



PASSENGER PROTECTION IN THE EVENT OF HELICOPTER DITCHING

PTS 60.2503

Rev 1

JUNE 2006

PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS Group of Companies.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' Group of Companies in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

The right to use PTS rests with three categories of users:

- 1) PETRONAS and its affiliates.
- 2) Other parties who are authorized to use PTS subject to appropriate contractual arrangements.
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PETRONAS disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PETRONAS and/or any company affiliated to PETRONAS that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PETRONAS, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PETRONAS. The copyright of PTS vests in PETRONAS. Users shall arrange for PTS to be held in safe custody and PETRONAS may at any time require information satisfactory to PETRONAS in order to ascertain how users implement this requirement.

AMENDMENTS RECORD SHEET

Chapter No.	Section No.	Description	Issue No.	Date	Revision No.	Date	Approve by : (initial)
All	All	PTS 60.2503 Passenger Protection in the Event of Helicopter Ditching	1	June 06	1	June 06	IGA

SUMMARY

1. INTRODUCTION

- 1.1 Policy
- 1.2 Purpose of the document
- 1.3 Ditching
- 1.4 Survival factors

2. SOME HAZARDS OF HELICOPTER DITCHING

- 2.1 'Cold shock'
- 2.2 Drowning
- 2.3 Slow body cooling
- 2.4 Concurrent injury
- 2.5 Collapse during and after rescue

3. THE SEQUENCE OF EVENTS

- 3.1 Preparedness
- 3.2 Flooding and capsizing
- 3.3 At the surface
- 3.4 Rescue

4. OPERATIONAL CONDITIONS

- 4.1 Sea temperature
- 4.2 Search and rescue time
- 4.3 Air temperature and relative humidity
- 4.4 Comfort duration

5. THE PROTECTIVE EQUIPMENT

- 5.1 Categories of equipment
 - 5.1.1 Underwater breathing aids

- 5.1.2 Life jackets
- 5.1.3 Spray hoods ('splash guards')
- 5.1.4 Immersion suits
- 5.1.5 Integrated thermal liner - use under a "dry" immersion suit
- 5.1.6 Other aids
- 5.1.7 Wear for helicopter crews
- 5.2 Performance objectives
 - 5.2.1 Normal wearing mode
 - 5.2.2 Underwater escape phase
 - 5.2.3 At the surface
- 5.3 Equipment selection
 - 5.3.1 Essential objectives
 - 5.3.2 Optional features
- 5.4 Suit issue policy
- 6. TRAINING**
- 7. THE MANAGEMENT OF SURVIVORS**
 - 7.1 Preparedness
 - 7.2 Horizontal lifting
 - 7.3 First aid
 - 7.3.1 Hypothermia
 - 7.3.2 Near drowning
 - 7.3.3 Hypothermia and near-drowning
 - 7.4 Medical treatment
- 8. REFERENCES**

Appendices

APPENDIX I	SUGGESTED PERSONAL PROTECTIVE EQUIPMENT IN RELATION TO RESCUE TIMES
APPENDIX II	EXAMPLE OF DECISION ANALYSIS FOR SELECTION OF A SURVIVAL SYSTEM
APPENDIX III	COLD WATER SURVIVAL TIME TABLE
APPENDIX IV	SPECIFICATION OF IMMERSED CLO VALUES

SUMMARY

Since the publication of the PETRONAS Safety Committee Guide "Protection of Passengers after Helicopter Ditching" in 1989, further experience has been gained in the wearing of survival equipment by passengers, and its use in emergencies. Progress has also been made in research into the problems associated with survival, assessment of equipment presently in use as well as the development of new concepts.

This document has been prepared with the assistance of Group E&P Operating Companies who have extensive helicopter-supported offshore operations, and provides an update of the information contained in the 1989 guide.

The hazards of helicopter ditching and subsequent escape and survival are described. The physiological and medical factors relating to survival in the water have been reviewed and the effect of prolonged immersion in temperate and even tropical waters are highlighted.

Performance specifications are given for personal survival systems, and the characteristics of various suit design concepts are outlined. Protective equipment addressed includes underwater breathing aids, life jackets and spray hoods as well as immersion suits and jackets.

The importance is stressed of selecting items of equipment which are compatible with each other when the whole is assembled into a personal survival system. Suit issue policies and maintenance are addressed.

The need to plan an emergency procedure for rescue, transport and treatment of ditching victims is emphasized.

1. **INTRODUCTION**

When a helicopter is ditched at sea, following the initial impact, passengers may be exposed to three environmental hazards before rescue is effected: escape from the helicopter, immersion in water below body temperature, and wave action. It should be noted that the hazards of escape and immersion are not confined to cold waters, and some protection may be needed in waters warmer than 20°C.

During and following recovery from the sea, passengers may still collapse and die.

1.1 **POLICY**

Management of all OPUs have the responsibility to take all necessary measures to protect passengers from the hazards of the environment following a ditching.

Helicopter passengers (including air crew) flying over water shall be provided with protection from the consequences of an unplanned ditching. This includes the means to escape, to prevent drowning, and the means to protect against the effects of immersion and exposure appropriate to the operating environment.

1.2 **PURPOSE OF THE DOCUMENT**

The purpose of this document is to assist OPU management to identify the possible hazards of helicopter ditching and to decide on the need and types of equipment and appropriate training for the adequate protection of crew and passengers in the environmental conditions of their area.

This revision of the guide is based on current Group E&P experience as well as industry developments. It should be appreciated, however, that developments in this field are continuing as further knowledge is gained on particular aspects of survival and improvements in equipment are identified. OPUs are actively supporting such developments to ensure that personnel have the benefit of the best available equipment.

OPUs must therefore check with advisers in the CHSE for the latest information on specific aspects of equipment design, equipment performance and training.

1.3 **DITCHING**

Ditching is defined as intentional alighting on water, as the result of an emergency situation, during which the aircraft is controllable by the crew. Depending on the sea state and other conditions, the aircraft might remain upright and stable or subsequently capsize.

Unplanned ditching is effectively a crash landing on water, during which damage to the aircraft and personal injury is possible, and immediate capsize is probable.

1.4 **SURVIVAL FACTORS**

The need for personal protection for a particular operating area should be based on the factors affecting survival time after immersion and the expected rescue time. This is a complex decision, and guidance on specific matters may be requested from advisers in the Service Companies.

Survival time of an immersed person depends on:

- a) weather conditions, i.e. sea state, water temperature, wind speed, and air temperature;
- b) availability and effectiveness of personal protective equipment such as an underwater breathing aid, life jacket and immersion suit;
- c) physical and medical fitness of the individual;
- d) physical characteristics (age, sex, body fat, diet, behaviour);
- e) training in procedures and discipline;
- f) effect of coincidental injury, if any;
- g) psychological condition;
- h) type and number of layers of clothing worn beneath the suit.

Rescue time depends on the response capabilities of search and rescue (SAR) facilities, which should take into account the capability to respond outside normal flying operation hours and/or in darkness. Rescue time should be considered as the longest estimated period between the initial event and **the rescue of the last person** involved. Search and rescue procedures and facilities must be part of the Operating Company's emergency response procedures.

2. **SOME HAZARDS OF HELICOPTER DITCHING**

Hazards associated with a helicopter ditching into the sea may be uncontrolled and result in injury to the crew and passengers, but commonly the descent is relatively controlled and the helicopter does not sink immediately. However, there is a high probability, even in these circumstances, that the helicopter will capsize such that the persons on board will have to make their escape through the water.

Whenever possible the passengers must follow the instructions of the flight crew and effect a disciplined and orderly exit from the aircraft. An inflated life-raft should be available to them as this will provide protection against environmental conditions and increase the chance of survival.

Provision must also be made for the protection and survival of an immersed individual and the following factors will review each of the hazards to be met.

There are a number of physical hazards but the main principal physiological hazards (some of which are potentially fatal) to be encountered are cold shock; drowning; slow body cooling; collapse during or after rescue. These will be outlined here before describing the survival sequence.

2.1 **'COLD SHOCK'**

Death may occur within 2 or 3 minutes of immersion if the survivor is not adequately protected. The powerful stimulus of cold water (20°C or below) on the skin causes a loss of control of breathing, a reduction of breath-hold duration and a sharp rise of blood pressure. As a consequence, drowning may occur before escape from the aircraft or, if wave action is severe, at the surface of the sea. Cold shock exposure has been responsible for many sudden deaths, even among good swimmers, and the importance of appropriate protection from this hazard is only now becoming widely recognised. The sharp rise of blood pressure is a significant hazard for those with a potential cardiac problem.

2.2 **DROWNING**

Drowning may occur when an individual is trapped within a capsized helicopter. Drowning may occur after initial survival, even when a life jacket is worn. Fatigue, body cooling (leading to hypothermia) and sea sickness may cause a loss of control of respiration and, in cases where the sea is rough, water or spray may be inhaled.

2.3 **SLOW BODY COOLING**

Water temperatures below body temperature, induce a loss of body heat. For the uninsulated individual this can occur in water as warm as 35°C. Immersion reduces the insulating properties afforded by normal personal clothes, the protective clothing and the air trapped in them.

If the loss of heat exceeds the body capacity to generate heat, a progressive deterioration takes place in the individual's ability to cope with his or her adverse

circumstances. A clouding of consciousness will occur. Continued exposure will be associated with further slow body cooling and lead towards **hypothermia**. This can be defined as a lowering of the core (rectal) temperature of the body to 35°C or lower. Soon shivering will cease. Further cooling may lead to unconsciousness and then death, either by the inability to time breathing in relation to the passing waves, or by progressive deep hypothermia.

2.4 CONCURRENT INJURY

Experience has shown that survival also depends very much on whether or not the survivor is injured. A broken ankle, for example, can seriously upset the body's natural mechanisms for maintaining thermal balance.

2.5 COLLAPSE DURING AND AFTER RESCUE

Experience has also shown that some individuals, fully conscious and lucid in the water, collapse and die whilst climbing out or lifted from the water, or shortly after. This effect may be caused by hypothermia, hypovolaemia or a cold-induced paralysis of the blood vessels which is unimportant as long as the survivor's legs are supported by the surrounding water. On rescue, where a survivor is raised vertically to a helicopter in a lifting strop, the hydrostatic pressure on the legs is lost and there may be a lack of circulation to the head or heart. For this reason survivors should be lifted in as close to a horizontal position as possible (See 7.2).

The redistribution of heat within the body after rescue may cause a transient loss of core temperature ("after-drop"). Also after rescue, the condition of the survivor may continue to deteriorate.