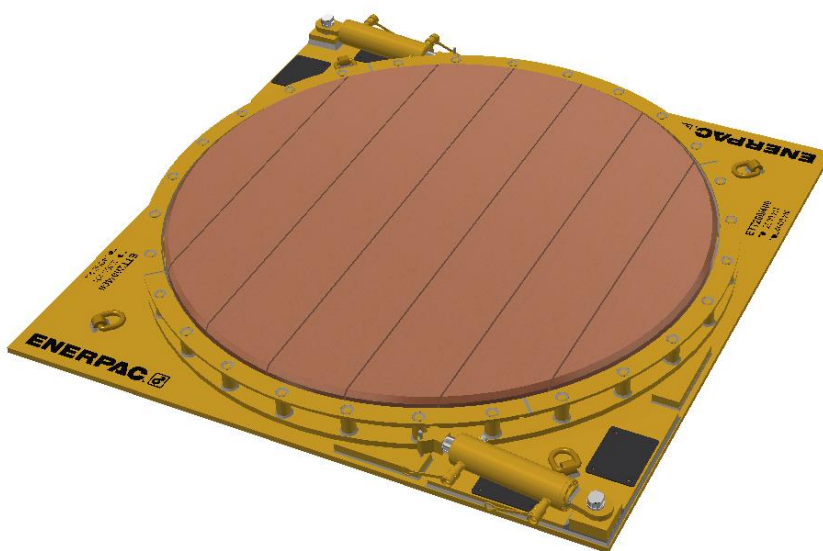


Instruction- and Maintenance Manual Turn Table ETT-200/400

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Preface

Dear customer,

This is the manual for assembling, operating and maintaining the Turn Table. In the rest of this manual, this machine is referred to by the term “**System**”.

The manual is part of the handbook of the System, and is meant to be used by operators and by maintenance engineers.



NB: It is essential that the user reads this manual completely **before** start working with the System.



- All information, illustrations and technical data in this manual are applicable to the System as it was at the **time of issuing** of this manual.
- We continuously **improve** our products and therefore reserve the right to implement improvements and **changes** whenever it is necessary and possible to do so, without any obligation to apply improvements or changes to models purchased previously. Nevertheless, when the system is improved due to serious **safety issues**, you as a customer will be informed.
- If this manual becomes **unreadable**, in whole or in part, you can order a copy by providing us the number given on the front cover.
- Despite the fact that this manual has been drafted with great care, we **cannot guarantee** that it does not contain any errors.
- The use and interpretation of all information in this manual and the possible consequences through improper use of the system are wholly the **responsibility of the user**. Enerpac shall under no circumstances accept any responsibility for such improper use.

Pictures and illustrations in this manual may differ from reality.

Within this document use is made of **structured text**. The following conventions are applied:

- Procedural steps are numbered. Execute the steps sequentially. Do not skip any step.
- Responses of the system are written on the next line in italic font.
- Choices are indicated with bullets.

Example:

1.	Press the green button. <i>The motor starts running.</i>	
2.	Select one of the options: <ul style="list-style-type: none">• Use the red button to stop the motor• use the blue button to pause the machine.	

We are interested in improving our documentation, and we welcome your comments and suggestions. If you have any difficulties using this manual, discover an error, or just want to provide some feedback, contact us. Please include the handbook code as shown at the front page.

We hope this manual will help you to use the System properly.

Enerpac

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1 Introduction

1.1 Manufacturer address

Enerpac Heavy Lifting Technology B.V.
 Zuidelijke Havenweg 3,
 7554 RR Hengelo (Ov)
 The Netherlands
 Tel. +31 74 242 20 45
 Fax. +31 74 243 03 38
 Email: info.hengelo@enerpac.com
 Website: www.enerpac.com

1.2 Declaration

Declaration of Conformity according to Machine Directive 2006/42/EC.
 For the EC Declaration of Conformity reference is made to ref [3] “EC Declaration of conformity” which is part of the product delivery.


1.3 Referenced documents

The following documents are referred to in this manual:

Ref	Name	Identification	Manufacturer
1.	General rules and safety requirements for systems and their components	NEN-EN-ISO 4413	NEN
2.	Technical handbook		Enerpac
3.	EC Declaration of conformity		Enerpac
4.	ASME B30.1-2015	Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries. (Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks and Slings)	American Society of Mechanical Engineers

1.4 Identification

Each main component is fitted with a name plate as shown below.



The name plate is a rectangular metal plate with four corner mounting holes. It features the Enerpac logo and CE mark at the top. Below, there are several rows of text labels followed by blank lines for handwritten information:

- Type
- Drawing
- Order nr.
- Machinery part
- Description
- Year of manufacture
- Self weight

At the bottom, the manufacturer's contact information is printed:

Enerpac Heavy Lifting Technology B.V.
 Zuidelijke Havenweg 3 7554RR Hengelo - The Netherlands
 Tel. +31(0)74 24 22 045 Service tel. +31(0)74 85 04 777

NB: Name plates are official documents. It is not permitted to alter them or render them illegible.

1.5 Liability

- Personnel as well as other people involved in the usage of the System are expected to have read and **understood** this manual.
- In cases of **doubt** about the use or application of this machine, always contact Enerpac for advice and recommendations.
- **Unauthorised alterations** to the machine may have a deleterious effect on the characteristics of the machine and may disrupt the control functions. Unauthorised alterations therefore annul any resultant damage claims against Enerpac.
- The **risk analysis** conducted by Enerpac, intended usage and reasonably foreseeable incorrect usage of the System were assessed. The instructions in this manual were drawn up based on this analysis.

1.6 Intended use

The definition of 'intended use' excludes any and all uses which do not meet the descriptions, including use that exceeds the machine's technical limitations. Enerpac shall not accept any liability for damage resulting from use that is not in accordance with the machine's intended use. The user shall bear any and all risks. The definition of 'intended use' also includes strict compliance with the instructions in the user manual and assumes that the equipment is inspected and maintained at the indicated times.

- The System should only be used in the **intended manner** as described in the instructions in this manual.
- The System should only be operated by **operators** with full knowledge of the applicable safety regulations and the hazards which may arise during use.
- The System was developed and built according to the officially recognized safety **regulations**. However, if the machine is not used as intended:
 - This may pose a **risk** to the health and lives of operators and bystanders.
 - The System may not function properly or may create **hazardous** situations.
- The System should only be used if the machine is in perfect technical **condition**.
- Faults which may result in hazardous situations must be **resolved** immediately.
- The machine must not be used in potentially **explosive** environments.

The Turn Table is a custom developed device to turn loads clockwise and counter clockwise.

1.7 Modifications

Never make any **modifications** or additions which could have an adverse impact on safety without prior approval from Enerpac. This also applies to the installation and adjustment of safety devices and valves and welding work on the System.

Spare parts should meet the technical specifications given by Enerpac.

Apply **original spare parts** as these parts are made according the technical specifications of Enerpac. In cases of doubt, please contact Enerpac.

1.8 Personnel and responsibilities

- Only **qualified personnel** are allowed to **operate** the System.
Qualified personnel are those who have certified skills to operate the System.
They should preferably have received training from Enerpac, or else from the customer.
- Only **qualified personnel** are allowed to **maintain** the System.
Qualified personnel are those who have certified main education for the jobs they have to perform, either mechanical, hydraulically or electrical.
They should preferably have received training from Enerpac, or else from the customer.
- **Qualification** of the personnel is a responsibility of the customer.
- Always comply with legal **minimum age** stipulations.
- The System should only be used, maintained and repaired by properly **instructed** and **trained** personnel. Clearly describe the qualifications of the relevant employees with regard to use,

commissioning, assembly, disassembly and all maintenance and repair work. If work must be performed by third parties, they must receive clear instructions so both the client and the contractor are up-to-date on the agreements reached.

- The supervisor and operator are authorized to refrain from following any instructions from **third parties** that may pose a risk to the machines or bystanders.
- Personnel who have **not been fully trained** and instructed in the use of the machine, or personnel who have only received general training, may only perform work on the System under continuous **supervision** of a qualified person.
- Work on the **electrical** and the **hydraulic systems** must be performed by competent, qualified personnel, or by trained personnel under the direct supervision of qualified personnel, in compliance with all applicable rules and regulations.
- **Assembly and disassembly** may only be performed by trained installers under the supervision of an authorized person who has adequate knowledge of the System.

The responsibilities listed the following sub-sections are in accordance with the standard as referred to in Ref [4] ASME B30.1-2015.

In some situations, the owner and the user may be the same entity and is therefore accountable for all of the following responsibilities listed in this chapter.

In other cases, the user may lease or rent the system without supervisory, operational, maintenance, support personnel, or services from the system owner. In these situations, sections 1.8.1 “The owner of the system” and 1.8.2 “The user of the system” shall apply.

1.8.1 The owner of the system

The responsibilities of the owner of the system are:

- a) to make sure the system meets the requirements as given in this manual as well as specific job requirements defined by the user,
- b) to make sure the system and all necessary components, specified by the manufacturer, meet the user's requested configuration and capacity,
- c) to provide the applicable capacity charts to the user,
- d) to provide this manual to the user to enable correct assembly, disassembly, operation and maintenance information,
- e) to make sure all inspections and maintenance activities are performed,
- f) to designate personnel for maintenance, repair, transport, assembly, and disassembly,
- g) and to designate personnel for inspections as required in the applicable chapters.

1.8.2 The user of the system

The responsibilities of the user of the system are:

- a) to comply with the requirements of this manual and all regulations applicable at the work site,
- b) to use supervisors for activities,
- c) to ensure that the system is in proper operating condition, prior to initial use at the worksite by
 - verifying that the Owner has provided this manual,
 - and verifying that a frequent inspection has been performed,
- d) to verify that the system has the necessary capacity to perform the proposed operations in the planned configuration,
- e) to ensure the assigned operators have been notified of adjustments or repairs that have not yet been completed, prior to commencing operations,
- f) to designate personnel for inspections as required in the applicable chapter,
- g) to designate personnel for maintenance, repair, transport, assembly, and disassembly,
- h) to ensure that all personnel involved in maintenance, repair, transport, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards,
- i) and to ensure that the inspection, testing, and maintenance programs specified by owner are followed.

1.8.3 The site supervisor

In some cases, the site supervisor and the system director may be the same person.

The responsibilities of the site supervisor shall include the following:

1. ensuring that the system meets the requirements prior to initial site usage.
2. determining if additional regulations or requirements are applicable.
3. ensuring that a qualified person is designated as the system director.
4. ensuring that the operations are coordinated with other jobsite activities that will be affected by or will affect the operations.
5. ensuring that the area for the system is adequately prepared. The preparation includes, but is not limited to, the following:
 - a. access for the system and associated equipment.
 - b. sufficient room to assemble and disassemble the system.
 - c. an operating area that is suitable for the system with respect to levelness, surface conditions, support capability, proximity to power lines, excavations, slopes, underground utilities, subsurface construction, and obstructions to operation.
 - d. traffic control as necessary to restrict unauthorized access to the system's working area.
 - e. ensuring that work involving the assembly and disassembly of system is supervised by a qualified person.
 - f. ensuring that operators meet the physical, knowledge, and skill requirements as described in this manual.
 - g. ensuring that conditions that may adversely affect the operations are addressed. Such conditions include, but are not limited to, the following:
 - poor soil or support conditions
 - wind velocity or gusting wind
 - weather conditions
 - extreme temperatures
 - inadequate lighting
 - operating surface conditions
 - excessive noise proximity to energized sources (e.g., power lines, pressurized lines)
 - ensuring that work performed by the rigging crew is supervised by a qualified person
 - ensuring that maintenance is performed by a designated person

1.8.4 The system director

The system Director's responsibilities shall include the following:

- a. being present at the job site during the operations.
- b. stopping the operations if alerted to an unsafe condition.
- c. ensuring that the preparation of the area needed to support the operation has been completed before the operation starts.
- d. ensuring necessary traffic controls are in place to restrict unauthorized access to the system's work area.
- e. ensuring that personnel involved in the operations understand their responsibilities, assigned duties, and the associated hazards.
- f. addressing safety concerns raised by the system operator or other personnel and being responsible if he decides to overrule those concerns and directs the operation to continue. In all cases the manufacturer's criteria for safe operation and the requirements of this manual shall be followed.
- g. designating the signal person(s) and conveying that information to the system operator.
- h. evaluating the operation in proximity to energized sources.
- i. ensuring precautions are implemented when hazards associated with special load handling operations are present. Such operations may include, but are not limited to, the following:
 - multiple types of system used simultaneously
 - shifting centre(s) of gravity or lifting below the centre of gravity
 - shifting, inclined, or moving surfaces
 - operating barges
 - informing the system operator of the weight and planned movement of the loads to be handled.

- obtaining the system operator's verification that this weight does not exceed the system's rated load.
- ensuring that load rigging personnel have been designated for the system.
- ensuring that the load is properly rigged and stable.

1.8.5 The operators

The system Operator shall be responsible for the following listed items.

The system Operator shall not be responsible for hazards or conditions that are not under his direct control and that adversely affect the system operations.

Whenever the system Operator has doubt as to the safety of operation, the system Operator shall stop the system functions in a controlled manner. System operations shall resume only after safety concerns have been addressed and the continuation of the operation is directed by the system Director.

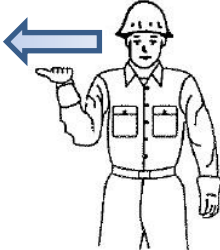
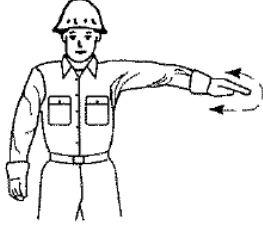
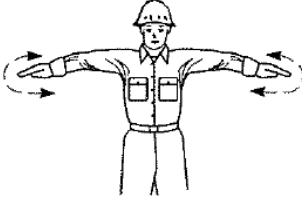
The system Operator's responsibilities shall include the following:

- a. reviewing the requirements for the system with the Director before the operations.
- b. knowing what types of site conditions could adversely affect the operation of the system and consulting with the system Director concerning the possible presence of those conditions.
- c. understanding and applying the information contained in this manual.
- d. understanding the system's functions and limitations as well as its particular operating characteristics.
- e. using the system's load/capacity chart(s) and diagrams and applying all notes and warnings related to the charts to confirm the correct system configuration to suit the load, site, and load handling conditions.
- f. refusing to operate the system when any portion of the load or the system could be adversely affected by proximity to energized sources until evaluated and approved by a qualified person.
- g. performing inspections as specified in the applicable chapter.
- h. promptly reporting the need for any adjustments or repairs.
- i. following applicable lock out/tag out procedures,
- j. not operating the system when physically or mentally unfit.
- k. ensuring that all controls are in the off or neutral position and that all personnel are in the clear before energizing the system.
- l. not engaging in any practice that will divert his attention while actually operating the system controls.
- m. testing the system function controls that will be used and operating the system only if those function controls respond properly.
- n. operating the system's functions, under normal operating conditions, in a smooth and controlled manner.
- o. knowing and following the procedures specified by the system manufacturer or approved by a qualified person for assembly, disassembly, and setting up the system.
- p. knowing how to travel the system, if applicable.
- q. ensuring that the load and rigging weight(s) have been provided.
- r. calculating or determining the rated load for all configurations that will be used and verifying, using the capacity chart(s), that the system has sufficient capacity for the proposed operation.
- s. considering all factors known that might affect the system capacity and informing the system Director of the need to make appropriate adjustments.
- t. knowing the standard and special signals as specified in the applicable chapter and responding to such signals from the signalperson. When a signalperson is not required, the system Operator is then responsible for the movement of the system. However, the system Operator shall obey a stop signal at all times, no matter who gives it.
- u. Understanding of rigging and basic rigging procedures. Ensuring that the load is properly secured and will be rotated safely.
- v. if power fails during the operations
 - set all locking devices
 - move all power controls to the OFF or neutral position
 - secure and stabilize the load, if practical
- w. before leaving the system unattended
 - secure and stabilize the load
 - set all locking devices
 - put the system controls in the OFF or neutral position
 - turn off the system power source

- follow the recommendations as given in this manual or given by a qualified person for securing the system

1.9 Hand signals

The following hand signals are applicable when using the system:

<p>ROTATE</p> <p>Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.</p>		<p>STOP.</p> <p>Arm extended, palm down, move arm back and forth horizontally.</p>	
<p>EMERGENCY STOP.</p> <p>Both arms extended, palms down, move arms back and forth horizontally.</p>			

1.10 Lifetime

The intended period of use is less than 10000 cycles, though the safe and effective lifetime strongly depends on:

- the intensity of use,
- the quality of the maintenance,
- the service conditions the system is exposed to, like wet or salty environments,
- and the load to which the system is exposed.

1.11 Warning symbols used within this document

In this manual warnings and symbols are used to draw your attention to important safety information. The table below shows the applied warnings and symbols:



NB is used to highlight important **work activities** and for **additional information**



Caution is used if failure to heed the given instructions may result in **damage to the system**.



Attention is a general warning to the operator of potential damage to **equipment** and the **environment**.



Hazard draws the user's attention to potential **hazards to personnel** if work instructions are not followed precisely

2 General safety aspects

This chapter contains general safety aspects.
Specific safety directions are mentioned in other chapters.

2.1 Mandatory protective gear

While using the System ensure that the locally applicable safety regulations are observed

Make sure that all people on the working place observe the following safety regulations:



Always wear safety goggles
and a safety helmet



Always wear safety footwear



Wear safety gloves.
But we strongly advise not to wear them when operating
handheld control consoles



Wear a safety harness when working at heights more
than 2 meters

2.2 General safety regulations

Special safety regulations are given in the relevant national legislations or company regulations for accident prevention. Compliance with these rules and regulations is a legal requirement and a condition of employment. In addition to the safety regulations set out under the law, also observe the following points:

- Keep the worksite **clean**.
- Before every start-up, always check that there are no **persons** in an unsafe situation or position with respect to the System. Stop working if, despite warnings, there are still employees in an unsafe situation.
- Only use the System on an adequately stable and robust **subsurface**.
- Keep all equipment out of the area of above-ground **power lines**.
- The **coverings** must be closed (this does not apply to the covering on control panels).
- The operator must switch off the System before leaving it **unattended**.
- Use all required **Personal Protection Equipment (PPE)**.
- Do not wear any loose **clothing or jewellery**. Long hair must be tied back.
- **Tools** and equipment, necessary for (dis-)assembly of the System as well as for maintenance have to be in good condition. Badly maintained equipment can cause time wastage and lead to permanent damage to the equipment and/or its surroundings
- Keep the hydraulic and moving equipment of the System **clean** to prevent it from jamming or causing damage to itself or other equipment.
- Do not use the System, whether loaded or not, while unauthorized people are in its **vicinity**. The System can be operated remotely.
- Maintain **focus** during the work. Carelessness may result in serious injuries.
- Additional **rotating gear** and accessories such as hawsers, shackles, lugs, slings etc. must comply with the legal requirements imposed in the country of use.
- **Inspect** the condition of the System before every individual start-up, given the fact that the slightest defect may have severe consequences.
- Personnel shall not place any **part of their body** under the load.

- Personnel shall **remain clear** of the system during operation.
- Personnel shall **not ride** on the system while it is moving or being moved.
- Remove loose tools or components from the load or the System if the load will be moved as they might fall down during moving, which can lead to fatal accidents.

Enerpac is not liable for improper use of accessories in combination with the System.

2.3 Symbols applied to the System

The System can be labelled with

- warning symbols,
- and mandatory signs.

The table below shows the most commonly used **warning symbols** in industrial environments:



Danger of contact with moving machine parts



Danger
Lethal voltage in the control panels



Danger of **parts of hands** getting trapped/caught



Danger of **parts of feet** getting trapped/caught



Danger of **falling**



Danger
Exercise extreme attention and caution when **under moving loads**.



Danger of getting **trapped**/caught between moving parts.

The table below shows the most common symbols of **mandatory signs** in industrial environments:



Read the instruction manual.



Wear **gloves** to prevent injury from and/or exposure to chemicals.



Wear safety **glasses** to prevent eye injuries.



Wear safety **shoes** to prevent injuries caused by falling objects and/or feet getting caught in machinery.



Wear **hearing** protection.



Wear a safety **helmet** to prevent injuries caused by falling objects.



Wear a safety **harness**



NB:

- The stickers on the machine are official documents and it is not permitted to alter them or render them illegible
- It is strictly obligatory to observe the warning symbols and the mandatory signs applied to the machine.

2.4 Welding work

- Welding, cutting and grinding work on the System is only permitted with the **prior written consent** of Enerpac.
- Welders must be properly qualified and must have a valid welding certificate.
- If welding work needs to be performed on the System then
- Switch the machine off
- Disconnect all power cables and communications cables
- Connect the system to a direct earth line.



NB: welding, cutting, grinding or any other structural adjustment work on the System is not permitted without Enerpac's prior written permission

2.5 Working on the hydraulic system

- Work on the hydraulics system or other components in a pressurized system must be performed by a **competent, qualified installer** or by trained personnel under the direct supervision of a qualified installer, in compliance with all applicable rules and regulations.
- Check all pipes, hoses, quick-release couplings and screw joints **regularly** for leaks and visible external damage. Repair damage immediately. Pressurized hydraulic fluid leaks may cause serious injury, and it may cause fire and damage to the environment.

- If parts need to be removed from the hydraulic system, the **hydraulic pressure must be released** according to the instructions in this manual before beginning work.
- Expand and install pressurized hydraulic pipes, tubes and lines in accordance with professional standards.
- Make sure that no ports have been **switched** during re-installation work.
- All parts and the length and quality of hoses meet the requirements of Ref 1 “General rules and safety requirements for systems and their components”.

2.6 Fire

The course of action in the event of an emergency is determined by the rules and regulations applicable on the worksite. Every company has its own special rules. So make sure you are up-to-date on these rules.

In any case, the following actions are necessary in the event of a fire:

- Keep **calm**.
- **Report** the emergency to the employee responsible for in-house emergency services (IHES). Tell who you are, where you are located and describe the emergency situation. (The IHES employee will notify external emergency services.)
- **Warn** your colleagues.
- **Extinguish** the fire if it is still in its early stage, using the extinguishing means available onsite.
- If possible, **switch off** the electrical power supply.
- Leave **the scene** of the emergency situation and report to the rendez-vous point.



Caution: Never use water to put out an electrical fire or a fluid fire

2.7 Working with hazardous substances

It is thought that special first aid procedures are required in cases of accidents with chemicals. But in cases of small quantities, standard measures suffice:

1. rinse thoroughly with water
2. wash with soap
3. provide fresh air
4. remove any contaminated clothing

In common the following rules are applicable:

- Contact with **skin**:
 - rinse thoroughly with water
 - remove any contaminated clothing
 - wash the relevant body parts with soap.
- Contact with **eyes**:
 - rinse thoroughly with water (10 till 15 minutes) using eye wash fountain
 - consult a doctor.
- Ingestion:
 - rinse the mouth out with water.
 - If necessary, dilute the substance by drinking water.
 - If a corrosive substance has been ingested, do not induce vomiting. This is to prevent the substance coming into contact with the sensitive oesophagus again.
 - If the victim is unconscious, never attempt to induce vomiting or have the victim drink anything.

Using a ‘neutralizing solution’ (such as a base for an acid) can actually make the situation **worse**.

In addition to this, it is advisable to consult the safety information (TREM CARD book, safety information sheets and the catalogue) and report everything that is relevant to the accident to a doctor.


When work has to be done in confined spaces:

- Wear personal protection equipment
- ventilate according to the relevant regulations
- Ask a colleague to remain by the entrance in order to provide assistance in the event of an emergency.
- You are legally required to be **familiar with the potential hazards** of the product.
The safety information sheets are intended to provide adequate, correct and up-to-date information on all substances used on the worksite.
- Relevant safety information sheets are given in E “Hydraulic fluid safety information”.

During maintenance, you may work with substances fitted with **GHS symbols**.
These GHS symbols are explained in the next below.¹

Symbol	General hazard indication	Possible precautionary measures
	May cause an allergic reaction on the skin.	Contaminated work clothing must not leave the workspace.
	Harmful to aquatic organisms, with long term effects	Do not discharge into the environment.
	Causes serious eye injury and/or damage to the skin.	Wear eye protection and skin protection (such as protective gloves).
	Fire hazard when heated and/or in presence of sparks.	Keep away from heat, sparks, open flames and/or hot surfaces. No smoking!
	May cause fire (oxidising agent).	Take the necessary precautionary measures to prevent mixture with flammable substances.
	Toxic in cases of ingestion and/or skin penetration	Do not eat, drink or smoke when using this product.
	May cause hypersensitivity of the airways or heritable mutations in male reproductive cells, is a potential carcinogen and/or is toxic to human reproduction	Apply a strict hygiene/health policy and wear suitable personal protection equipment.
	Explosion hazard when heated and/or in presence of sparks	Keep away from heat, sparks, open flames and/or hot surfaces. No smoking!

¹ CLP is the Regulation on Classification, Labelling and Packaging of substances and mixtures (EC No 1272/2008). This regulation brings European legislation on the classification, labelling and packaging of chemical substances into accordance with the GHS (Global Harmonised System for classification and labelling of chemical substances). The GHS is a United Nations system used to identify chemical substances and inform users of their hazards using standard symbols and phrases on labels, packaging and Safety Information Sheets (SIS).

Symbol	General hazard indication	Possible precautionary measures
	Contains a gas under pressure. May explode if heated	Keep out of sunlight. Store in a well-ventilated space.

2.8 Assembly and disassembly

- **Assembly** and disassembly of the System has to be performed by properly trained operators
- Only use **certified lifting** and hoisting equipment.
Check the validity of these certificates and qualifications.
- Only use lifting and hoisting equipment with **suitable capacity** for the loads in question.
- Before commissioning, any parts that were disassembled for transport must be **re-assembled**, re-installed, checked and approved by qualified personnel.
- Make sure that the **instructions in this manual** have been followed precisely before commissioning the System.
- **Lift** loads as described in the user manual (connection points for lifting hooks) and observe the professional standards.



Hazard: Any components that are blocked or stuck in any way (and any parts connected to these components) will be under mechanical tension. If you release these parts, they could change position suddenly and seriously injure you

2.9 Transport, loading and unloading of the System

- Loading and unloading has to be performed by properly trained operators
- Only use lifting and hoisting equipment with suitable capacity for the loads in question.
- Lift loads as described in the user manual (connection points for lifting hooks) and observe the professional standards.
- Only use suitable containers with adequate load-bearing capacity for transport purposes.
- Secure the load properly using suitable connection points and twist locks (for the containers). When using twist locks secure them properly and check that the locking mechanism is working correctly.
- Disconnect all electrical and hydraulic connections when the System has to be moved, even if it is for only a short distance.
- To avoid damage during transport use timbers, rubber pads and plastic for packaging.
- Containers may be used for transport, since they provide rigid protection against and avoid weather influences. Make sure that all parts are secured against sliding around.


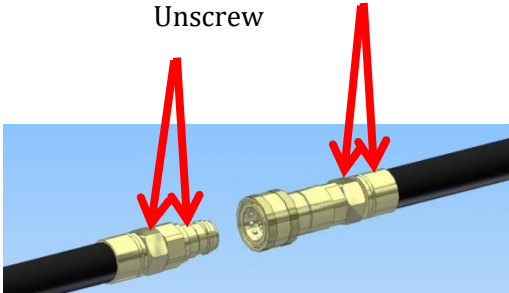
2.10 Dealing with hoses

2.10.1 Common directions

- Make sure the **maximum** permitted pressure is never exceeded:
 - Do not change any safety setting.
- Ensure that the **accumulators** and by-pass hoses are in good condition.
- Do not **drive over** or stand on the hoses:
 - Standing on and driving over the hoses causes damage to the hose fabric, which causes leaks.
 - A sudden increase in pressure caused by squeezing the hose causes serious damage to other components.
- Do not **pull** on a hose that is connected:
 - If pulling forces are exerted on a hydraulic coupling the hose and coupling interface will weaken which may result in the hose bursting out of the coupling.
 - Always lift a hose by the hose itself, whilst supporting the coupling.

- Stow hoses in such a way that no forces (gravitational force) are exerted on the coupling.
- While moving the hoses, prevent the couplings **being dragged** over the ground:
 - Prevent excessive wear on the couplings and hoses by transporting them on pallets, if possible.
 - During assembly the hose must be supported by necessary use bend guides to prevent twisting of the hose.
- Protect the hose **sleeve** in places where chafing etc. cannot be avoided:
 - Wear spots can be prevented by sliding protective sleeves over areas where wear is expected or by covering sharp edges.
- Change **worn or damaged hoses** immediately:
 - If a hose is pressurized continuously by more than 20% above working pressure it must be replaced.
- Do not use **dirty** or corroded couplings.
 - They are less reliable
 - They will cause leaks over time.
 - They pollute the hydraulic system
- **Disconnecting** hydraulic tubing and hoses shall be done with utmost care.
 - The system is designed in such a way that hydraulic pressure drops to zero when the system is switched off. Nevertheless, pressure can remain due to
 - The presence of load on the system
 - Raise of temperature
 - But the hydraulic connections have been designed in such a way that either
 - they cannot be uncoupled when they're under pressure, or
 - they can be uncoupled under pressure of only a few bars, but measures have been taken that no oil can come out
 - Always use the manometers of the System to verify that the pressure is zero.

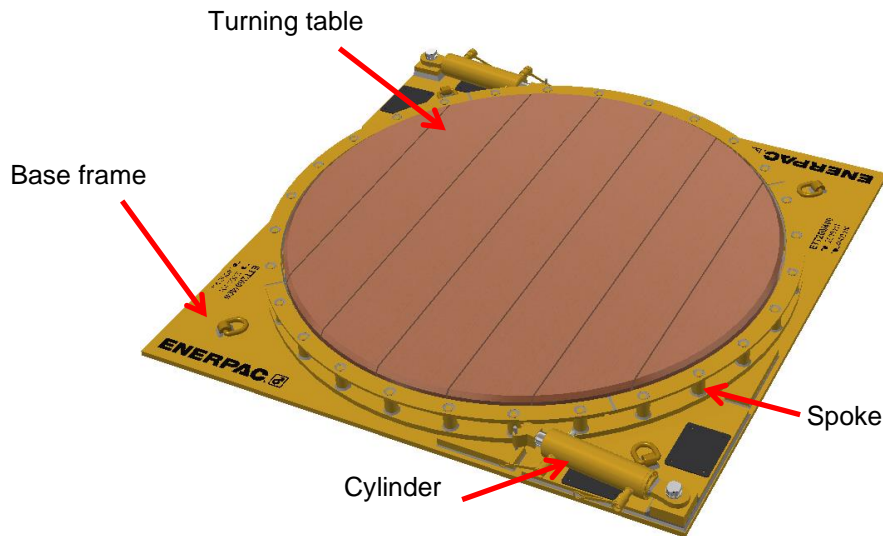
2.10.2 Main procedure for connecting hoses

1.	Inspect the couplings. Clean the coupling if dirty. Replace the coupling if damaged.
2.	Clean the inner and outer side of the couplings before they are mounted; dirt might get in the system causing damage. Use degreaser.
3.	Dry the couplings with paper and visually check them for dirt.  Caution: Do not use any brake cleaner or other detergents; they might affect the couplings.
4.	Hoses which are not mounted may be under pressure though, due to exposure to warmth. If so, it is hard to connect the couplings. To reduce the pressure in the hose: <ol style="list-style-type: none"> 1. Twist the coupling off the hose. <i>A little until oil will come out</i> 2. Turn the coupling tight again. 
5.	Screw the screw-coupling together to the end. <i>While tightening the couplings, the oil passage is opened up</i>



Hazard: Careless handling of hydraulics can cause serious injuries

3 System Overview



The system is a device to turn a load of up to 2000 kN when one cylinder is used and up to 4000 kN when two cylinders are used.

The load can be turned either clockwise or counter clockwise.

The turn table is comprised of three main components:

- base frame,
- rotating table,
- cylinders.

The following sequence applies:

1. One or two cylinders push against the spokes of the table and rotate the table a few degrees.
2. When the cylinders are at the end of their stroke, they are retracted.
They automatically align, to be able to push against the next spokes.
3. The sequence is repeated until the desired rotation is reached.

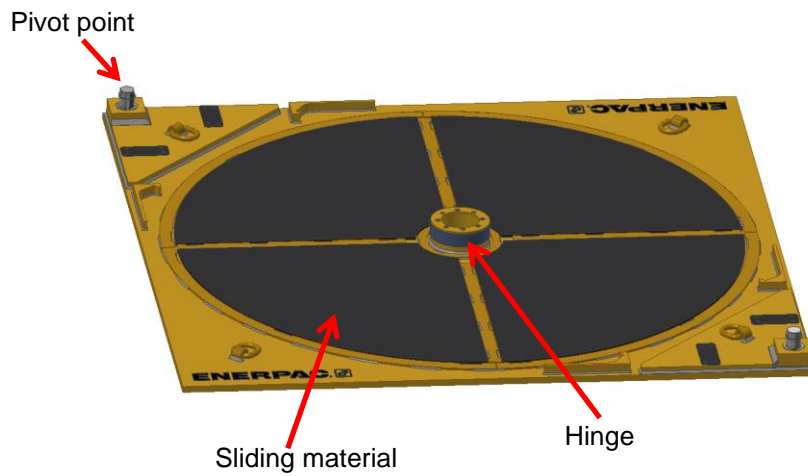


Ensure that the cylinders are fully extended when pushing against a spoke and before starting to retract them completely to assure good alignment with the next spoke. Failure to do so might lead to damage of the system.

To rotate the table in the opposite direction, the cylinders have to be disassembled from the table and placed alongside the other side of the base frame.

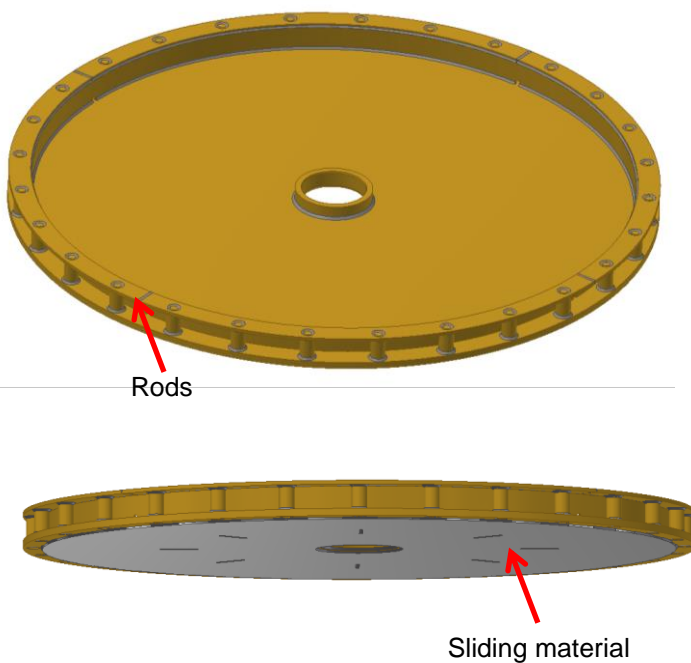
The System is manual controlled by an external power pack, which is not part of the delivery.

3.1.1 Base frame



The base frame is provided with sliding material to enable smooth turning of the turning table. The cylinders are connected to the pivot points.

3.1.2 Rotating table



The turning table is provided with rods to which the cylinders press in order to turn. The bottom side of the rotating table is covered with sliding material. The rotating table is filled with wood.

3.2 System specifications

3.2.1 Main specifications

Temperatures		
Operating temperature of the machine	Min	-10°C
	Max	+50°C
Storage temperature of the machine	Min	-25°C
	Max	+60°C
Oil		
Type	Shell Tellus S4 VE 46	
Purity	The purity of the medium is in accordance with: - class 10 of NAS 1638 - class 21/19/16 of ISO DIS 4406	
Noise pressure	The System itself does not produce significant noise.	




Hazard: There is a risk of ice accretion at temperatures below 0° C.
 If ice has accreted on machine components, they cannot be used since they may lock up

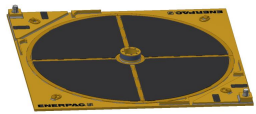
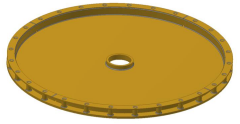


NB: Consult Enerpac if you want to apply the system by other temperatures

3.2.2 Functional specifications

Capacity	With one cylinder: 2000 kN With two cylinders: 4000 kN
Rotating speed	90° per 6 min, depending on the capacity of the applied hydraulic pump.
Max allowed inclination	0.2° both in X- and Y direction.
Maximum work pressure	700 bar.  NB: All hydraulic components have to be able to handle this pressure, in order to couple the System to standard Enerpac equipment

3.2.3 Dimensions

Unit	L x W x D [mm]	Weight [kg]	
System	2000 x 2000 x 155	1660 incl cylinders 1610 without cylinders	
Base frame	2000 x 2000 x 131	750	
Rotating table	Ø1920 x 125	860 incl wood	
Cylinder	600 x 205 x 95	23 kg	

3.3 Service conditions

The System has been designed for an onshore and inland fresh waterway transport environment. This requires normal corrosion resistance on all exposed parts.




NB: The System is explicitly **not intended** to move people.



Hazard: using the System for other purposes than the intended use may cause hazards to personnel and may cause damage to the equipment.

4 Plan an operation

This chapter describes all theoretical activities which have to be performed before the System is assembled and used.

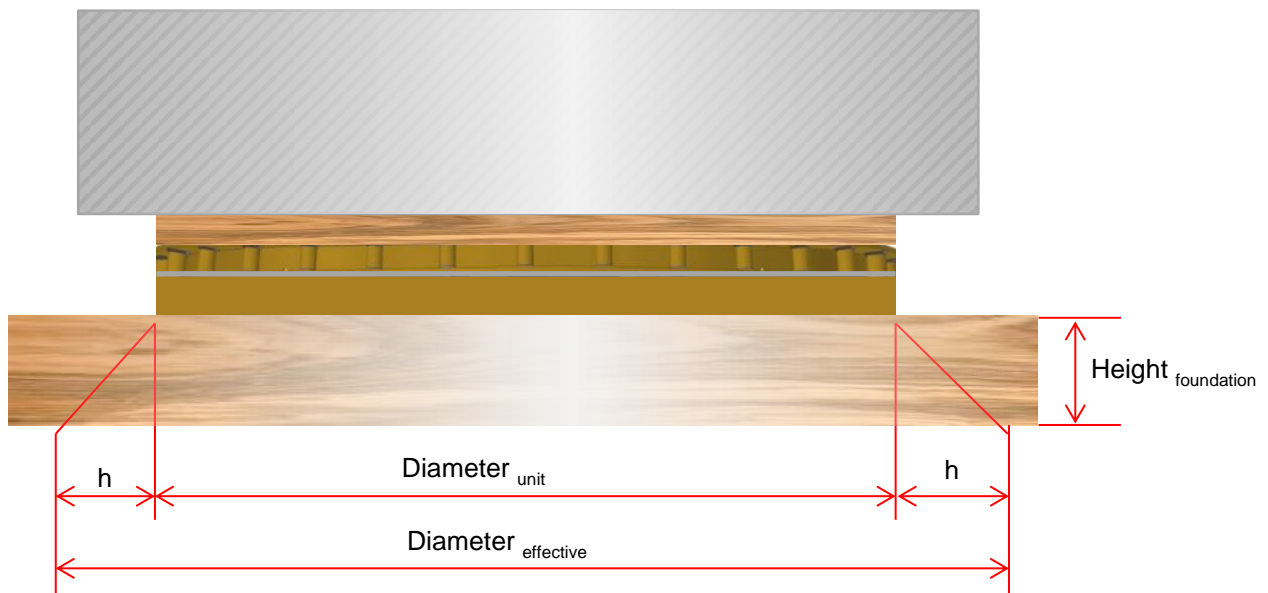
 **NB:** It is of the utmost importance to read this whole chapter carefully before start the rotating operation.

To plan an operation, observe the following:

1. Complete the checklist given in Appendix A “Checklist for planning” while you’re planning.
2. Verify that the bearing ground is stable, and able to bear the load.
3. Verify that the weight of the load will not exceed the capacity of the System, as given in section 3.2.2 “Functional specifications”.
4. Make sure there is enough space around the System to rotate the load.
5. Calculate the ground pressure on the ground.
To reduce the ground pressure you may apply a foundation.

4.1 Calculate the ground pressure


This chapter describes how to calculate the ground pressure without and with a foundation.



To reduce the ground pressure, a foundation can be applied, as shown above. Due to the fact the load is spreads over an angle of 45°, h is equal to Height_{foundation}.

The diameter D of the System:	2000 mm.
Height of the foundation:	H
The ground pressure without foundation:	$\sigma = F / \pi \cdot D^2$
The ground pressure with foundation:	$\sigma = F / \pi \cdot (D + 2h)^2$
Safety factor	1.7

Example:			
The load F	2000 kg		
Own weight	1660 kg		
Height of the foundation	0,30 m		
Without foundation:	$\sigma = 1.7 \times (2000+1660) / \pi \cdot 2^2$	=	495 kg/m ²
With foundation of 30 cm:	$\sigma = 1.7 \times (2000+1660) / \pi \cdot (2+2 \cdot 0,3)^2$	=	293 kg/m ²

 **Attention:** No gaps in the foundation are allowed; the total surface of the bottom plate must be supported.

4.2 Requirements of foundation material

Permitted material for the foundation material:

- Metal load spreaders,
- Hard wood with a mechanical compressive strength of at least 25 N/mm² without any occurrence of deflection. However, Enerpac strongly recommends adhering to 30N/mm²; preferably Azobé. The minimum hard wood thickness is 50 mm and the maximum thickness is 150 mm.

Hazard:

Use of other wood types such as plywood, multiply, pine and compressed wood will endanger the stability of the system. Therefore, use of other types is strictly forbidden. In case of doubt, consult Enerpac.

NB:

Wood is a natural product: its quality is not assured. In order to guarantee quality, test the timber on 125% of the expected load.

For your planning keep in mind that suitable wood may not always be available immediately.



Attention:

Construct the foundation in such a way that the force can spread down over 45° in all directions.

The foundation has to support the whole bearing surface of the System.

Do not allow gaps between the timbers below each bearing area!



Caution: Minor deformations in filler material or subsoil may result in strong internal transverse forces or diagonal or longitudinal movements of the load or masts.

It is the responsibility of you as the customer that the foundation of the system is sufficient and according to the specifications.

5 Install the System

This section describes how to install the System as well as the preparations which have to be made for the working location.

Fully complete the checklist as given in Appendix 40 "Checklist for installing the System".

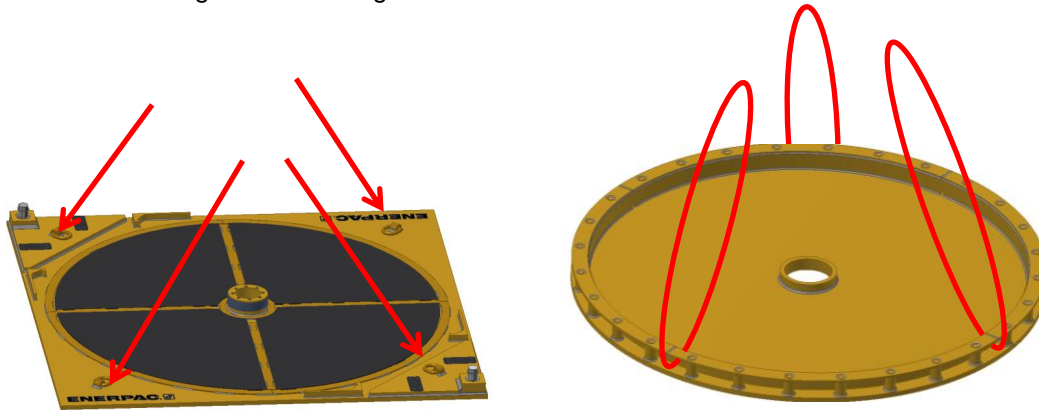
5.1 Mechanical

This section describes how to assemble the system. Both the mechanical and hydraulically aspects are explained.

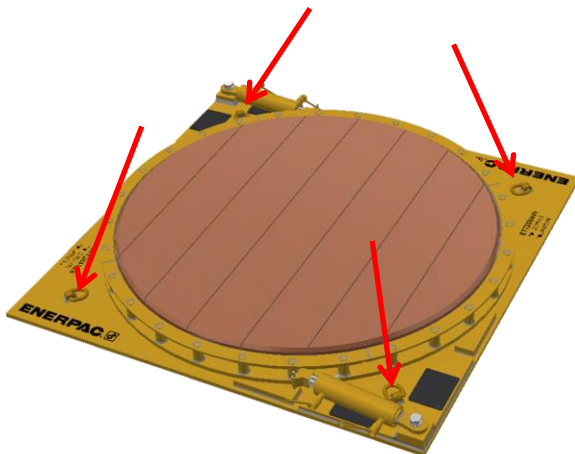
5.1.1 Hoisting Instructions

To hoist the bottom plate use the hoisting eyes.

To hoist the rotating table use slings.



To hoist the assembled System, use the hoisting eyes of the bottom plate:



5.1.2 Assemble and position the system

To assemble the system, proceed as follows:

1. Fence off the working area.
2. Put the rotating table in top of the base frame.
NB: Leave the rotating table on top of the base frame after the operation; do not remove it for other reasons than maintenance.
3. Put the System on the flat bearing ground.
4. Make sure the System is well aligned according to the requirements given in section 3.2.2 "Functional specifications".
Hazard: not complying to the requirements may cause the system to be unstable and to collapses.
5. Make sure the topside of the bottom plate and the down side of the rotating table are clean.
6. Mount one or two cylinders in such a way that the system will turn in the required direction.

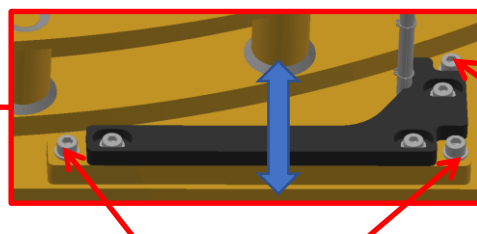
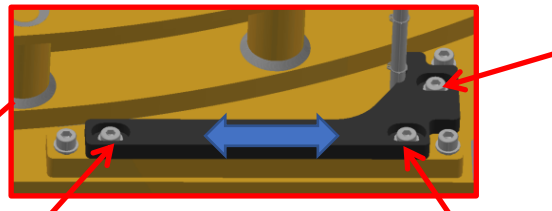
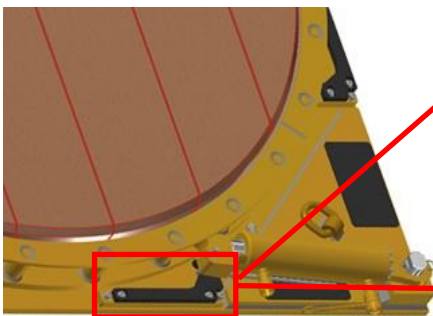


NB: the connections of the cylinders shall always point to the outside.

7. Lock each cylinder with a pin.



8. Adjust the positions of the cylinders.





Attention: If you use a splitflow pump, incorrect adjustment can lead to a cylinder not applying one cylinder any force



NB: Base frame and rotating table should be kept assembled. Only disassemble for maintenance purposes.

5.2 Hydraulics

Connect the hydraulic hoses to the cylinders of the system.
Observe the directions given in section 2.10 "Dealing with hoses".

In order to create equal forces on both cylinders, you may make use of a splitflow pump or put the cylinders on one bath.



Attention: Verify that the cylinders are correctly connected, in order to prevent that one cylinder retracts while the other extends.



Hazard: When the couplings have not been tightened to the end, overpressure may occur which could damage the system

5.3 Put the load on top of the System

Observe the following rules when you put the load on top of the System.



Preferably distributed evenly over the System.

Attention: If the centre of gravity is not in the centre of the system, the System will have a reduced bearing capacity.

6 How to control the System

Use the hydraulic power pack to control the System.


6.1 Limiting devices

No limiting devices make part of the System.

7 Execute an operation

This section describes how to perform a rotating operation.

Precondition is, that the system has been set to work completely, and that you are familiar with the operation if the system.

 **NB:** Operating the System is only permitted if you are certified by Enerpac as an authorised operator.

7.1 Risks and Warnings

Proper handling of the System is essential for safety.

Observe the System while operating.

Make sure the working area is fenced off.

Address the following subjects:



Hazard

- **Improper use** of the machine may result in accidents causing damage not only to the machine itself, but also to objects and goods in its vicinity or mounted to the machine, as well as injuries to people in the immediate area, and possibly even death.
- Failure to adhere to the **checklists** may result in serious injury to the user, possibly even death.
- Even if all safety measures are taken and the system is operated correctly, there will remain a **residual risk** of falling of the system.



Caution

- Failure to **prepare correctly** for a rotating operation may result in total loss of machine stability during use.
- When rotating, always assume a **worst-case scenario**. The wind can be unpredictable, quickly changing speed and direction. Do not take any chances: if the wind is strong, that means it's a 'no go'!
- Do not operate the system when a **person is close** to it.



Attention

- It is of the utmost importance to **read this manual** carefully before setting up the machine. Failure to prepare correctly for a rotating operation may result in total loss of machine stability during use.
- Adhere to the **checklists** during all work activities: during preparation for the operation, system construction, and for rotating the load.
- Ensure that the load avoids contact with any obstructions while rotating.
- The operator should have an unobstructed view of the system and load during operation of the system. If this is not possible, a signalperson shall be used with an effective means of communication to provide directions to the operator.
- Communication among personnel involved in the operation shall be maintained continuously during all movement of the load. If at any time communication is disrupted, the operator shall stop all movements until communication is restored.
- Signals to the operator should be in accordance with the standards prescribed in section 1.9 "Hand signals". If special signals are required, they shall be agreed upon by the operator and support personnel prior to the rotating operation. Signals shall be visible or audible at all times. No action shall be taken unless signs are clearly understood.
- Load handling personnel shall obey any stop signal.

 **NB:** Pay attention to the "Hydraulic fluid safety information" as listed in Appendix E.

7.2 Rotate the load

To rotate the load, follow the instructions given in the manual of the Hydraulic Power Unit.

8 Solve problems

This chapter describes localization and solving of problems.

- A main problem localization procedure is given.
- A list of possible problems is given, together with causes and possible solutions.

8.1 Main problem localization procedure

In case of anomalies proceed as follows to solve the problem:

1. Is any error indicator lit on the HPU?
2. Are there are mechanical blockades?
3. Is any hydraulic leakage visible?
4. Are the top side of the bottom plate and the down side of the rotating table clean?

Call Enerpac if you need assistance.



Hazard: Performing repairs on the System may cause dangerous effects when not executed by well-skilled personnel.



NB: Contact Enerpac if you need assistance.

9 Storage

9.1 System

When the system is stored then retract all cylinders.

- Short term storage:
Cover the units with a tarpaulin in order keep electrical and other moisture-sensitive components dry, especially when stored in open air.
- Long term storage:
Enerpac recommends a dry and closed space.

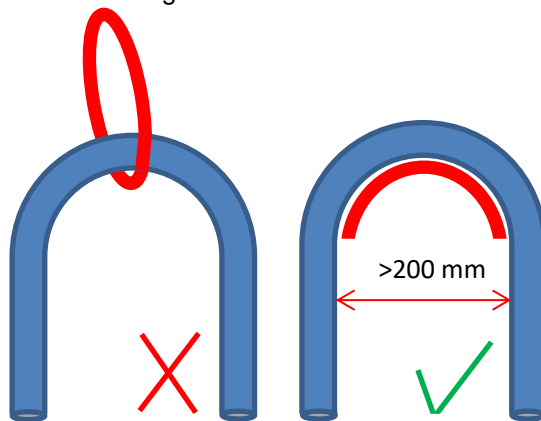
For storage temperature of the system reference is made to 3.2.1 "Main specifications".



NB: During storage in the open air, cover the units with a tarpaulin in order keep moisture-sensitive components dry.

9.2 Hydraulic hoses

- Store hoses in a **frost-free**, cool, dry space with medium air humidity (condensation free).
- Keep hoses out of direct **sunlight** (UV radiation).
- Keep hoses out of the outlet flow of ventilators (drying effect).
- Protect hoses against exposure to **ozone** (released during welding work).
- Ozone causes accelerated ageing of hoses (splitting due to dryness).
- Protect hoses against dirt and **moisture**.
- Preferably store hoses in a **horizontal** position.
When you store the hoses in **vertical** position use hose brackets with a bend **radius** of at least 200 mm, or more for larger hose diameters.



10 Maintenance

Keep the machine in good condition to obtain optimum performance from your machine and to guarantee the safety of the users.

This chapter describes

- the maintenance jobs to be carried out
- the required skills for the maintenance jobs
- the time-intervals the jobs have to be performed in.
The time intervals are given for regular frequency of use and normal severity of service conditions. The time intervals have to be taken proportionally shorter when
 - the system is applied more often than regular, which is once per month.
 - the system is used in exceptional service conditions, like wet or salty environments
 - the system is applied to the limits of its capacity
 - the system is applied for special service. The time interval has to be discussed with Enerpac.

The time intervals may be varied based on experience gained on the service life of systems used in similar circumstances.

- If the system was idle for at least 6 months, all inspections as listed in the following section with a prescribed frequency of at least 6 months have to be performed.
- Prior to use, all new, altered, modified, or repaired hydraulic systems shall be inspected to verify compliance with the applicable provisions of this section. Written records are not required.



NB:

- Only perform maintenance on the units if they are not under load
- Only perform maintenance on the units if the header beams have been removed.
- Any maintenance procedures not detailed in this section can only be performed by or in consultation with Enerpac.
- Only apply spare parts provided by Enerpac. If non-Enerpac parts are applied, all guarantees will be void.



NB: If the system has been idle for more than 12 months than it shall be inspected prior to use completely.

10.1 Rules to be observed for maintenance

Due to the regulations as stated in Ref 4 “ASME B30.1-2015” observe the following rules for maintenance:

1. If the system was **idle** for at least 12 months, all inspections as listed in the following section with a prescribed frequency of at least 12 months have to be performed.
2. Prior to use, all **new, altered, modified, or repaired** hydraulic components shall be inspected to verify compliance with the applicable provisions of this section. Written records are not required.
3. Only perform maintenance if the system is **not under load**.
4. Any maintenance procedures **not detailed** in this section can only be performed by or in consultation with Enerpac.
5. Only apply **spare parts** provided by Enerpac. If parts of foreign make are applied, all guarantees will be void.
6. The warranty shall void if any **modifications** are made to the powerpack without the consent of the manufacturer.
7. Make certain that you are **familiar** with the powerpack and its use. Read the user manual carefully and in full and request instructions from the operator where needed.
8. Only perform maintenance work if you are **qualified** to do so. Unauthorized personnel may not open the Power pack.
9. Follow all instructions given on the **warning symbols** on the powerpack.
10. Follow all **safety instructions** in this manual.

11. When working with **flammable liquids**, take the applicable safety regulations into account.
12. Only perform maintenance work after the powerpack has been **shut down**. Before starting maintenance, make sure the powerpack is secured against unauthorized use. Put up warning signs.
13. Make certain that the hydraulic system is **not under pressure**. Use the manometer.
14. If maintenance has to be executed while the system is **running** then a person has to be present to supervise, and to stop the machine if needed. This also applies for work on the electrical system if the system needs to be powered.
15. Do not **spill** any oil and similar fluids. Be mindful of the environment and the costs of cleaning up.
16. Make certain that you apply personal protection equipment (**PPE**) and take any other safety precautions required by the working conditions.
17. Make sure that you know the location of **fire alarms**, firefighting facilities and fire extinguishers.
18. Only use suitable work **equipment**. Prevent damage due to use of unsuitable equipment.
19. Without the express consent of the manufacturer, you are not allowed to make any **changes**, additions or adjustments to the Powerpack which affect the safety of the machine. This also applies to installation and adjustment of safety devices, covers and valves and to welding work on load-bearing parts.
20. Make certain that the powerpack is made **ready for operation** after the maintenance work was been completed. Inform the operator.

10.2 Responsibilities

Due to the regulations as stated in Ref 4 "ASME B30.1-2015" observe the following rules for responsibilities.

The maintenance tables indicate for each maintenance job whether it has to be performed either by the owner or by the manufacturer.

10.3 Mechanical

This section lists the maintenance jobs to be executed, as well as the frequencies.

Subject	Action	Person O (owner) EE (Enerpac expert)	First 40 hours	Before use	40 hours Weekly	Each 500 hours Each year	Remarks
1.1. Main construction	Visual check of all welding	O		X			
	Visual check painting	O		X		X	
	Visual check on corrosion and damages	O		X	X		
	Check all bolts.	O				X	
	Visual check of the hoisting lugs	O				X	
	Inspect the readability of the warning signs. Clean if obscured by dirt. Restore if damaged or even no longer present	O				X	
	Clean the top side of the bottom plate	O				X	
	Clean the down side of the rotating table	O				X	

10.4 Hydraulics

This section lists all maintenance jobs for the hydraulics.

Record all activities in Appendix D "Logging Maintenance".

For hydraulic fluid safety information sheet, see Appendix E "Hydraulic fluid safety information".

Regard the following:

- Before starting maintenance, make sure no pressure is present in the hydraulic system.
- All inspections up to yearly have to be performed if the system has been idle for at least 12 months. The system shall only be returned to service when approved by a qualified person as described that section.
- All replacement parts including the ram, hoses, couplings, seals, valves, and caps shall meet or exceed the original equipment manufacturer's specifications.
- Once the hydraulics are installed, verify that the cylinders are correctly connected, in order to prevent that one cylinder retracts while the other extend.



NB: Enerpac strongly advises to apply parts as bought from Enerpac.




Hazard:

Applying parts which do not apply to the specifications may cause hazards to personnel and the system. Before removing a component of the hydraulic system, check if there is no hydraulic pressure left within the hydraulic system



Hazard: High pressured hydraulic oil spray can cause physical injuries, fire or death of personnel

Subject	Action	Person O (Owner) EE (Enerpac expert)	First 40 hours	Before use	40 hours Weekly	500 hours yearly	2000 hours 2 years	10000 hours 10 years	Remarks
1. Hydraulic connections									
1.1. Pipes, hoses and brackets	 NB: Hoses are not part of the System and can be bought separately by the owner. Therefore, the instructions below are indicative.								
	Check on oil leakage and damages	O		X					
	Check if the couplings are tightened well.	O	X			X			
	Replace all seals within the piping (Walform)	O						X	
	Replace all hoses	O					X		
Replace all plastic brackets	O					X			
1.2. Couplings and quick-screw couplings	Check on oil leakage and damages	O			X				
	Check if the couplings are tightened well	O			X				
	Replace all seals of the couplings	O						X	
	Replace fast couplings and screw couplings	O						X	
2. Cylinders									
2.1. Common	Check on leakages	O		X					
	Replace all seals	EE						X	

11 Quality

None

12 Dismantling the system

To dismantle the system at the end of its lifetime, proceed as follows:

- Drain the hydraulic oil,
- Dismount rubber and plastic components.
- Dismount the metal components.

Collect all material, sort it and let it be recycled by a specialized company.



Attention: Dispose of all material in a responsible manner.

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Appendices

A. Checklist for planning

1. Project

Project data			
Project		Description	
Customer		Weight	
Location			
Date			

2. Planning

<input type="checkbox"/>	The bearing ground is stable
<input type="checkbox"/>	Weight of the load will not exceed the capacity of the System
<input type="checkbox"/>	There is enough space around the System to rotate the load.
<input type="checkbox"/>	The ground pressure
<input type="checkbox"/>	A foundation will be applied.
<input type="checkbox"/>	If so, the quality foundation material meets the requirements.

3. Commitment

Preparations by:

Date:

Signature:

Approved by:

Date:

Signature:

B. Checklist for installing the System

1. Project

Project data	
Project	
Customer	
Location	
Date	

2. Mechanical and hydraulically

<input type="checkbox"/>	Checklist A "Checklist for planning" completed and signed off
<input type="checkbox"/>	The area is fenced off.
<input type="checkbox"/>	The bottom plate is positioned and aligned well.
<input type="checkbox"/>	The bottom plate is lubricated.
<input type="checkbox"/>	The cylinders operate in equal direction. If one extends, the other does not retract and vice versa.
<input type="checkbox"/>	The cylinders are mounted in such a way that the System will rotate in the required direction.
<input type="checkbox"/>	The load has been put on top of the System.
<input type="checkbox"/>	The hydraulic hoses have been connected to the Hydraulic Power Unit.
<input type="checkbox"/>	The centre of gravity of the load is in the centre of the System.
<input type="checkbox"/>	The weight of the is distributed evenly over the System.

3. Commitment

Installations by:

Date:

Signature:

Approved by:

Date:

Signature:

C. Recording a rotating operation

1. Project

Project data	
Project	
Customer	
Location	
Date	

2. Recording of activities

	Activity	Time
<input type="checkbox"/>	The checklist in Appendix A “Checklist for planning” has been completed and signed off	
<input type="checkbox"/>	Checklist B “Checklist for installing the System” completed and signed off	
1		
2		
3		
4		
5		
6		
7		
8		

	Activity	Time
9		
10		
11		
12		
13		
14		
15		
16		
19		

3. Commitment

Executed by:

Date:

Signature:

Approved by:

Date:

Signature:

D.Logging Maintenance

Hydraulics

Subject	Action	Date	Remark
1. Hydraulic connections			
1.1. Pipes, hoses and brackets	Check on oil leakage and damages		
	Check if the couplings are tightened well.		
	Replace all seals within the piping (Walform)		
	Replace all hoses		
	Replace all plastic brackets		
1.2. Couplings and quick-screw couplings	Check on oil leakage and damages		
	Check if the couplings are tightened well.		
	Replace all seals of the couplings		
	Replace fast couplings and screw couplings		
2. Cylinders			
2.1. Common	Check on leakages		
	Check if the bolts are still tightened		
	Replace all seals		
	Grease the bearings		

Mechanical:

Subject	Action	Date	Remark
1. Main construction			
1.1. Main construction	Visual check of all welding		
	Visual check painting		
	Visual check on corrosion and damages		
	Check all bolts.		
	Visual check of the hoisting lugs		
	Inspect the readability of the warning signs.		
	Clean the top side of the bottom plate		
	Clean the down side of the rotating table		

3. Composition/information on ingredients

- 3.1. Mixtures
 Chemical nature Blend of polyolefins and additives
 Hazardous components

Chemical name	CAS-No. EC-No. Registration number	Classification (REGULATION (EC) No 1272/2008)	Concentration [%]
Distillates (Fischer - Tropsch), heavy, C18-50 – branched, cyclic and linear	848301-69-9 482-220-0 01-0000020163-82	Asp. Tox.1; H304	85- 95
Triazole derivative	91273-04-0 401-280-0	Skin Corr.1B; H314 Skin Sens.1A; H317 Aquatic Chronic1; H410	0,01 - 0,05

4. First aid measures

- 4.1. Description of first aid measures
 Protection of first-aiders When administering first aid, ensure that you are wearing the appropriate personal protective equipment according to the incident, injury and surroundings.
 If inhaled No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
 In case of skin contact Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop. Obtain medical attention even in the absence of apparent wounds.
 In case of eye contact Flush eye with copious quantities of water.
 Remove contact lenses, if present and easy to do. Continue rinsing. If persistent irritation occurs, obtain medical attention.
 If swallowed In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
- 4.2. Most important symptoms and effects, both acute and delayed
 Symptoms Oil acne/folliculitis signs and symptoms may include formation of black pustules and spots on the skin of exposed areas. Ingestion may result in nausea, vomiting and/or diarrhoea. Local necrosis is evidenced by delayed onset of pain and tissue damage a few hours following injection.
- 4.3. Indication of any immediate medical attention and special treatment needed
- 4.4. Treatment
 Notes to doctor/physician:
 Treat symptomatically.
 High pressure injection injuries require prompt surgical intervention and possibly steroid therapy, to minimise tissue damage and loss of function. Because entry wounds are small and do not reflect the seriousness of the underlying damage, surgical exploration to determine the extent of involvement may be necessary. Local anaesthetics or hot soaks should be avoided because they can contribute to swelling, vasospasm and ischaemia. Prompt surgical decompression, debridement and evacuation of foreign material should be performed under general anaesthetics, and wide exploration is essential.

5. Firefighting measures

- 5.1. Extinguishing media
 Suitable extinguishing media Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only. Do not use water in a jet
 Unsuitable extinguishing media
- 5.2. Special hazards arising from the substance or mixture
 Specific hazards during firefighting Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide may be evolved if incomplete combustion occurs. Unidentified organic and inorganic compounds
- 5.3. Advice for firefighters
 Special protective equipment for firefighters Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
 Specific extinguishing methods Use extinguishing measures that are appropriate to local circumstances and the surrounding environment

6. Accidental release measures

- 6.1. Personal precautions, protective equipment and emergency procedures
 Personal precautions 6.1.1 For non emergency personnel: Avoid contact with skin and eyes.
 6.1.2 For emergency responders: Avoid contact with skin and eyes
- 6.2. Environmental precautions
 Environmental precautions Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
 Local authorities should be advised if significant spillages cannot be contained

- 6.3. Methods and materials for containment and cleaning up
 Methods for cleaning up Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material.
 Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly
- 6.4. Reference to other sections
 For guidance on selection of personal protective equipment see Chapter 8 of this Safety Data Sheet., For guidance on disposal of spilled material see Chapter 13 of this Safety Data Sheet

7. Handling and storage

- General Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
- Precautions
- 7.1. Precautions for safe handling
 Advice on safe handling Avoid prolonged or repeated contact with skin.
 handling Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires.
- 7.2. Conditions for safe storage, including any incompatibilities
 Other data Keep container tightly closed and in a cool, well-ventilated place. Use properly labeled and closable containers. Store at ambient temperature. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.
- Packaging material Suitable material: For containers or container linings, use mild steel or high density polyethylene. Unsuitable material: PVC.
- Container Advice Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.
- 7.3. Specific end use(s)
 Specific use(s) Not applicable

8. Exposure controls/personal protection

- 8.1. Control parameters
 Occupational Exposure Limits
 Biological occupational exposure limits
 No biological limit allocated.
 Monitoring Methods
 Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
 Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory.
 Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available.
 National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods <http://www.cdc.gov/niosh/>
 Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods <http://www.osha.gov/>
 Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous Substances <http://www.hse.gov.uk/>
 Institut für Arbeitsschutz Deutschen Gesetzlichen Unfallversicherung (IFA), Germany <http://www.dguv.de/inhalt/index.jsp>
 L'Institut National de Recherche et de Sécurité, (INRS), France <http://www.inrs.fr/accueil>
- 8.2. Exposure controls
 Engineering measures
 The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
 General Information:
 Define procedures for safe handling and maintenance of controls. Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or subsequent recycle. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.
- 8.3. Personal protective equipment
 The provided information is made in consideration of the PPE directive (Council Directive 89/686/EEC) and the CEN European Committee for Standardisation (CEN) standards. Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
- Eye protection If material is handled such that it could be splashed into eyes, protective eyewear is recommended.
 Approved to EU Standard EN166.
- Hand protection Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection.
 PVC, neoprene or nitrile rubber gloves Suitability and durability of a glove is dependent on usage, e.g.

frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Glove thickness should be typically greater than 0.35 mm depending on the glove make and model.

Respiratory protection No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [Type A/Type P boiling point > 65°C (149°F)] meeting EN14387 and EN143.

Thermal hazards Not applicable

8.4. Environmental exposure controls

General advice Take appropriate measures to fulfill the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Section 6. If necessary, prevent undissolved material from being discharged to wastewater. Wastewater should be treated in a municipal or industrial wastewater treatment plant before discharge to surface water. Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Liquid
Colour	Colourless
Odour	Slight hydrocarbon
Odour Threshold	Data not available
pH	Not applicable
pour point	: -48 °C Method: ISO 3016
Initial boiling point and boiling range	> 280 °C estimated value(s)
Flash point	260 °C, Method: ASTM D92 (COC)
Evaporation rate	Data not available
Flammability (solid, gas)	Data not available
Upper explosion limit	Typical 10 %(V)
Lower explosion limit	Typical 1 %(V)
Vapour pressure	< 0,5 Pa (20 °C) estimated value(s)
Relative vapour density	> 1 estimated value(s)
Relative density	0,832 (15,0 °C)
Density	: 832 kg/m3 (15,0 °C) Method: ISO 12185
Solubility(ies)	
Water solubility	negligible
Solubility in other solvents	Data not available
Partition coefficient: n- octanol/water	log Pow: > 6(based on information on similar products)
Auto-ignition temperature	> 320 °C
Decomposition temperature	Data not available
Viscosity	
Viscosity, dynamic	Data not available
Viscosity, kinematic	46 mm2/s (40,0 °C), Method: ISO 3104 8,7 mm2/s (100 °C), Method: ISO 3104
Explosive properties	Not classified
Oxidizing properties	Data not available

9.2. Other information

Conductivity This material is not expected to be a static accumulator

10. Stability and reactivity

- 10.1. Reactivity The product does not pose any further reactivity hazards in addition to those listed in the following sub-paragraph
- 10.2. Chemical stability Stable. No hazardous reaction is expected when handled and stored according to provisions
- 10.3. Possibility of hazardous reactions
 - Hazardous reactions Reacts with strong oxidising agents.
- 10.4. Conditions to avoid Extremes of temperature and direct sunlight
- 10.5. Incompatible materials
 - Materials to avoid Strong oxidising agents
- 10.6. Hazardous decomposition products

Hazardous decomposition products No decomposition if stored and applied as directed

11. Toxicological information

11.1. Information on toxicological effects

Basis for assessment	Information given is based on data on the components and the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).
Information on likely routes of exposure	Skin and eye contact are the primary routes of exposure although exposure may occur following accidental ingestion
Acute oral toxicity Product	LD50 rat: > 5.000 mg/kg Remarks: Low toxicity: Based on available data, the classification criteria are not met.
Acute inhalation toxicity	Remarks: Based on available data, the classification criteria are not met.
Acute dermal toxicity	LD50 Rabbit: > 5.000 mg/kg Remarks: Low toxicity: Based on available data, the classification criteria are not met.
Skin corrosion/irritation Product	Remarks: Slightly irritating to skin., Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis., Based on available data, the classification criteria are not met.
Serious eye damage/eye irritation Product	Remarks: Slightly irritating to the eye., Based on available data, the classification criteria are not met.
Respiratory or skin sensitisation Product	Remarks: For respiratory and skin sensitisation; Not a sensitiser. Based on available data, the classification criteria are not met.
Components	Triazole derivative: Remarks: May cause an allergic skin reaction in sensitive individuals.
Germ cell mutagenicity Product	Remarks: Non mutagenic, based on available data, the classification criteria are not met.
Reproductive toxicity Product	Remarks: Not a developmental toxicant., Does not impair fertility. Based on available data, the classification criteria are not met.
STOT - single exposure Product	Remarks: Based on available data, the classification criteria are not met.
STOT - repeated exposure Product	Remarks: Based on available data, the classification criteria are not met.
Aspiration toxicity Product	Not an aspiration hazard.
Further information Product	Remarks: Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal., ALL used oil should be handled with caution and skin contact avoided as far as possible. Remarks: High pressure injection of product into the skin may lead to local necrosis if the product is not surgically removed. Remarks: Slightly irritating to respiratory system. Remarks: Classifications by other authorities under varying regulatory frameworks may exist.
Summary on evaluation of the CMR properties	
Germ cell mutagenicity- Assessment	This product does not meet the criteria for classification in categories 1A/1B.
Carcinogenicity-Assessment	This product does not meet the criteria for classification in categories 1A/1B.
Reproductive toxicity - Assessment	This product does not meet the criteria for classification in categories 1A/1B.

12. Ecological information

12.1. Toxicity

Basis for assessment	Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).(LL/EL/IL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Product: Toxicity to fish (Acute toxicity)	Remarks: LL/EL/IL50 > 100 mg/l Practically non toxic: Based on available data, the classification criteria are not met.
Toxicity to crustacean (Acute toxicity)	Remarks: LL/EL/IL50 > 100 mg/l Practically non toxic: Based on available data, the classification criteria are not met.
Toxicity to algae/aquatic plants (Acute toxicity)	Remarks: LL/EL/IL50 > 100 mg/l Practically non toxic: Based on available data, the classification criteria are not met.
Toxicity to fish (Chronic toxicity)	Remarks: Data not available
Toxicity to crustacean (Chronic toxicity)	Remarks: Data not available

Toxicity to microorganisms (Acute toxicity) Components: M-Factor (Short-term (acute) aquatic hazard)	Remarks: Data not available Triazole derivative 1
12.2. Persistence and degradability Product: Biodegradability	Remarks: Not readily biodegradable., Major constituents are inherently biodegradable, but contains components that may persist in the environment.
12.3. Bioaccumulative potential Product: Bioaccumulation Partition coefficient: n- octanol/water	Remarks: Contains components with the potential to bioaccumulate. log Pow: > 6Remarks: (based on information on similar products)
12.4. Mobility in soil Product: Mobility	Remarks: Liquid under most environmental conditions. If it enters soil, it will adsorb to soil particles and will not be mobile. Remarks: Floats on water.
12.5. Results of PBT and vPvB assessment Product: assessment	This mixture does not contain any REACH registered substances that are assessed to be a PBT or a vPvB.
12.6. Other adverse effects Product: Additional ecological information	Does not have ozone depletion potential, photochemical ozone creation potential or global warming potential., Product is a mixture of non-volatile components, which will not be released to air in any significant quantities under normal conditions of use. Poorly soluble mixture. Causes physical fouling of aquatic orgasms

13. Disposal considerations

13.1. Waste treatment methods Product	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Waste product should not be allowed to contaminate soil or ground water, or be disposed of into the environment. Waste, spills or used product is dangerous waste.
Contaminated packaging	Dispose in accordance with prevailing regulations, preferably to a recognized collector or contractor. The competence of the collector or contractor should be established beforehand. Disposal should be in accordance with applicable regional, national, and local laws and regulations.
Local legislation Waste catalogue Waste Code Remarks	EU Waste Disposal Code (EWC): 13 01 11* Disposal should be in accordance with applicable regional, national, and local laws and regulations. Classification of waste is always the responsibility of the end user.

14. Transport information

14.1. UN ADN ADR RID IMDG IATA	Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good
14.2. Proper shipping name ADN ADR RID IMDG IATA	Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good
14.3. Transport hazard class ADN ADR RID IMDG IATA	Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good
14.4. Packing group ADN CDNI Inland Water Waste Agreement ADR RID IMDG IATA	Not regulated as a dangerous good NST 3411 Mineral Lubricating Oils Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good
14.5. Environmental hazards ADN ADR RID	Not regulated as a dangerous good Not regulated as a dangerous good Not regulated as a dangerous good

- IMDG Not regulated as a dangerous good
- 14.6. Special precautions for user
 Remarks Special Precautions: Refer to Section 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.
- 14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
 Not applicable for product as supplied. MARPOL Annex 1 rules apply for bulk shipments by sea.

15. Regulatory information

- 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
- REACH - List of substances subject to authorisation (Annex XIV)
 Product is not subject to Authorisation under REACH
- Volatile organic compounds 0 %
- Other regulations The regulatory information is not intended to be comprehensive. Other regulations may apply to this material. Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), annex XIV. Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), annex XVII. Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work and its amendments. Directive 1994/33/EC on the protection of young people at work and its amendments. Council Directive 92/85/EEC on the introduction of measures to encourage improvements in the safety and health at work of pregnant workers and workers who have recently given birth or are breastfeeding and its amendments.
- The components of this product are reported in the following inventories
- EINECS All components listed or polymer exempt
- TSC All components listed
- 15.2. Chemical safety assessment
 No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

16. Other information

- 16.1. Full text of H-Statements
- H304 May be fatal if swallowed and enters airways
- H314 Causes severe skin burns and eye damage
- H317 May cause an allergic skin reaction
- H410 Very toxic to aquatic life with long lasting effects
- 16.2. Full text of other abbreviations
- Aquatic Chronic Long-term (chronic) aquatic hazard
- Asp. Tox. Aspiration hazard
- Skin Corr. Skin corrosion
- Skin Sens. Skin sensitisation
- 16.3. Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
AICS	Australian Inventory of Chemical Substances
ASTM	American Society for Testing and Materials
BEL	Biological exposure limits
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAS	Chemical Abstracts Service
CEFIC	European Chemical Industry Council
CLP	Classification Packaging and Labelling
COC	Cleveland Open-Cup
DIN	Deutsches Institut für Normung
DMEL	Derived Minimal Effect Level
DNEL	Derived No Effect Level
DSL	Canada Domestic Substance List
EC	European Commission
EC50	Effective Concentration fifty
ECETOC	European Center on Ecotoxicology and Toxicology Of Chemicals
ECHA	European Chemicals Agency
EINECS	The European Inventory of Existing Commercial Chemical Substances
EL50	Effective Loading fifty
ENCS	Japanese Existing and New Chemical Substances Inventory
EWC	European Waste Code
GHS	Globally Harmonised System of Classification and Labelling of Chemicals
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
IC50	Inhibitory Concentration fifty
IL50	Inhibitory Level fifty
IMDG	International Maritime Dangerous Goods

INV	Chinese Chemicals Inventory
IP346	Institute of Petroleum test method N° 346 for the determination of polycyclic aromatics DMSO-extractables KECI = Korea Existing Chemicals Inventory LC50 = Lethal concentration fifty
LD50	Lethal Dose fifty per cent.
LL/EL/IL	Lethal Loading/Effective Loading/Inhibitory loading LL50 = Lethal Loading fifty
MARPOL	International Convention for the Prevention of Pollution From Ships
NOEC/NOEL	No Observed Effect Concentration / No Observed Effect Level
OE_HP	Occupational Exposure - High Production Volume PBT = Persistent, Bioaccumulative and Toxic
PICCS	Philippine Inventory of Chemicals and Chemical Substances
PNEC	Predicted No Effect Concentration
REACH	Registration Evaluation And Authorisation Of Chemicals
RID	Regulations Relating to International Carriage of Dangerous Goods by uail
SKIN_DES	Skin Designation
STEL	Short term exposure limit
TRA	Targeted Risk Assessment
TSCA	US Toxic Substances Control Act
TWA	Time-Weighted Average
vPvB	very Persistent and very Bioaccumulative

16.4. Further information

Training advice

Other information

Sources of key

data used to

compile the

Safety Data Sheet

Provide adequate information, instruction and training for operators

No Exposure Scenario annex is attached to this safety data sheet as it is a non-classified mixture containing no hazardous substances.

Under Article 31 of REACH, a SDS is not required for this product. Therefore, this SDS has been created on a voluntary basis to pass on potentially relevant information required under Article 32.

A vertical bar (|) in the left margin indicates an amendment from the previous version

The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

F. Torque settings

Inspect all bolt joints which may pose a hazard to people and machines at fixed intervals and check their torque.

Apply the torque values unless indicated otherwise on the drawing.

Nominal size	Strength class	Course pitch [Nm]	Fine pitch [Nm]
		(Copper-grease)	(Copper-grease)
		0.08	0.08
M4	8.8	2.2	
	10.9	3.2	
	12.9	3.8	
M5	8.8	4.3	
	10.9	6.3	
	12.9	7.4	
M6	8.8	7.4	
	10.9	10.9	
	12.9	12.5	
M7	8.8	12.0	
	10.9	17.5	
	12.9	20.5	
M8	8.8	18	19
	10.9	26	28
	12.9	31	32
M10	8.8	36	37
	10.9	52	55
	12.9	61	64
M12	8.8	61	63
	10.9	90	93
	12.9	105	109
M14	8.8	97	103
	10.9	145	150
	12.9	165	175
M16	8.8	145	155
	10.9	215	225
	12.9	250	270
M18	8.8	210	230
	10.9	300	330
	12.9	350	380
M20	8.8	300	320
	10.9	420	460

Nominal size	Strength class	Course pitch [Nm]	Fine pitch [Nm]
		(Copper-grease)	(Copper-grease)
		0.08	0.08
	12.9	500	530
M22	8.8	400	430
	10.9	570	610
	12.9	670	710
M24	8.8	510	640
	10.9	730	900
	12.9	850	1060
M27	8.8	750	920
	10.9	1070	1310
	12.9	1250	1530
M30	8.8	1000	1280
	10.9	1450	1820
	12.9	1700	2130
M33	8.8	1400	1700
	10.9	1950	2430
	12.9	2300	2840
M36	8.8	1750	2230
	10.9	2500	3170
	12.9	3000	3710
M39	8.8	2300	2850
	10.9	3300	4050
	12.9	3800	4740