mexico
R.O.	Reverse Osmosis
UPVC	Unplasticised Polyvinyl Chloride
UV	Ultra Violet

4. Water quality**4.1. Human Consumption**

- a. The water provided for human consumption shall comply with the regulations in force in the host country.

Examples of different countries' regulations are:

- *USA - Safe Drinking Water Act*
- *EEC - EEC Directive (standards for water intended for human consumption)*
- *Norway - National Institute of Public Health*

- b. Tables 1 and 2 detail the requirements of several major potable water regulatory authorities.
- c. The applicable national requirements shall always be met, however, in the absence of a national regulation, or where the regulations are not as stringent as the WHO Guidelines then the WHO Guidelines shall apply.

4.2. General industrial use

- a. Fresh water for industrial use may be provided for process or non-critical applications.

Typical uses would include wash down of plant, top up of closed loop fresh water cooling systems, fire water systems, chemical dilution, workshop and laboratory use, hydrostatic testing, pipework flushing and so on.

- b. Clearly, there is no accepted quality specification for fresh water industrial use but water approved for human consumption or produced by a desalination process should be acceptable.
- c. However, before a water source is used for a particular application, a compatibility check shall be carried out to ensure there are no trace elements which could adversely affect the system or application in which it is to be used.



4.3. Special use

Water quality requirements for special uses shall be defined by BP for the particular application. Examples would be boiler feedwater, battery top up, gas turbine injection / blade washing, etc. Reference should be made to BP Group RP 56-2 for details applicable to Boiler Installations.

5. Consumers**5.1. Personnel**

The daily utilisation rate for potable water depends on the type and location of the facility - the following figures should be used for guidance.

- a. + Stand-alone installations where the staff live and work at the location, e.g., offshore platform or remote onshore or island sites - 250-300 litres (66-80 gals.) per person/day
- b. + Installations where the staff do not live at the location- 90 litres (25 gals.) per person per day
- c. Normal drinking water intake of potable water for a human being (WHO estimate) – 2 litres (0.5 gal) per person per day
- d. Dwelling houses and flats – 90 litres (25 gals.) per person per day
- e. Hotels – 135 litres (36 gals.) per person per day
- f. Offices with canteens – 45 litres (13 gals.) per person per day
- g. Restaurants, per meal – 7 litres (2 gals.) per person per day

Note: These consumptions include drinking water, cooking, personal hygiene, laundry, etc., as appropriate. Toilet flushing and HVAC demands are excluded from the items marked +.

5.2. Safety applications

Potable quality water should be provided for eyebaths, safety showers, etc. These items should be included when sizing equipment.

These items although not contributing to the overall system water demand could well affect equipment sizing criteria. Safety showers, for example, depending on manufacture, could demand 20-30 m³/h (88-132 gpm).

5.3. Process and general industrial use

- a. The daily use of industrial water will depend on the size and type of the plant being considered and the number and type of process users. Plants with boiler or significant process consumption will have much higher demands and each installation should be assessed individually.
- b. Typically, for a “small” (135 beds, 70,000 bpd) offshore platform in the North Sea, using water for cooling system top up, workshop use, gas turbine blade washing and a small process demand, 1,5 m³/h (6.6 gpm) has been used as a design basis.

6. Sources of supply**6.1. Onshore**

- a. Connection shall be made to the public water supply, providing the following criteria are satisfied:
 - 1. Security of supply.



2. Quality - personnel and process.
3. Cost-effective.
- b. The simplest and most direct way of providing potable water is by means of a connection to the public water supply. The following points should be considered:
- c. The long term security of the supply should be confirmed. Are the required quantities of water always available, or are there likely to be interruptions to the supply, in which case could buffer tanks be used to cater for such contingencies?
- d. Is the quality of the water from the public supply suitable for human consumption, or is further treatment necessary? Is the quality of the water suitable for the process use?
- e. The costs of buying water from the public utility should be compared with on site production; desalination by any process should not be contemplated unless there is a very strong economic case for it.

6.2. Offshore or remote location

- a. Potable water may be supplied by one of the following:
 1. Production from sea-water
 2. Importing
 3. Water wells (boreholes) or
 4. Rivers
- b. Water should always be imported unless an overwhelming technical or economic justification can be produced for onsite desalination.

For normally manned installations the usual supply alternatives are production from sea-water on the platform / site itself, importing of potable water from an approved supply base, or supply from nearby boreholes or rivers.

The choice between the various methods will depend on an overall economic comparison which evaluates Capex and Opex costs over the life of the installation.

When the site is "remote" it may be appropriate to provide an emergency desalination plant, capable of "life support," which could be used in the event that normal supplies are disrupted.

6.2.2. Production from sea-water

- a. The selection of the type of process will depend on the particular arrangement of the host installation and Tables 3 and 4 highlight some of the advantages and disadvantages of each.

See Annex A1.

- b. The sea-water fed to the desalination plant shall be free from contamination - sewage, process fluids, solids, etc., and if it is to be drawn from a line which provides sea-water for other purposes such as plant cooling, then the take off should be upstream of any supplies to process equipment.

On a small offshore platform, discharges from the sewage system, drainage, drilling cuttings, production water, etc., could all cause local contamination, rendering the sea-water close to the intake unsuitable as a feed to the desalination units.

- c. When water is to be processed for drinking purposes, computer modelling should be used to establish a suitable location for the sea water intake, to ensure adequate separation from discharged effluents.



6.2.3. Importing water

- a. Transportation tanks shall be dedicated to carrying potable water and they shall be inspected, cleaned and disinfected on a regular basis.
- b. When receiving water on to the installation it should be “run to dump” until elementary checks - smell, appearance, conductivity and pH show the supply to be acceptable. It should then be directed to an “off line” storage tank with chlorine being injected to give a residual concentration in the tank of 0,2 – 0,5 mg/l after a period of 30 minutes.

6.2.4. Bore holes or rivers

Depending on analysis, further treatment may include filtration or desalination to meet potable water requirements. That treatment will be dependent on the particular characteristics of the source water and advice should be sought from BP Engineering.

Supplies could include local or on-site bore holes or river water each of which may be subject to seasonal variation in quantity and quality.

7. Descriptions of water maker systems

The BP engineer should consider several different technologies for making potable water offshore from seawater; Reverse Osmosis (R.O.), Vapor Compression and Waste Heat.

The RO makes potable water with the latter two above actually providing industrial quality distilled water.

- a. The rising film waste heat package should be acceptable for onshore applications.
- b. All systems will produce potable water, but require further treatments to correct for pH and for taste when used as drinking water.

The respective systems function as follows:

- *R.O. packages use high-pressure seawater fed into special membranes to create fresh water. The packages are marginally the heaviest of the three processes but use less power and minimal utilities. They require periodic cleaning and maintenance to maintain full performance and have the lowest overall cost. (See Figure 1)*
- *Vapor Compression packages use equivalent size and space of R.O. systems, but are the most capital cost and use significantly more power. The packages are machinery intensive and require significant maintenance. (See Figure 2). BP has had considerable experience with vapor compression packages offshore in the North Sea and their maintenance load has been so onerous, that some packages have been taken out of service in favour of supply boat delivery. Vapor compression is a distillation process, where evaporation of sea or brackish water is obtained by the application of heat delivered by compressed vapor. The water vapor is compressed by means of an electrically driven, mechanical centrifugal compressor. The saline water is evaporated at sub-atmospheric pressure on one side of the heat transfer surface, and on the opposite side it is condensed into fresh water, which is collected and extracted as product water. The remaining concentrated saline water (the brine) is also extracted as a blow down, which has an average concentration factor approximately two times that of the initial value. In the case of vacuum assist this makes a more efficient package since boiling / evaporation occurs at a lower temperature.*
- *Waste heat packages are designed to be used with liquid cooled engines and the hot coolant is used provide heat to the process for producing distilled water. These are the lowest direct capital cost packages, but operating costs are high due to the high volume seawater cooling requirements. Standard packages*

