WAVE⁴

USER MANUAL REV 2.0

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Original Instructions

reflexmarine

About This Manual

This manual contains information for operating, maintaining, and storing your WAVE personnel transfer carrier.

The key to safe operations is the familiarisation and participation in planning of all crew involved. Please refer to the Marine Transfer Forum's guidelines on personnel transfer by crane, which can be downloaded, from www.marinetransferforum.org. This document contains comprehensive guidance and information to assist in performing safe personnel transfer operations. It is a valuable tool for those researching, planning, managing, and conducting crane transfers.

Safe and proper use of WAVE is the responsibility of the user having considered the information provided in this document.

You should ensure that all safety measures are in place as required by relevant legislation and by good operational practice.

Appropriate training should be provided for all personnel involved in the use of this device. Please see RML website for training courses that can be provided http://www.reflexmarine.com/supporting-you/training/.

For the purposes of this manual RML is Reflex Marine Limited.

Please retain this manual for future reference. The latest version can be downloaded from www.reflexmarine.com/support.

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1 Introduction

1.1 Product Overview

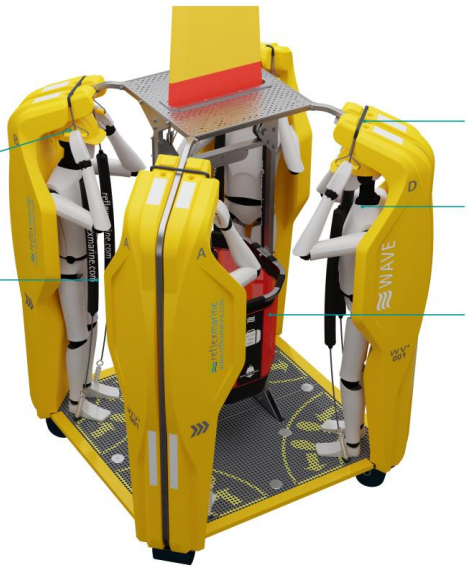
WAVE is a personnel carrier for standing passengers that offers impact protection, fall prevention and has floating and self-righting capabilities. This 4-person carrier is best suited for routine crew transfers, medical evacuations and as part of a contingency plan.

Passenger Experience

Familiar, intuitive, safe

Passenger comfort & security
Contoured buoyancy panels & hand grips

Rapid entry & exit
Step in > hold on > go
Dedicated passenger exits



Overhead protection
Contoured buoyancy panels

Visibility
Internal facing
Good peripheral visibility of exit & deck

Luggage facility
Central luggage basket for carry on bags

Safety

Protection from the 4 key risks

Collision Protection
Stainless steel ribs & buoyancy shield
Impact protection
2.0 m/s | 6.6 ft/s

Heavy landing protection
Shock absorbing feet
Operational to 2.5m SWH | 8.2 ft SWH

Fall protection
Contoured buoyancy panels secure passengers
Passenger safety restraints and hand grips

Immersion Protection
Buoyancy panels
Self-righting & floating

MedEvac

Rapid response & casualty support

IV Hook-up
IV drip hook to maintain support during the transfer

Casualty comfort
Raised position, off the floor, improving casualty's sense of security and comfort
Above the water line in case of immersion

Medical Assistance
Medic able to reassure and monitor during the transfer

FAST
Stretcher slides in and is secured in 2 minutes

1.2 Product Specifications

Category	Description	Specification	
Model No.		**WV4**	
Passenger Capacity	Standard	4	
	Stretcher Mode	2 Passengers + Stretcher	
Luggage Capacity	Light Luggage	Central luggage net	
	Large Luggage	Below central luggage net	
Passenger Safety	Fall Prevention	Passenger safety restraints + hand grips	
		Metric	Imperial
Operating Temperatures	Standard Model	-20 °C to +50 °C	-4 °F to 122 °F
Impact Protection	Vertical impacts	Up to 2.14 m/s	Up to 7.0 ft/s
	Lateral impacts	Up to 2.0 m/s	Up to 6.6 ft/s
Dimensions (Nominal)	Width 1	1710 mm	67 in
	Width 2	1710 mm	67 in
	Height	2336 mm	92 in
Weight	Maximum Gross Mass	850 kg	1874 lbs
	Tare Weight	350 kg	772 lbs
	Payload	500 kg	1102 lbs
Lifting Points SWL	Main 1	850 kg	1874 lbs
	Main 2	850 kg	1874 lbs
Wire Rope Lifting Assembly	Safe Working Load	850 kg	1874 lbs
	Wire Rope	2 leg anti-rotation wire rope	
Stability	Horizontal	32°, for a load of 1-4 passengers.	
	Submerged Self-Righting	Up to 180° inverted to the vertical position	
Materials	Frame	316 Stainless steel, A4 stainless fixings	
	Central Columns / Load Plate	316 Stainless	
	Floor Grating	GRP	
	Buoyancy	PE moulded shell with Polyurethane (PU) closed-cell foam fill.	
	Landing Feet	EVA Foam	
VERIFICATION & CERTIFICATION			
Certification	Class	EC Attestation of Conformity Certificate No. **DK-MAC000008 i01**	
		ABS Statement of Fact	
Quality	System	Manufactured to ISO 9001:2015	
Standards	National Technical Standards	UK, BS EN 1993 series: The design of steel structures	
	Industry European Standards	EC Machinery Directive BS EN ISO 12100:2010 Load Test – ILO152 / LOLER	
	National Regulations	UK, PUWER / LOLER	

Table 1 - WAVE Specification

2 First Use

2.1 Product Registration

By registering your product, you will receive the following important benefits:

- User Manual Updates
- Technical Bulletins
- Safety Alerts
- Important Product Development

RML will then be able to ensure you have all the latest operating information to continue transferring people safely and efficiently. Register your product here:

http://www.reflexmarine.com/register/

2.2 Training

It is important that anybody using the WAVE is properly trained and knows how to use the equipment correctly. The following training is available from Reflex Marine:

- Product Familiarisation
- Inspection & Maintenance
- Planning for Crane Transfer
- Crew & Passenger Briefings
- Crew Transfer Operations

2.3 User Pack

Every WAVE comes with a User Pack that includes the following:

- Certification pack
- User Briefing DVD
- Golden Rules DVD
- USB Stick
- North Sea Lifting Handbook

Certification pack

This includes, but not limited to, manufacturer's declaration of conformity, all of the critical parts certificates, load test certificates and the third-party release note and checklist.

If any further certification is required, please contact RML.

USB Stick

The USB stick contains the following:

- User Manual
- User Briefing Videos
- Crane Transfer Guidelines
- Passenger and Crew Briefing
- Crane Transfer Planning Tool
- Customer Drawing Pack

2.4 Customer Drawing Pack

Every WAVE comes with a Customer Drawing Pack that contains all of the relevant guidance and procedures to aid in its maintenance. This manual contains the following:

- General Assembly Drawings
- Replacement Parts Kits
- Torque Settings
- Bill of Materials

2.5 Putting WAVE into service

Before entering service, your new WAVE should be visually inspected to ensure that it is fit for use, and the certification reviewed to ensure that it is valid.

On entry into service, the date should be stamped onto the Data Marking Plate (Figure 1). This will record the start of the WAVE's Inspection & Maintenance schedule (Section 4.5).

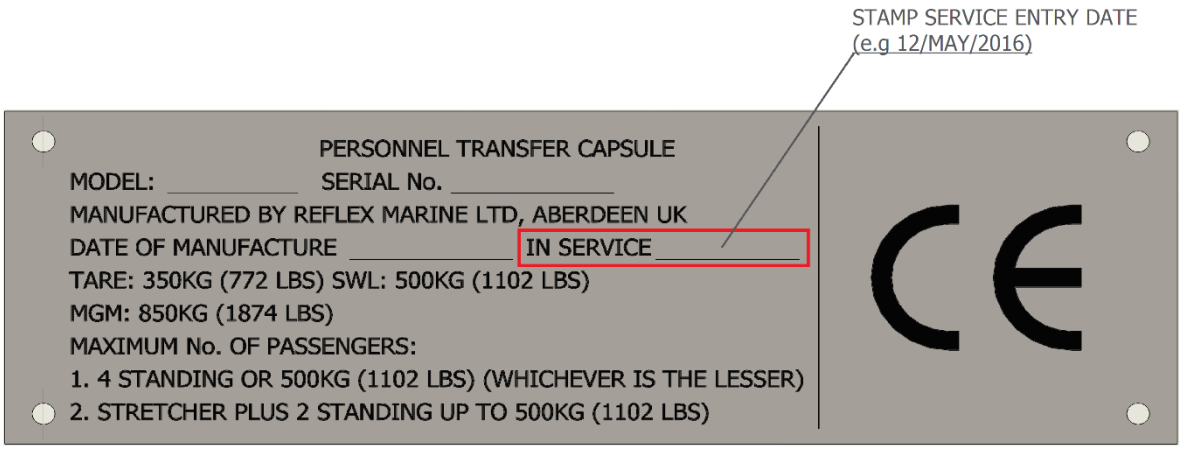


Figure 1 Data Marking Plate

Equipment can be considered in service when it is exposed to conditions that may cause deteriation i.e. when the unit is placed into an offshore or operating environment.

2.6 Equipment held in stock

If your WAVE unit is being held in stock prior to being put into service for the first time it is certified for use by the manufacturer's declaration of conformity for 12 months from date of issue and would not require a thorough examination prior to being put into service. However, RML recommends that the equipment is visually inspected prior to being put into service.

For WAVE units & parts held in stock RML recommend the following inspection schedule.

In-stock inspections

Type	In-stock visual inspection frequency
Transfer capsules	1 Year
Wire Rope Lifting Assembly	6 months
Other replacement Parts (not lifting assemblies)	None

Table 2 WAVE In-stock inspections

Storage Actions

- Remove lifting assembly from unit to prevent damage.
- Place all items into clean dry storage and remove any lifting assembly covers to prevent possible build-up of moisture and corrosion.
- Chock up unit to preserve the impact absorption properties of the feet.

Prior to First Use

When placing stock items into service RML recommends the following inspections are conducted.

Type	Transfer carriers	Wire rope lifting assembly	Replacement parts
Load test & Post load test visual inspection	< 2year old = No > 2year old = Yes	-	-
Report of thorough examination	-	Yes	-
Visual inspection	Yes	-	Yes
Update certificates	Yes	Yes	-
Stamp In service date on Data marking plate	Yes	-	-

Table 3 Inspection of stock items entering service.

3 Operations

3.1 General

A range of factors affect the risk of conducting marine personnel transfers which can be broadly grouped into;

- **equipment factors**, e.g. carrier type, crane specification, vessel specification.
- **environmental factors**, e.g. wind and wave, visibility, temperature, precipitation.
- **personnel**, e.g. skill, experience, awareness, and training.
- **operational and management**, e.g. risk assessment, planning, communication etc

The most important of these factors is management; without appropriate assessment, planning, and implementation of operations there cannot be control of the other factors and risks.

For more detail RML recommend the Marine Transfer Forum's guidelines on personnel transfer by crane, which can be downloaded, from www.marinetransferforum.org . This document contains comprehensive guidance and information to assist in performing safe personnel transfer operations.

The following sections of this chapter contain specific operational guidance relating to the WAVE.

Sea State

Passengers riding the WAVE are secure by the restraint assembly. Protection from shock loading is provided through the polymer landing feet and passengers adopting the recommended brace position. The maximum recommended significant wave height for WAVE operations is derived from the maximum relative landing and pick-up velocity between the load (carrier) and the deck. A relative landing speed of 2.14m/s has been validated in testing.

The calculated operational sea states detailed in Figure 2 are based on vertical impact speeds and bio-mechanical considerations. They reflect the ability to withstand such impacts with minimal risk of injury to the human body. However, there are many additional factors that may affect the safety of crane transfer operations. These include vessel station-keeping, crew competence, wind and visibility. The operator should always refer to general guidelines on crane transfers operations to assess overall risks.

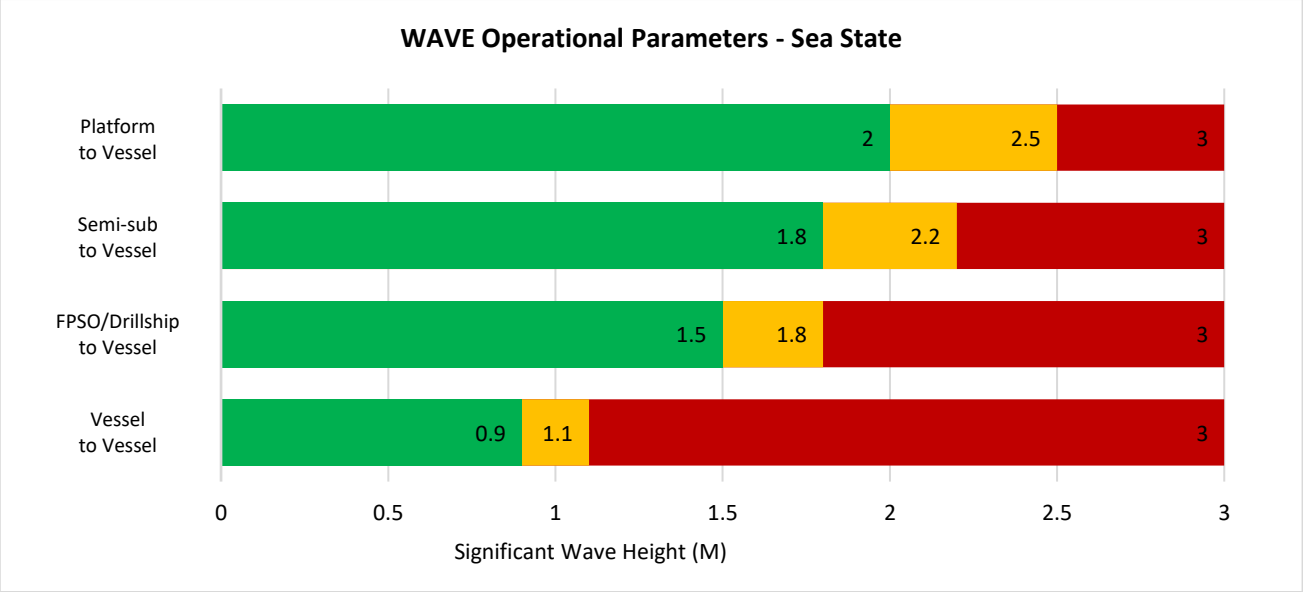
Technical note:

The calculation for relative velocity used here is based on the European offshore crane standard, BS EN 13852-1:2013. Whereby the maximum anticipated relative velocity between a load and a vessel deck, is given by the following;

Relative velocity = (0.5*Hook velocity)[1] + √ (Vessel deck velocity [2] + Boom tip velocity [2])

[1] Equal to 1.67 m/s (100 m/min) for lifts below 5 tonnes. Higher crane hook speeds may be available, and it follows that the higher the available crane speed the higher the possibility of a heavy landing or take off. However, with a qualified Crane Operator, it is considered unlikely that the FROG-XT will be landed at full hook speed on a deck rising at full speed. If there are concerns about heavy landings, operators may wish to consider the following methods to reduce risks; dry runs without passengers, landing in centre of deck where there is less vessel movement, transferring fewer passengers to increase damping, using a hook speed indicator.

Figure 2 WAVE Operating Parameters



Note:

- **Recommended Operating Window** – For an impact at worst case scenario* under these sea conditions, WAVE units are well within performance range. Consideration of all risk factors and pre-job planning are still a requisite.
- **Extended Operating Window** – For an impact at worst case scenario* under these sea conditions, WAVE product performance has been designed, tested, and validated to provide complete passenger protection. In such elevated sea states other risk factors will increase. A thorough risk assessment and trials should be conducted to ensure. Contact Reflex Marine if you need assistance.
- **High Risk Operating Window** – Operating in this window presents risk of exceeding WAVE product safety performance. For any operations in this window, specific measurements of relative motion are recommended to ensure they are within safety margin. A thorough risk assessment and trials should be conducted to ensure. Please contact Reflex Marine for any guidance.

**Relative velocity between load and landing deck based on European offshore crane standard, BS EN 13852-1:2013*

3.2 Safety Features

Protected Passenger Positioning:

Passengers are positioned between the contour of the WAVE's buoyancy panel and its restraint assembly, providing maximum protection and minimised sense of exposure. The arrangement of the passenger positioning and individual entry / exit points allow rapid access and egress, allowing faster and more efficient transfers.

Fall Protection:

The passenger restraint assembly and adoption of the recommended brace position protect personnel from the risk of falling during transfer.

Vertical impact protection:

Passenger protection from vertical, landing and pick-up impacts is provided by the impact absorbing EVA foam feet and passengers adopting the recommended brace position.

Lateral impact protection:

Passengers are protected from lateral impacts by the stainless steel framework, buoyancy panels, and passenger restraints and grab handles provided.

Floatation:

Buoyancy panels ensure the carrier floats with in both four-person passenger configuration and stretcher configuration, maintaining airway above the water line. The WAVE transfer capsule is performance tested for the most extreme immersion scenarios. The WAVE capsules self-rights up to 180° inverted to the vertical position in less than 6 seconds and will provide a stable floating platform in a wide range of conditions. The WAVE was also tested for its response to a free-fall into water.

3.3 Recommended Operating Parameters

Parameter	Recommendation	
	Metric	Imperial
Vertical Impact Protection	2.14 m/s	7.0 ft/s
Lateral Impact Protection	2 m/s	6.6 ft/s
Wind Speed	20 m/s	40 knots
Visibility	Crane Operator should have a clear view of the pickup and set down areas.	
Vessel Motion	10º Pitch and Roll	
Vessel Station-Keeping Radius	5 m	16 ft
Landing Area	Must be clear of any obstructions or hazards	
Landing Area on Vessel	4 m x 4 m	13 ft x x13 ft
Landing Area on Installation	3 m x 3 m	10 ft x 10 ft
Crane Requirements	Crane must be suitable for lifting personnel. Suitable minimum hoisting speed Appropriate slewing and luffing speeds	

Table 4 WAVE Recommended Operational Parameters

3.4 Crane Transfer Planning Tool

RML has developed a planning tool that can be used to determine whether the conditions are suitable for transfers to take place.

The Crane Transfer Planning Tool can be found on the USB stick in your user pack, or alternatively you can download a copy from our website.

Using the Crane Transfer Planning Tool

There are three main sections that need to be completed:

A. Risk Assessment
B. Pre-transfer Checklist
C. Passenger Log
D. Post-transfer Review

It is important that the conditions are assessed prior to every transfer operation as conditions are never the same.

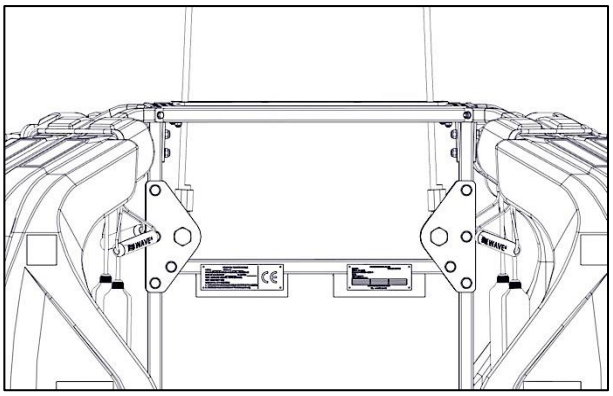
It is recommended that a trial run is conducted as this provides real time feedback on the conditions.

The crane operator should always refer to general guidelines on crane transfers operations to assess overall risks.

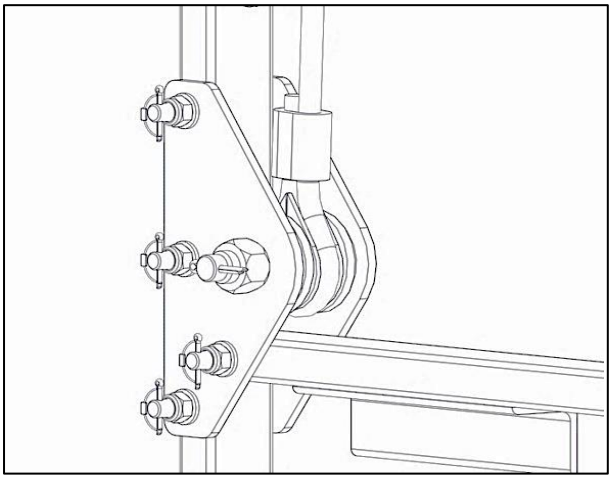
If there is ever any concern about the conditions, transfers should be stopped.

3.5 Lifting Assembly Connection

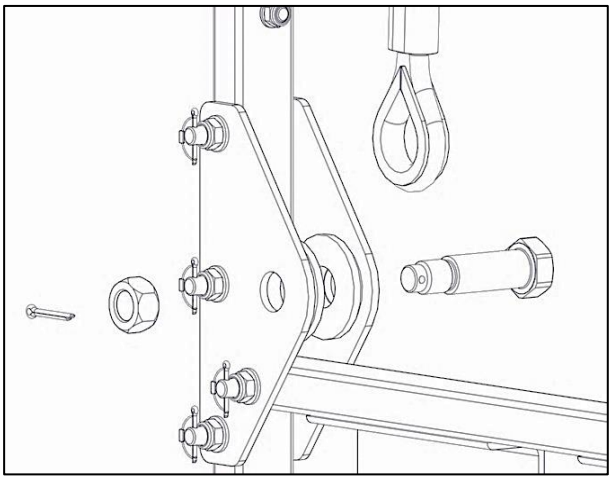
1. The lifting assembly on the WAVE is made up of two legs, attached to the carrier as shown.

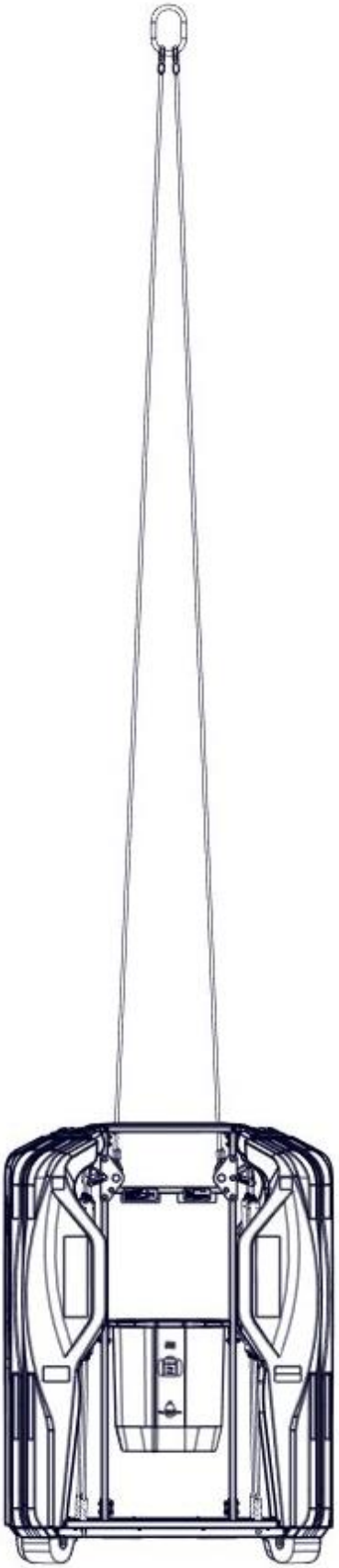


2. Each leg is connected to the lift plates with a safety bolt.



3. Safety bolts are secured with a nut and split pin. Two nylon washers between the lifting plates and wire rope termination prevent excessive movement of each leg.





3.6 Control of Lifting Assembly

Upon landing the WAVE upon a vessel, the crane operator should pay out sufficient slack so that the WAVE remains stable on deck allowing for vessel motions. A designated deck crew member should manage the position of the lifting assembly to ensure:

- It remains clear of potential snagging points
- It does not encroach into the capsule.
- It is not a hazard for passengers entering or exiting the capsule.
- When lifting the capsule ensure the lifting assembly remains safely routed
- Only the designated deck crew, wearing appropriate PPE (i.e. gloves) should manage the position of the slings.

Parameter	Recommendation
Ideal lifting assembly length	The recommended limits in this section are based on the use of the standard wire rope lifting assembly length of 6 m / 20 ft.
Shorter lifting assemblies	For the use of shorter lifting assemblies an additional risk assessment combined with dry runs should be performed to establish safe operational routines and weather conditions. Using a shorter lifting assembly set also increases risks associated with the hook block being in close proximity to the capsule

Table 5 Control of Lifting Assembly

Lifting assembly Length		Recommended Slack		Allowable Drift		Distance to the Crane Hook	
6 m	20 ft	3 m	10 ft	5.2 m	17 ft	3 m	10 ft
4 m	13 ft	1.5 m	5 ft	3.1 m	10 ft	2.5 m	8 ft

Table 6 Lifting Assembly Lengths

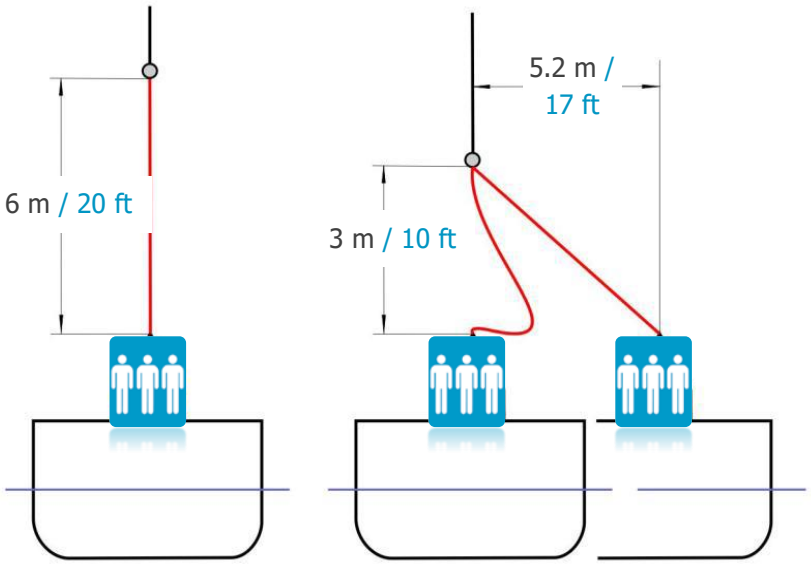


Figure 3 Lifting assembly slack

3.7 Crew Instructions

PRE-TRANSFER

ORDER	RESPONSIBLE	ACTIVITY
1	Supervisor	Conduct **risk assessment**
2		Conduct **pre-use check** of equipment
3		Conduct passengers and crew **briefing**
4	Deck crew	Ensure landing areas are **clear of obstructions**
5		Check passengers are correctly wearing personal flotation device and any other **appropriate PPE**
6		Assign passengers to a group and position to ensure **even load distribution within SWL**

Table 7 Pre-Transfer Instructions

TRANSFER

ORDER	RESPONSIBLE	ACTIVITY
1	Deck crew	**Connect** lifting assembly to crane hook. Ensure positive lock is closed.
2		**Route lifting assembly** into a safe position
3		**Load luggage** into Luggage basket
4		When safe **signal to passengers to enter**
5		Ensure lifting assembly and any taglines are **clear from snagging hazard**
6		**Signal lift** to crane operator.

Table 8 Transfer Instructions

LANDING

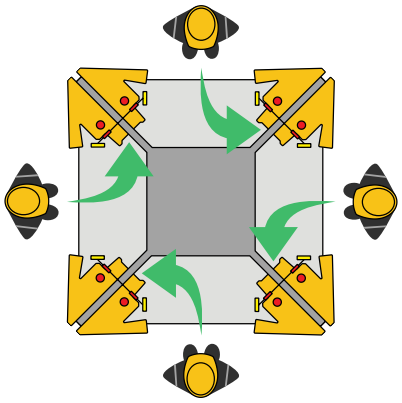
ORDER	RESPONSIBLE	ACTIVITY
1	Crane operator	Land carrier on **clear landing area**
2	Deck crew	If used, beware **taglines risks**
3	Crane operator	**Pay out slack** on lifting assembly when carrier is landed
4		Place **hook down-wind** of carrier
5	Deck Crew	**Route lifting assembly** away from exiting passengers
6		When safe, **instruct exit and guide passengers** to a safe area
7		Unload luggage

Table 9 Landing Instructions

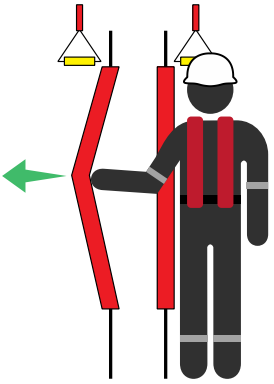
3.8 Passenger Instructions

ENTRY

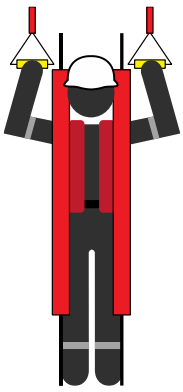
1. Under instruction from deck crew; take position for entry



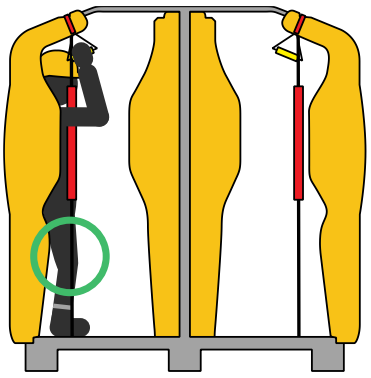
2. Leading with one arm and shoulder; step through vertical restraints.



4. Bring second shoulder through restraint and grip handholds.

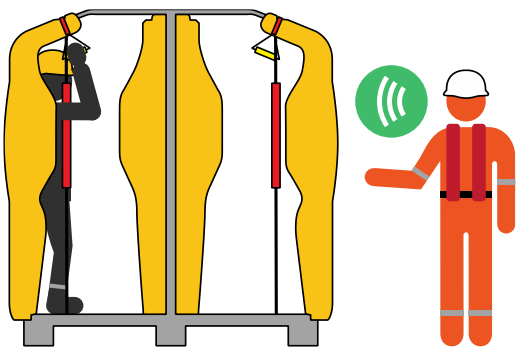


3. During take-off and landing: keep legs apart and bend knees slightly.

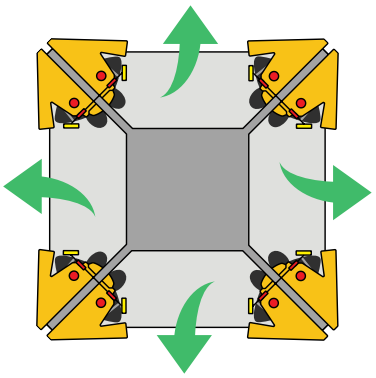


EXIT

5. On landing: await instructions from deck crew.

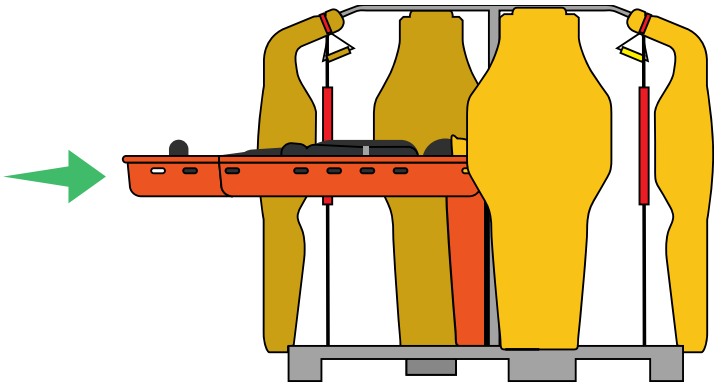


6. Exit, and move to safe area.



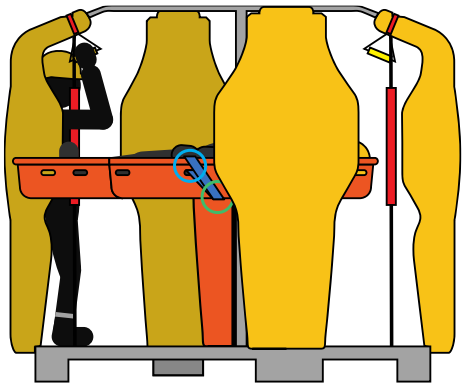
3.9 Stretcher Mode

The following steps outline the procedure to load a stretcher into the WAVE.
WAVE can accommodate one stretcher and two passengers.



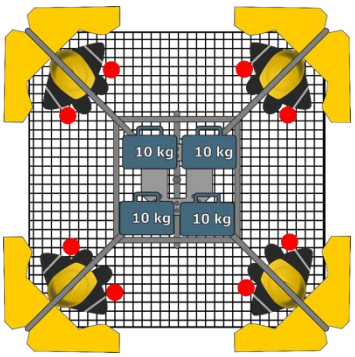
1. Prepare stretcher straps, loosening them and slide the stretcher into the WAVE headfirst.

2. Secure the stretcher using the four stretcher straps provided.



3. Each stretcher strap should be fed through a handle on the stretcher and then attached to the stretcher frame below.

3.10 Luggage



1. The WAVE can carry up to 40 kg of luggage.

2. Light luggage may be loaded into the luggage basket. Heavy luggage should be secured on grating under the luggage basket with appropriate fastening.

3.11 Accessories

The following accessories are available from RML to maximise operational effectiveness. They can be supplied with the carrier or ordered separately.

Item	Description	How to ft
Strobe light 	Provides greater visibility at night and in poor weather conditions. High-intensity: light weight, waterproof to 300 m, Flash Rate 50 per min, with 6-mile visibility. C cell battery powered.	Fitted to the overhead protection plate in the WAVE.
Basket Stretcher 	Essential for conducting emergency medical transfers, RML supply a rigid stretcher that is compatible with the WAVE.	The stretcher slides on top of the luggage storage basket. There are 4 straps that are used to secure the stretcher.
Protective Cover 	A silver reflective protective cover which is made of flame-resistant fabric (BS7837) and protects against degradation from UV light and the weather.	The cover has a single doorway that unbuckles to allow you to wrap the cover around the unit. There are also straps to tie the base of the cover the base of the unit.

Table 10 WAVE Accessories

3.12 PPE

Item	Description
Manually Inflatable Life Jacket 	**Make**: Crewsaver **Model**: Crewfit 275N **Description**: Designed for offshore use in severe conditions, the Crewfit 275N is tailored for use with heavy waterproof clothing yet is still comfortable and practical in more benign conditions. The fire retardant cover prevents damage when in working use. It is available with a number of safety options including harness, firing mechanism, light and hood.
Head Protection 	**Make**: Petzl **Model:** Vertex Best **Description**: Comfortable helmet for work at height and rescue With its strong chinstrap, the VERTEX BEST helmet sets the standard in head protection for workers at height. Its unventilated shell protects against electrical hazards and molten metal splash. Its six-point textile suspension ensures maximum comfort, and its CenterFit adjustment system adjusts the headband and keeps the helmet centred on the head. The VERTEX BEST is designed for optimal attachment of a PIXA or ULTRA VARIO headlamp, a VIZIR, VIZIR SHADOW or VIZEN protective shield, and hearing protection.

Table 11 Recommended WAVE PPE

3.13 Storage and Transport

Lashing For deck fastening, place straps over the top of the floor grating.
Chocks Prolonged periods of exposure to hot decks and self-weight can cause compression set to the foam polymer landing feet. If the carrier is to be stored for long periods a set of chocks should be used to lift the feet from the deck. Any chocks used should fit properly underneath the carrier, without causing any damage to any fixings.
Forklift Care should be taken when handling the carrier with a forklift truck to avoid damage to the frame or landing feet. Alternatively, the carrier may be secured to a pallet specifically designed for use with forks.
Cover The WAVE should be stored under a WAVE weatherproof cover whilst not in use, to protect from any hazardous elements and UV degradation.
Deck Movements When moving the WAVE, the standard lifting assembly can be used. However, if this is too long, then it should be removed and replaced with a shorter sling. Care must be taken not to damage the lifting assembly. **Shackle should not be fitted through the thimble of the lifting assembly eyes** as this can cause damage.
Road Transport Prior to shipping, it is recommended that the carrier is covered with a WAVE weatherproof protective cover or plastic wrap.
Shipping The WAVE will fit on its side in a standard container or upright in a high-cube container. If transported on flat rack it must be secured. The unit should be chocked to avoid any foot damage.
Inspection Before and after transportation the carrier must be inspected to check for damage sustained in transit, this includes checking fasteners to ensure none have vibrated loose during transport. The unit must not be used if any structural damage is observed. If any damage has been observed a visual inspection should be carried out.

Table 12 Recommended Storage and Transportation of the WAVE, and Parts

4 Inspection & Maintenance

4.1 Introduction

Following the recommended procedures set out in this section will help to ensure safe operation of the WAVE.

4.2 Definitions

Transfer Lifts

One transfer lift is defined as one pickup and put down when passengers or cargo are on board.

Usage Category

This is defined by the number of transfer lifts per year. There are three different usage categories. See Table 4.5.

Critical Parts

These are the identified set of load bearing parts.

Consumable Parts

These parts are identified as needing periodic replacement. The timing for their replacement is based on both the unit's usage and a parts condition assessment.

Competent Person

A competent person is a person who has appropriate practical and theoretical knowledge and experience of the equipment. This will enable them to detect defects and weaknesses and to assess their importance in relation to the safety and continued use of the equipment. It is recommended that the competent person is sufficiently independent and impartial to allow objective decisions to be made.

Non-destructive Testing

Although not considered necessary, some operators choose to carry out non-destructive testing prior to any re-installation of a critical part.

If this is done, then a dye penetrant test should be used, as any other tests may produce a false positive.

4.3 Inspection Types

Type	Description
Pre-use check	A check of key areas prior to each use without dismantling the assembly. Carried out by a competent person.
Visual	A careful and critical assessment of the components, carried out by a competent person without dismantling the assembly.
Examination	A careful and critical assessment of the components, carried out by a competent person. This includes dismantling the assembly and performing a visual assessment of the condition of each component specified in the examination procedure, supplemented by other means such as measurement and non-destructive testing as considered necessary. For lifting assemblies this should include a visual inspection of the condition of each leg.
Post Load Test Inspection	A careful and critical assessment of the components following a proof load test. Carried out by a competent person without dismantling the assembly.

Table 13 WAVE Inspection Types

All inspections should be:

i. Performed by a competent person.
ii. Carried out as per the frequency indicated in the usage table.
iii. Formally recorded.

General Guidance

i. If there is any doubt regarding the usage of the equipment, then it is recommended that the maintenance strategy should revert to a more conservative, higher usage category.
ii. This recommendation applies to change out of components parts only and does not replace or alter the inspection intervals as prescribed by the relevant legislation.
iii. Details of all damage should be recorded in a damage report. Details of the cause of the damage should also be recorded, if known.
iv. If damage to the frame has occurred, welds should be examined for cracks using dye penetrant.
v. Details of all repairs or modifications carried out should be recorded and copies of damage and repair should be sent to the party controlling the use of the WAVE.
vi. If the wire rope lifting assembly is removed and placed into storage, the covers should be removed to prevent the build-up of condensation.
vii. Contact RML or one of our approved partners for technical advice on inspection, testing or maintenance. Send your query to support@reflexmarine.com.

4.4 Data Plates

Inspection Data Plate

An inspection data plate will be issued and attached by the inspector, which should show:

i. Tare Weight (kg)
ii. Pay load / SWL (kg)
iii. Maximum gross load (kg)
iv. The load test date (DD/MMM/YYYY)
v. Test load (kg)
vi. Serial number: WV4-XXX (where XXX is unit I.D. No)
vii. Model number: WAVE-4

Marker Plate

Every unit comes with a marker plate, which includes the following information:

i. Model number: WAVE-4
ii. Serial number: WV4-XXX (where XXX is unit I.D. No)
iii. Date of manufacture (DD/MM/YYYY)
iv. Tare weight (kg)
v. Pay load / SWL (kg)
vi. Maximum gross load (kg)
vii. Maximum number of passengers (standard & stretcher mode)
viii. Entry into service date (DD/MMM/YYYY)

4.5 Inspection and Maintenance Schedule

The check, inspection, examination, and test routine as detailed in this document should always be carried out on schedule.

WAVE RECOMMENDED INSPECTION AND MAINTENANCE SCHEDULES						
Usage Category No of Transfer Lifts per year	**Pre-Use Check**	**Visual Inspection**	**Examination**	**Wire Rope Lifting Assembly Replacement**	**Critical Parts Replacement[2]** **Load Test** **Post Load Test Visual Inspection**	**Unit Replacement[1]**
Contingency <50	Prior To Every Use	6 months	12 months	12 months	48 months	12 years
Routine 50 - 1000		6 months	12 months	12 months	24 months	10 years
Heavy 1000 - 4000[3]		3 Months	12 months	6 months	12 months	8 years
Notes	[1] This may be extended subject to a 'condition & service assessment' carried out by Reflex Marine or an Approved Partner					
	[2] Only applies to critical parts marked "consumable"					
	[3] When exceeding 4000 lifts, please refer to the Ultra-High Usage section (4.6) for further inspection guidance					
	In the event of a heavy impact, a detailed examination should be carried out to ensure integrity before conducting any further lifts					

Table 14 WAVE Inspection and Maintenance Schedule

4.6 Ultra-High Usage

For WAVE units exceeding 4000 lifts per year, this section provides additional inspection criteria.

Pre-use checks

i. Check load plate for wear, cracks, nicks, gouges, corrosion, and distortion of plate or holes.
ii. Check node plate weldment for cracks, nicks, gouges, corrosion, and distortion of plate or holes, paying particular attention to the welds.
iii. Check the passenger restraints folding seat support assembly, seat mounting cross member, Cantilever Weldment, sliding sleeve weldment for cracks, distortion, paying particular attention to the welds.

Visual inspection

i. In addition to the guidance, the node plate welds should be visually inspected for cracks.
ii. In addition to the guidance, the passenger restraint springs should be visually inspected for cracks.
iii. In addition to the guidance, the foot mounting plate should be visually inspected for cracks and distortion.
iv. In addition to the guidance, the floor grating should be visually inspected for sign of distortion, cracking, corrosion, or splinters. The penny washers should also be visually inspected for signs of distortion or deformation.

Examination

i. In addition to the guidance, the load plate for cracks and distortion. Particular attention should be paid to the holes in the load plate.
ii. In addition to the guidance, the welds on the lower node plate should be inspected using the dye penetrant technique for cracks. The welds on the upper node plate should be visually inspected for cracks.

In addition to the guidance, the buoyancy panels should be removed, and the pillar strut weldment should be visually inspected for cracks and distortion. Particular attention should be paid to the welds, holes, and the inner ends of the pillar strut where they join the node weldment. The floor grating should be visually inspected for sign of distortion, cracking, corrosion, or splinters. The welds should be visually inspected around the mounting plates for cracks.

4.7 Load Test Procedure

Question	Response
When should a Proof Load Test be conducted?	i. After replacement of any critical parts (not lifting assembly) ii. After any suspected damage iii. If the history of the unit is uncertain iv. If the inspection data plate is missing, illegible or out of date.
Who should conduct this test?	i. Independent 3rd party. ii. A competent and certified test person.
Does this test require a formal record?	Yes.
What equipment is required to perform this test?	i. Loading weights or sandbags. ii. Certified weighing scale or load cell. iii. Lifting equipment certified for > 2 Tonnes SWL. iv. A ladder or top access platform.

Table 15 Load Test Requirements

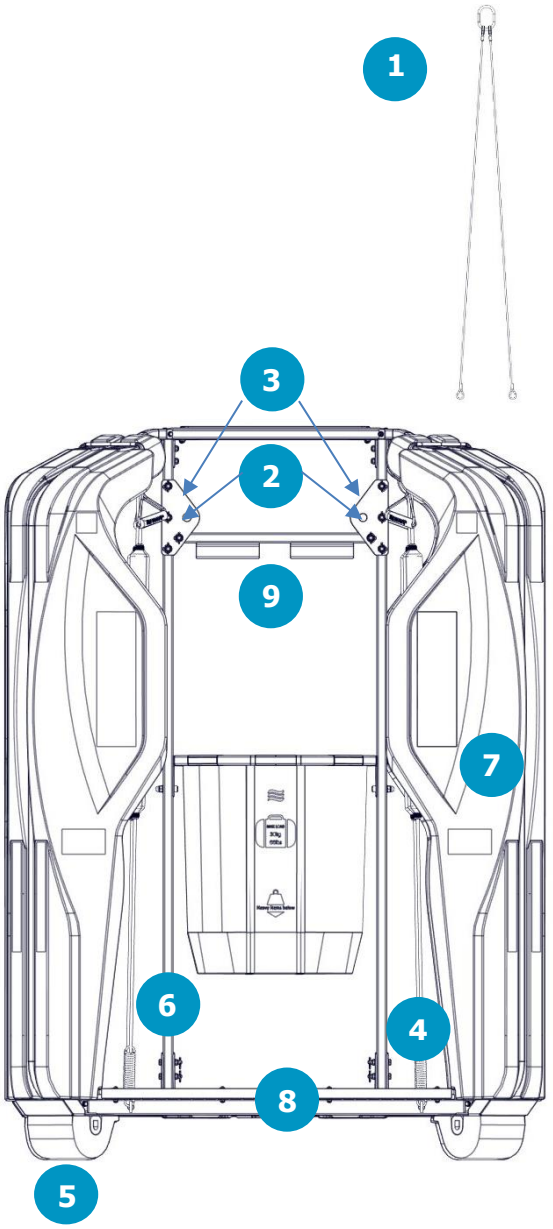
Item	Instruction	
Components Under Test	i. Lifting Assembly Safety Bolts, Lift Plates ii. Central Column Load Bearing Assembly. iii. Floor Structure.	
Test Proof Load	1350 kg	2976 lb
Test Proof Load Distribution	Load placed on the floor in the four corners and distributed evenly.	
Basis of Test Proof Load	Twice Maximum Gross Weight, less Tare Weight* = 2 x 850 kg – 350 kg = 1350 kg	
Crane Hook Load	1700 kg	3748 lb
Test Method	Lift the unit and hold static for 3 minutes.	

Table 16 Load Test Instructions

* ***Note: The maximum tare weight of the WAVE is approximately 350 kg (772 lb) but may vary slightly. Each WAVE must be weighed prior to load test***

4.8 Pre-use Check

Unit No		Date	
Inspected by		Signature	



Item	Description	Action
1	Lifting Assembly	Check correctly attached and in good condition.
2	Lifting Assembly Safety Bolts	Check split pins are fitted.
3	Lifting Plates, and safety bolts	Check free from any damage and tamper proof seals are fitted.
4	Passenger Restraints	Check operate correctly and attachment points are secure.
5	Landing Feet	Check free from any damage.
6	Lower Node Plate and safety Bolts	Check free from any damage and tamper proof seals are fitted.
7	Buoyancy	Check for damage to the panels and stickers.
8	Framework and Floor Grating	Check for any damage.
9	Load Test Plate	Check that the unit is certified for use.

Comments:

4.9 Inspection Tool List

To complete some of the inspection and maintenance requirements for WAVE the following tools may be required:

Required Tools	Optional Tools
1x 36mm Spanner / Wrench	Parts tray
1x 32mm Spanner / Wrench	Ladder/Platform
2x 19mm Spanners / Wrench	Hammer/ Mallet
2x 17mm Spanners / Wrench	Copper grease
2x 10mm Spanners / Wrench	Forklift/Overhead Crane
1x 19mm Socket	Inspection stands - Secure stands to elevate the unit for access to underside.
1x 17mm Socket	
2x 13mm Sockets with 6” extensions	
1x Socket Wrench	
1x Torque Wrench (for 60Nm and 45Nm)	
1x Pliers	
1x 6 mm Allen Key	
1x Slow-Release Ratchet Straps	

4.10 WAVE Inspection Checklist Form

WAVE Inspection checklist form (Page 1/3)					
Unit Serial Number		**Inspection date**		**Inspection Type**	
Installation / Vessel		**Inspected by**		**Visual Inspection (V)**	
No of Transfers / Year		**Company**		**Examination (E)**	
Usage Category		**Signature**		**Post Load Test Inspection (P)**	

No.	Item	V	E	P	Description	Comments	Pass/Fail /Action
1	**Lifting Assembly (Critical Part) (Consumable)**	✓	✓	✓	Check correctly attached. Check terminations and hardware. Remove cover and check each wire rope leg for signs of damage. Replace cover. Record Serial Number in comments.	Serial No.:	
			✓		Replace Lifting Assembly according to the WAVE usage level. Irrespective of apparent condition Lifting Assembly should be replaced at least every 12 months. Record new Serial Number in comments.		
			✓		**Tools Required:** 1x 36mm spanner, 1x 32mm spanner, 1x pliers. **Optional:** tray, hammer.		
2	**Lifting Assembly Safety Bolts (Critical Part) (Consumable)**	✓	✓	✓	Check for damage. Check split pins and tamper proof seals are fitted, and nuts are securely fastened. Replace items where required. Record Colour Code against certificates in comments.	Colour code:	
			✓		Remove and inspect thread and nuts for damage. Depending on the usage level, you might need to replace these bolts. If bolts are being re-used, clean threads and lubricate with copper grease. Replace split pins, nuts and tamper proof seals. Note: Hand tighten.		
			✓		**Tools Required:** 1x 36mm spanner, 1x 32mm spanner, 1x Pliers. **Optional:** tray, copper grease, hammer.		
3	**Lift Plates (Critical Part)**	✓	✓	✓	Check securely fastened and for any signs of damage. Record Serial Number in comments.	Serial No.:	
			✓		Remove each plate from the unit and check condition. Pay particular attention to cross holes.		
4	**Lift Plate Safety Bolts (Critical Part) (Consumable)**	✓	✓	✓	Check for damage. Check split pins and tamper proof seals are fitted, and nuts are securely fastened. Replace items where required. Record Colour Code against certificates in comments.	Colour Code:	
			✓		Remove and inspect thread and nuts for damage. Depending on the usage level, you might need to replace these bolts. If bolts are being re-used, clean threads and lubricate with copper grease. Replace split pins, nuts and tamper proof seals. Note: Tighten to 60Nm.		
			✓		**Tools Required:** 2x 19mm Spanner, 1x Pliers, 1x Torque Wrench, **Optional:** Parts Tray, Hammer		

WAVE Inspection checklist form (Page 2/3)							
No.	**Item**	**V**	**E**	**P**	**Description**	**Comments**	**Pass/Fail /Action**
5	**Lower Node Plate (Critical Part)**	✓	✓	✓	Check securely fastened and for any signs of damage. Record Serial Number against certificates in comments	Serial No.:	
			✓		**Tools Required: Optional:** Forklift/Overhead Crane		
6	**Node Plate Safety Bolts (Critical Part) (Consumable)**	✓	✓	✓	Check for damage. Check split pins and tamper proof seals are fitted, and nuts are securely fastened. Replace items where required. Record Colour Code against certificates in comments.	Colour code:	
			✓		Remove and inspect thread and nuts for damage. To avoid the central column shifting position remove only 2 bolts at one time. Depending on the usage level, you might need to replace these bolts. If bolts are being re-used, clean threads and lubricate with copper grease. Replace split pins, nuts and tamper proof seals. Note: Tighten to 45Nm.		
			✓		**Tools Required:** 2x 17mm Spanners, Inspection Stands. **Optional:** Forklift/Overhead Crane, Hammer		
7	**Passenger Restraints**	✓	✓	✓	Check that the bottom and top attachment points are secure and free from damage. Check ropes are not frayed or overly faded. Check tension of each restraint: they should be tight enough to allow the passenger to lean against the restraints, but not so tight that they made entry difficult. Note: The length of the spring should be 180mm to 210mm measured from the loop bearing faces.		
			✓		**Tools Required:** 2x 10mm Spanners, 1x Slow Release Ratchet Straps. Optional: Forklift/Overhead Crane, Hammer		
8	**Landing Feet**	✓	✓	✓	Check each foot for any signs of damage. Measure and record the height of each foot. Replace foot when foot height is under 105mm. Note: Securing bolts to be wrench tight.	Foot A: C: B: D:	
			✓		**Tools Required:** 2x 13mm Socket with 6" extensions, Inspection Stands. **Optional:** Forklift/Overhead Crane		
9	**Framework**	✓	✓	✓	Check for any signs of damage or excessive corrosion. Inspect welds for signs of deformation of cracking. Note: Replace any parts deformed greater than 10mm or any signs of cracking.		
			✓		**Tools Required:** 2x 17mm Spanners, Inspection Stands. Optional: Forklift/Overhead Crane		
10	**Buoyancy**	✓	✓		Inspect each panel for any signs of damage. Note: Replace the panel if the foam core has been exposed, or if the panel is no longer secure when fitted.		
					Tools Required: 1x 6 mm Allen Key. Optional: Overhead Crane, Ladder/Platform		
11	**Floor Grating**	✓	✓	✓	Check both sections of floor grating for any damage. Ensure that the bolts securing the grating are secure. Inspect the edging strips for any damage. Note: Replace damaged floor grating, in order to do so the passenger restraints will need to be removed.		
					Tools Required: 1x 6 mm Allen Key, Inspection Stands. Optional: Overhead Crane		

WAVE Inspection checklist form (Page 3/3)							
No.	**Item**	**V**	**E**	**P**	**Description**	**Comments**	**Pass/Fail /Action**
12	**Luggage Storage**	✓	✓		Check that there is no damage to the luggage basket, and Velcro attachment points. Note: Replace item when damaged		
13	**Stickers**	✓	✓		Check that all stickers are on the unit. Replace items when damaged or have become badly faded		
14	**Stretcher Fittings**	✓	✓		Inspect the stretcher fittings for any signs of damage and test fit the stretcher to ensure that the straps work correctly. Note: Replace the straps if they are badly damaged or have become overly faded.		
15	**Clean Unit**	✓	✓		Clean the unit with fresh water / mild detergent, pay particular attention to passenger riding positions.		
No.	**Item**	**V**	**E**	**P**	**Reports**	**Comments**	**Complete Y/N**
16	**Report**	✓	✓	✓	Prepare inspection report including photographic report		
17	**Unit marking**	✓	✓	✓	Stamp date and Inspection type onto Load Test Plate		
18	**Certification**	✓	✓	✓	Update certification pack		
NOTES:							

4.11 Replacement Parts

RML hold most replacement parts and accessories in stock and can supply most individual components. A full list of parts is contained in the Customer Drawing Pack, issued with every unit.

- Replacement parts can be supplied as individual items or as appropriate kits.
- Before ordering, please identify your unit serial number, found on the unit data plate.

It is advisable to hold an inventory of frequently used parts. This will help to ensure the continued safe operation of the carrier. Minimum stock quantities will be influenced by:

i. Remoteness of location
ii. Downtime implications
iii. Usage Level
iv. Customs processing time
v. Delivery cost for small parts

RML can recommend stock items and quantities for your operation.

It is recommended that you only use genuine OEM parts.

Kits - The following kits are available for routine and non-routine maintenance.

Kit Name	Part Number	Contents
Lifting Assembly Kit, 6m	RA0496	Wire rope lifting assembly High visibility cover Cover fixings
Replacement Parts Kit	RA0483	Lifting assembly safety bolt Lift plate safety bolts Node plate safety bolts Associated nuts, cotter pins, and seals.
Critical Part Kit, 6m Lifting Assembly	RA0497	Replacement parts kit RA0483 plus Lifting assembly kit RA0497
Restraint Kit	RA0490	4 x Passenger restraints assembly
Landing Foot Kit	RA0491	4 x Feet Associated fixings
Full-Service Kit	RA0498	1 x Lifting assembly kit (6m) 1 x Replacement parts kit 1 x Restraint kit 1 x Landing foot kit

Table 17 WAVE Replacement Part Kits

Parts - The following parts and kits are available for routine and non-routine maintenance.

Part Name	Part Number
Lifting Assembly Kit, 6m	RA0496
Lifting Assembly Kit, 4m	RP0489
Lifting Assembly Kit, 3m	RA0517
Lifting Assembly Safety Bolt	RP0432
Passenger Restraint	RA0460
Foot	RP0451
GRP Floor Grating Panel, Complete	RP0526
Buoyancy Panel	RP0419
Buoyancy Sticker Set	RA0421
Lift Plate Safety Bolt	RP0457
Node Safety Bolt	RP0458
M12 Hex Nyloc Nut	112-000-NN-4
M10 Hex Nyloc Nut	110-000-NN-4
M5x36 Split Cotter Pin	105-036-SP-2
M3.2x28 Split Cotter Pin	1032-028-SP-2
Tamper Proof Seal	100-000-TS-4

Table 18 WAVE replacement parts

4.12 Parts identification

Each assembly or part is assigned a part number which provides the unique identification of the part /assembly.

Where material grades and material traceability are deemed to be safety critical these components will be stamped with a unique serial number. For bolts, where etching is impractical, batches will be colour coded and a note added to the mill certificate to identify the colour used.

Components that require unique identification are referenced in the parts list.

4.13 Storage

Replacement parts should be stored in dry clean environments and be suitably labelled and tagged.

5 Certification

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Danmark

Machinery Directive - Attestation of Conformity

Certificate number:	**DK-MAC000008 i01**
Certificate Holder and Manufacturer	**Reflex Marine Old School House. School Hill, Shortlanesend, Truro Cornwall, United Kingdom**
EC Representative	**Reflex Marine SL Carrer de Ramon Turro, 100 08005 Barcelona Spain**
Product(s)	**Wave 4**
Product Type	**Wave-4 Personnel Transportation Capsule**
Apparatus (inc Variants)	**Standard**
Standards	**BS EN ISO 12100:2010 Safety of machinery. General principles for design. Risk assessment and risk reduction Note: See full Design Dossier file for complete list.**
Test/Assessment Reports	**See Technical File for tests and calculation reports.**
Technical Documentation File Identity	**WAVE Technical File 16.02.22**

This Attestation of Conformity is issued on a voluntary basis according to Council Directive 2006/42/EC related to Machinery. It confirms that the listed equipment complies with the Essential Health and Safety Requirements of the listed Directive. It refers to the sample submitted for testing and inspection and only relates to this sample in the build state and configuration at the time of test/inspection.

Valid from: 11/03/2022 Ian Wright - TÜV SÜD

TÜV SÜD Danmark is an accredited Certification Body of TÜV SÜD.

This Attestation has been issued in accordance with the TÜV SÜD Testing and Certification Regulations.

The CE marking may be used on the equipment described above, subject to the equipment meeting the requirements of all applicable EU directives.

For further details related to this Attestation please contact babt@tuvsud.com

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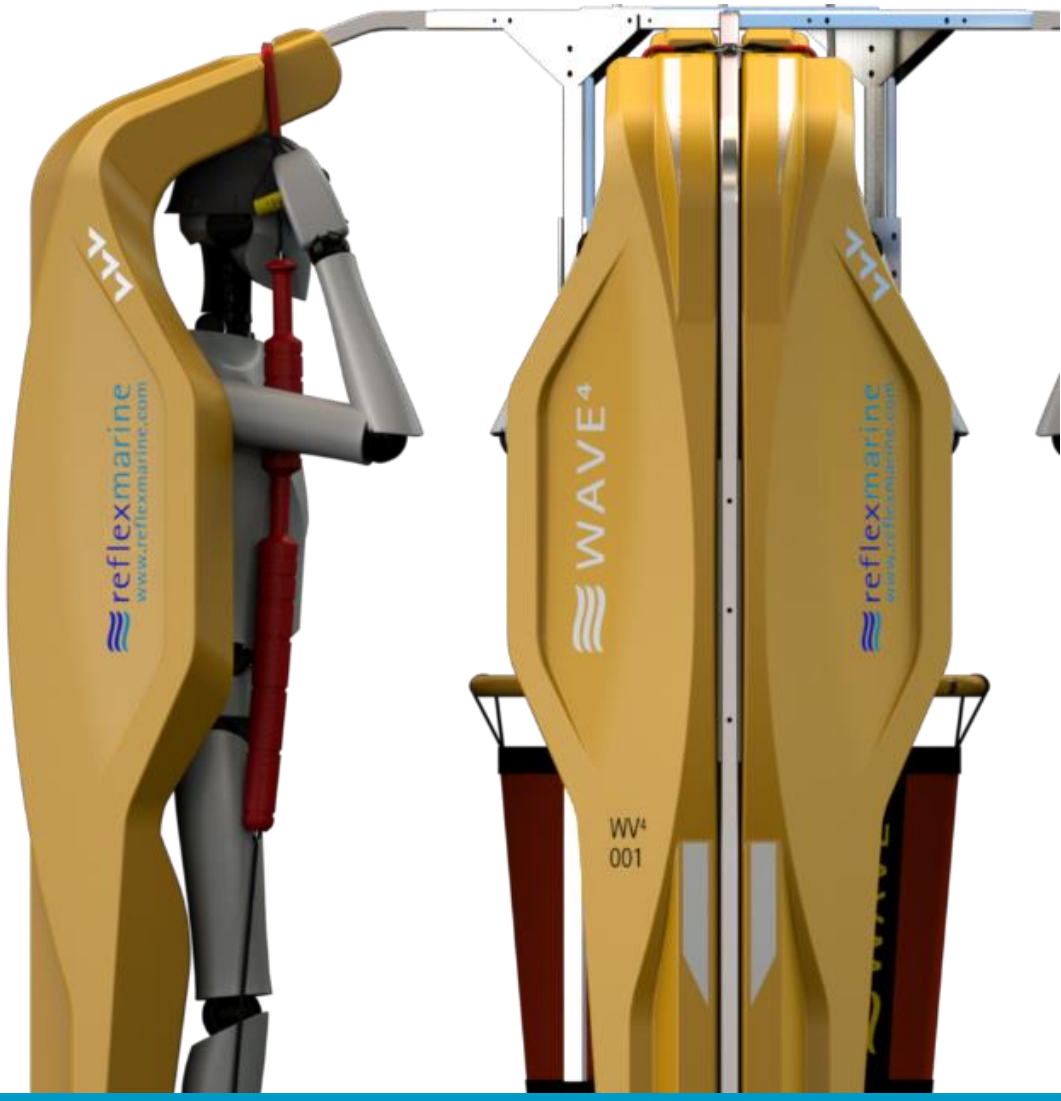
Figure 4 RML Attestation of Conformity

WAVE⁴



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