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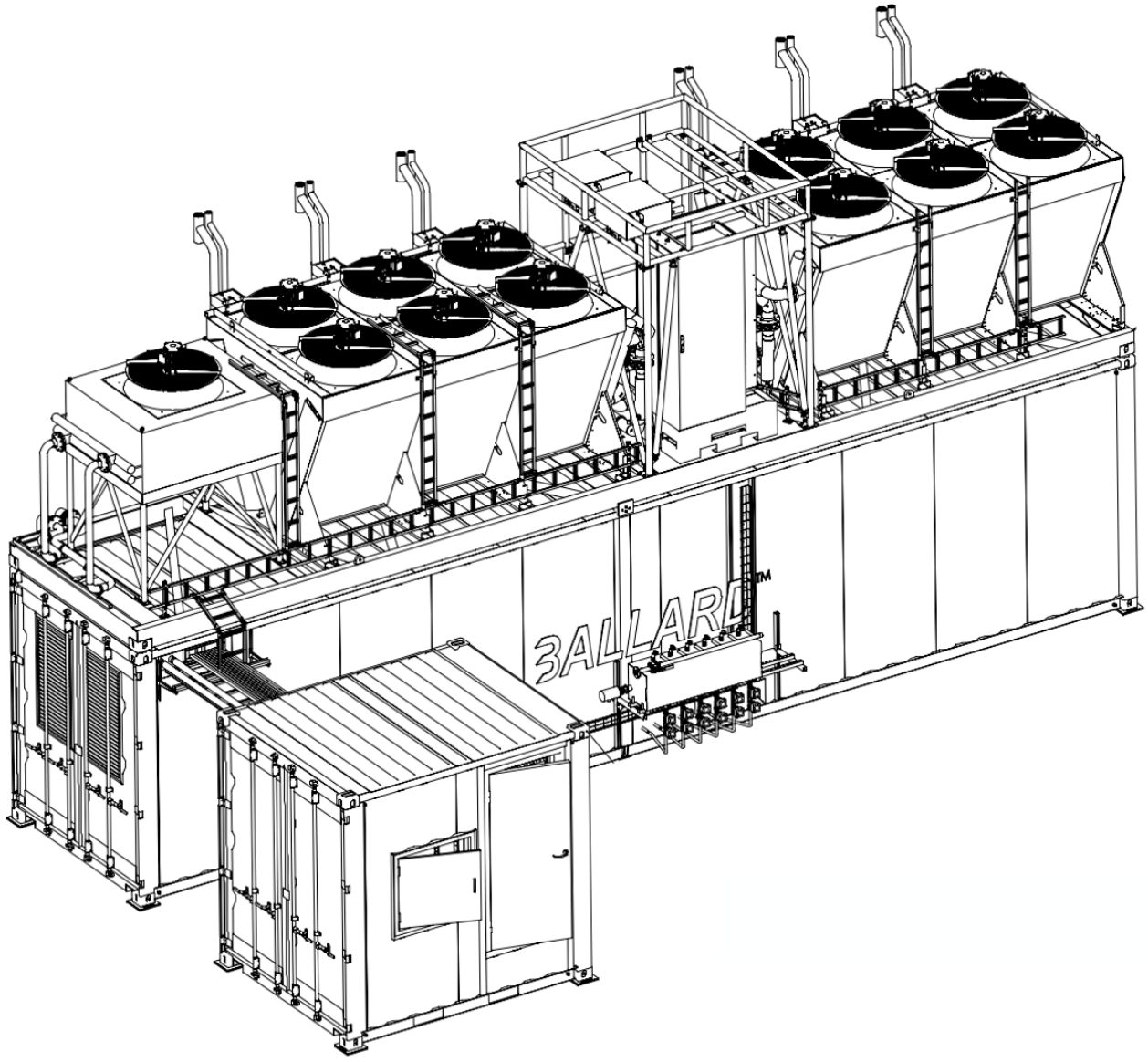
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FC Megablock 1000 kW

Part no.: 5550003

Configuration: 40ft Fuel Cell Container w. 6 FCwave's
10ft Grid Interface Container, 6,6 kVAC

Transport and Handling Manual



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1.0 Disclaimer

NOTE: READ THIS BEFORE ATTEMPTING ANY PROCEDURES DESCRIBED IN THIS MANUAL

There are inherent risks in the operation of a fuel cell module that can result in death or bodily injury or loss or damage to property. It is therefore necessary for the customer to take all prudent safety precautions in the installation, use, and maintenance of this device. Persons who install, operate, and service the device are required to be technically qualified and experienced in working with electrical equipment, compressed gases, and H2.

This manual includes certain safety guidelines and recommendations; however, this manual is not intended to cover all situations. The customer is responsible for determining the suitability of the customer's particular design or application, and for ensuring the safe operation, maintenance, and storage of the device and any systems into which it is integrated. Ballard Power Systems Europe A/S ("BPSE") cannot be responsible for the use of the device in ways, or as part of systems, that deviate from the operating recommendations in the manual. The customer is responsible for being aware of, and complying with, all applicable laws and regulations. BPSE has limited its liability for damages incurred by the customer or its personnel in the contract documents pursuant to which the device is provided to the customer. Please refer to those documents for additional information.

Procedures described in any part of the manual can only be attempted once the customer has read this entire manual. Failure to follow any instruction or recommendation could result in death or bodily injury or loss or damage to property.

BPSE intends for the device to be installed, operated, and serviced only by approved technically qualified and experienced people who understand the principles of fuel cell technology, are aware of the safe operating limits of fuel cells, and are familiar with the risks posed by operating a fuel cell module. BPSE relies on customers to use their own knowledge and experience when installing, operating, and servicing the device. BPSE also relies on the people using this manual to be familiar with common terms and abbreviations used in the manual.

Information in this manual is subject to change without notice. BPSE makes no commitment to update or keep current the information in this manual and reserves the right to make updates or other changes to this manual and/or to the products described in this manual, at any time without notice. Updates and other changes to the manual may be posted on the BPSE website and may be accessed through the customer portal; it is the customer's responsibility to check for any such updates or changes.

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2.0 Manual Introduction

2.1 Purpose and scope

This manual provides information regarding land-based transportation and handling of the 3 major components of the solution. It is intended to be used for transportation from the manufacturer to the area of designated placement, where the system will be permanently installed.

As an addition, anchoring of the components has been included.

For details regarding special transportation methods, se referrals.

2.2 Intended audience

The intended user of this manual is personnel qualified in the preparation of and execution of transportation and handling of freight, e.g. shipping and/or crane personnel.

As an addition, information regarding anchoring of the system onto the platform is provided for the integrator.



Before commencing transportation and handling of this solution, manual users must read and apply this Transportation and handling Manual

2.3 Manual series

The Manual Series provides manuals covering different life-phases of the system, as defined in Table 2-1:

Table 2-1: Manual series contents

Document no.	Title	Brief purpose description	Intended user(s)
7003672	Transportation and Handling Manual	As described in section 2.1	As described in section 2.2
7003718	Integration Manual	Enables integrators to design designated site and subsystems required within the intended use and limits of the system.	Integrators partaking in designing the designated site and subsystems, and commissioning.
7003717	Operator Manual	Provides information to personnel for safe operation of the solution, instructions for operator-based maintenance, safety rules and recommendations	Operators, Integrators, Installers, Service and Maintenance personnel, personnel working in or near the system, and persons instructing visitors.
7003719	Service and Maintenance Manual	Provide information regarding Service and Maintenance schedules and related safety.	Service and Maintenance personnel.

Ballard Power Systems Europe may update the provided manuals on an ongoing basis.

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2.4 References

Table 2-2: Reference documents Document no.:	Document name:
K559-2254-CWIWP4202202-D05-001	Material Safety Data Sheets
K559-2254-CWIWP4202202-B01-001	General Arrangement
K559-2254-CWIWP4202202-B99-001	Structural calculations - Reactions from 40ft container and flatbed with coolers on sea type barge (300' x 90' x 20' or larger)
K559-2254-CWIWP4202202-B99-002	40ft Flatbed - calculations report

2.5 Readers Guide

Prior to engaging in work covered by the manual, the manual user must read and apply this section.

2.5.1 Safety Indications

Throughout the manuals, hazard symbols are used to indicate objectives, hazards or prohibitions the manual user must be aware of.

Table 2-3: Hazard symbols	
	**MANDATORY ACTIONS**: are marked with blue action-points. This indicates actions that must be performed. Ignoring may result in an accident, which could cause damage to equipment or other property, and could cause bodily injury if not promptly detected and remedied.
	**PROHIBITIONS**: are marked with red prohibition-signs. This indicates a forbidden action. Ignoring may result in immediate bodily injury, loss of life, or could cause damage to equipment or other property
	**WARNINGS**: are marked with yellow triangles and/or square warning. Indicates hazards that may result in an accident, which could cause immediate bodily injury or loss of life or could cause damage equipment or other property.
	**CAUTION** in this manual indicates actions that may result in an accident, which could cause damage to equipment or other property, and which could cause bodily injury if not promptly detected and remedied.
	**ELECRICAL HAZARD** Obey ALL warnings, cautions, and safety instruction related to electricity. Failure to do so may result in electrical shock leading to personal injury or death.

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3.0 Safety

Please take notice and read this section very carefully prior to transport and handling of the system.

It is the responsibility of the operator to read and understand this transport and handling manual and other information provided, and to use the correct operating procedures.

The product should only be operated by qualified (trained) personnel. Failure to do so can result in personal injury or equipment damage.

This section contains general safety-related information. It describes the potential hazards and associated warnings for the system and the precautions that must be taken to minimize these hazards.

Figure 1: General safety precautions



Manual users must adhere to safety precautions

3.1 Batteries

The system houses 24VDC (2x12v in series) lead battery modules. This requires tools to access.

Prior to transport and handling: Check that 24VDC UPS batteries are securely fastened and remove the fuses on the module connection boards.

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3.2 Coolant



The Coolers may hold a small quantity, less than 100l, of Proviflow® Neo coolant in the HT and LT cooling circuit.

Each FCwave™ in the container contains Glysantin® FC G20.

Refer to Material Safety Data Sheets for details.

General rules are:

- Avoid contact with eyes and skin.
- Use protective gloves and tightly sealed googles.
- Avoid ingestion and inhalation of vapors.
- Spillage – do not allow to enter sewers/surface or ground water, absorb with a liquid–binding material, dilute with water.
- Disposal must be made according to official regulations.

3.3 Component displacements

The MV transformer is a heavy component that resides inside the 10ft container.

Fixation must be supplemented with applicable tools i.e. straps, prior to transport and handling.

After transportation and handling, the following visual inspection must be performed:

- Open the container door to access the transformer compartment.
- Visually inspect that the transformer has not been displaced, so that it does not fall over a person when opening the door container doors.

3.4 Lifting equipment

Personnel lifting the component(s) must adhere to local rules and legislation regarding the applicable lifting equipment. Improper use of equipment could result in severe injury.

3.5 Placing of components

The components must always be supported in such a way that the structural integrity of both the component and the underlying surface or structure is not damaged.

It is recommended to use applicable grillage or plating to evenly distribute the weight on surfaces (e.g. soft surfaces)

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4.0 Anchoring/assembly on designated site

Order of procedure for placing on designated site:

1. 40ft Fuel cell container placed and anchored as described in section 5.4.
2. Cooling Platform placed and anchored onto 40ft fuel cell container as described in section 6.4.
3. 10ft Container placed and anchored as described in section 7.4.



Transporting the system with the Cooling Platform mounted on top of the container is prohibited.



Notice that when the Cooling Platform is anchored to the Fuel Cell Container the structure is 6,11m in heigh. Windy conditions will create high tension forces in the anchoring points of the Fuel Cell Container – refer to "Structural calculations - Reactions from 40ft container and flatbed with coolers on sea type barge"

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5.0 Fuel Cell Container

5.1 Technical Data

Table 5-1: Key figures for 40ft Fuel Cell Container	
Container type	Modified 40ft High Cube ISO Container
Dimensions (l/w/h)	12.2/2.5/2.9 m
Weight (dry)	21680 kg

Refer to General Arrangement for CoG or attached document.

5.2 Packaging

The Fuel Cell Container needs proper packaging, and this is the responsibility of Ballard.



The LT and HT cooling circuits shall be drained from coolant to the extent possible prior to transportation and handling

5.2.1 Loose parts

Components may be shipped as loose parts inside the container if they are secured against sliding or other unintended movement, which could damage the container or component.

Loose parts may include:

- Exhaust chimney
- Ventilation chimney
- Cooler pipes wall passthrough and piping, dried from coolant

5.2.2 Preparation for transport

Preparing the Fuel Cell container for transportation from manufacturer site is a Ballard responsibility.

The following must be completed:

- If risk of frost, the FCwave must have a dry-out procedure performed prior to shipment
- Disassembly and packaging of chimneys
  Open pipes must be covered by a protective plug/cover.
- Disassembly and packaging of cooling pipes
  Open pipes must be covered by a protective plug/cover.
- Disassembly and packaging of H2 heater
  Open pipes must be covered by a protective plug/cover.
- All wall passthroughs must be covered to ensure no ingress
- Check that all floor plates are securely fastened.
- Check that air intake and exhausts are closed.
- Check that 24VDC UPS batteries er securely fastened, and that voltage is disconnected.

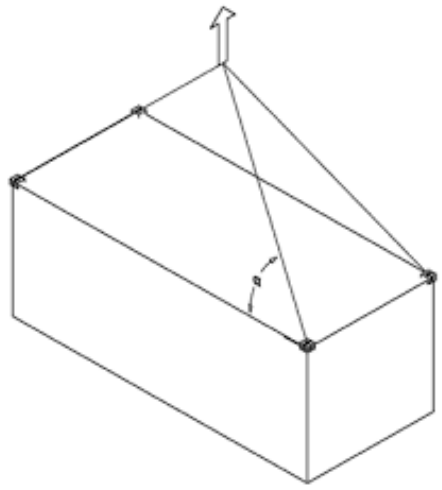
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- Check that all cabinets are securely locked.
- Check that access doors and container doors are securely locked against unauthorized access.
- Check that loose parts placed inside the container is fixated.
- Wrap the container if needed, to prevent dust and dirt from entering the container during transport.

5.3 Handling and Transportation

The Fuel Cell Container can be transported and craned using ordinary truck and craning equipment, suitable for handling an ISO container as per ISO 3874. It is the responsibility of the handler to read and decide the applicable method.

Figure 2: 40ft Container lifting example



Recommended lifting method, since the bottom corners might need to meet anchor points of the designated site.

The driver must make sure that the container is adequately secured on the truck for transport.

Standard safety procedures, approved tools and Personal Protective Equipment must be used. Ballard will inform the crane operator of any additional on-site regulations that must be adhered to.

Craning must always be supervised by Ballard responsible, however this does not remove the responsibility for the crane operator to ensure that the craning and crane equipment in use is done safely, and it does not remove the responsibility for damages incurred during craning from the operator.

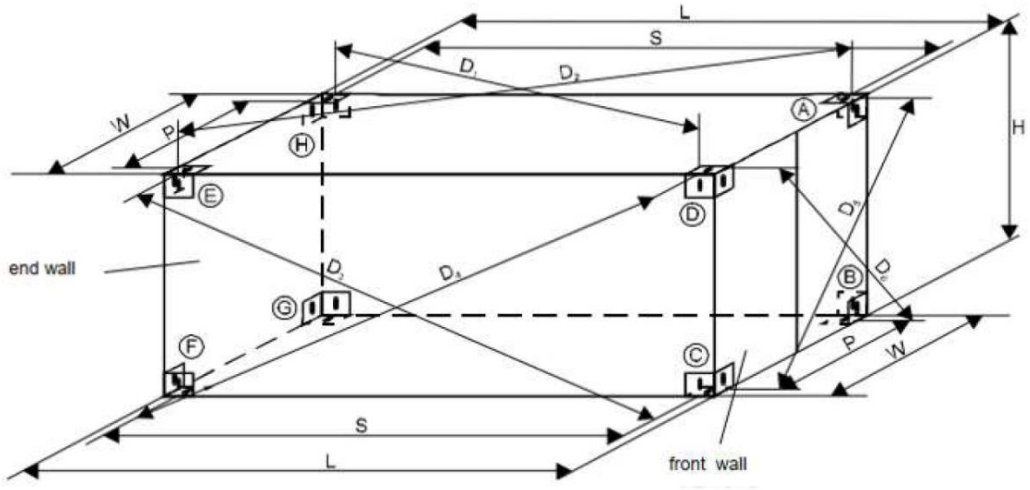
5.4 Anchoring on designated site

To anchor the Fuel Cell Container on the designated site, integrator must use the standard ISO corners of the container.

Integrators of the system are recommended to anchor the container onto the designated site with ground-plate twist-locks. If anchoring is done using the bottom-side of the ISO corners (B, C, F, G in Figure 3), e.g. ground-plate twist-locks, verify the corner-distances of the containers prior to design of site.

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Figure 3: 40ft Container ISO corners distances



P = 2260 (+3) (-5) mm.
S = 11989 (+3 (-10) mm.

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6.0 Cooling Platform

6.1 Technical Data

The Cooling Platform has standard ISO 1161 corners for anchoring during transportation and for final assembly onto the 40ft Fuel Cell Container.

Table 6-1: Key figures of Cooling Platform	
Dimensions (l/w/h)	12.2/2.5/2.5 m
Flat Support Plate location (Figure 5)	From left to middle: 6232 mm From right to middle: 5960 mm
Weight (dry)	10060 kg

Refer to General Arrangement for CoG or attached document.

6.2 Packaging

The Cooling Platform needs packaging, and this is the responsibility of Ballard.



The coolant circuit(s) must be drained of coolant to the extend possible before transportation and handling.

6.2.1 Preparation for transport

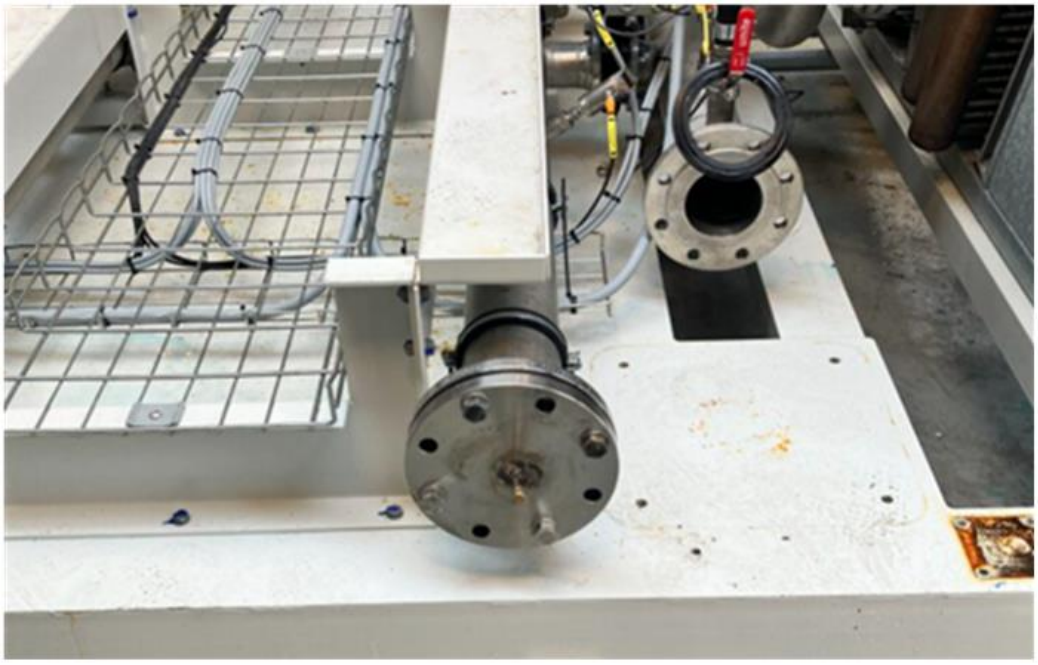
Do not strap any loose parts onto the platform for shipping. Loose parts should be shipped separately.

The following must be completed:

- Conduct visual inspection and document the condition of the cooler fins before and after transportation.
- Disassembly and packaging of exhaust frame
- Disassembly and packaging of cooling pipes
  Open pipes must be covered by a protective flange cover.
- Check that all floor plates are securely fastened.
- Check that 24VDC UPS batteries in Cooling control cabinet is securely fastened, and that voltage is disconnected.
- Check that the cabinet is securely locked.
- Wrap the platforms to protect it from dust and dirt.

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Figure 4: Prepared for shipment



Indicative picture of piping covered prior to transportation

6.2.2 Coolers fixation

The coolers must be fitted with supplementary fixation to the platform for transportation. This ensures that they do not move under de- and acceleration.

It is recommended to use straps and edge protectors.

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6.3 Handling and Transport

The Cooling Platform must be maneuvered, craned/lifted, and transported according to the information below. Special consideration is to be taken to protect the platform frame from deformation.

Standard safety procedures, approved tools and Personal Protective Equipment must be used. Ballard will inform the crane operator of any additional on-site regulations that must be adhered to.

Craning/lifting must always be supervised by Ballard responsible, however this does not remove the responsibility for the crane operator to ensure that the craning and crane equipment in use is done safely, and it does not remove the responsibility for damages incurred during craning from the operator.

More details on the structure can be found in 40ft Flatbed - calculations report.

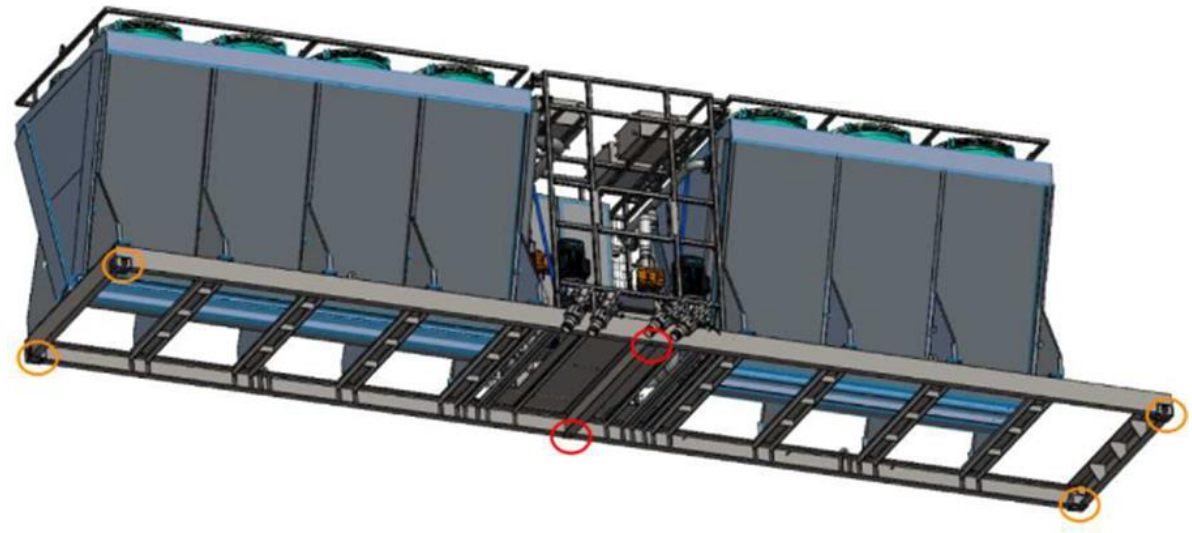
6.3.1 Support

When the Cooling Platform carries its own weight, it must be supported at the 6 points indicated in Figure 5.

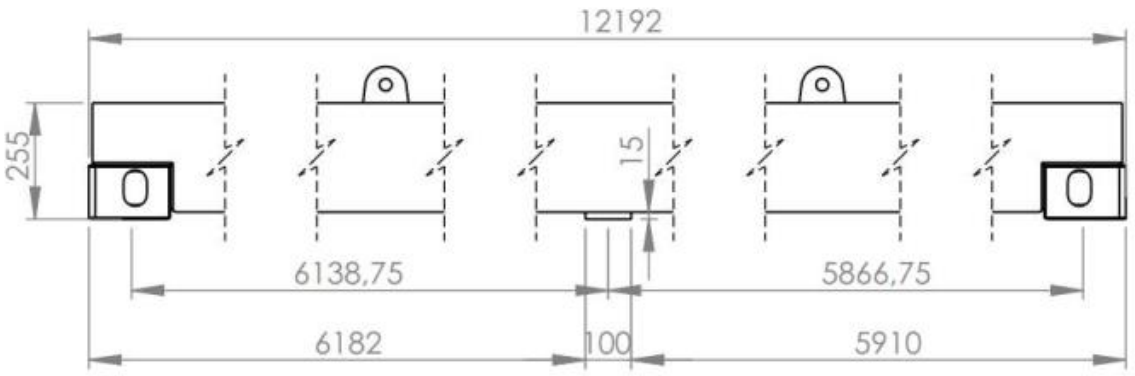
The Cooling Skid must always be supported vertically at the ends and at the Flat Support Plates.

(Figure 5– Orange, ISO Corners. Red, middle Flat Support Plates).

Figure 5: Cooling Platform support points



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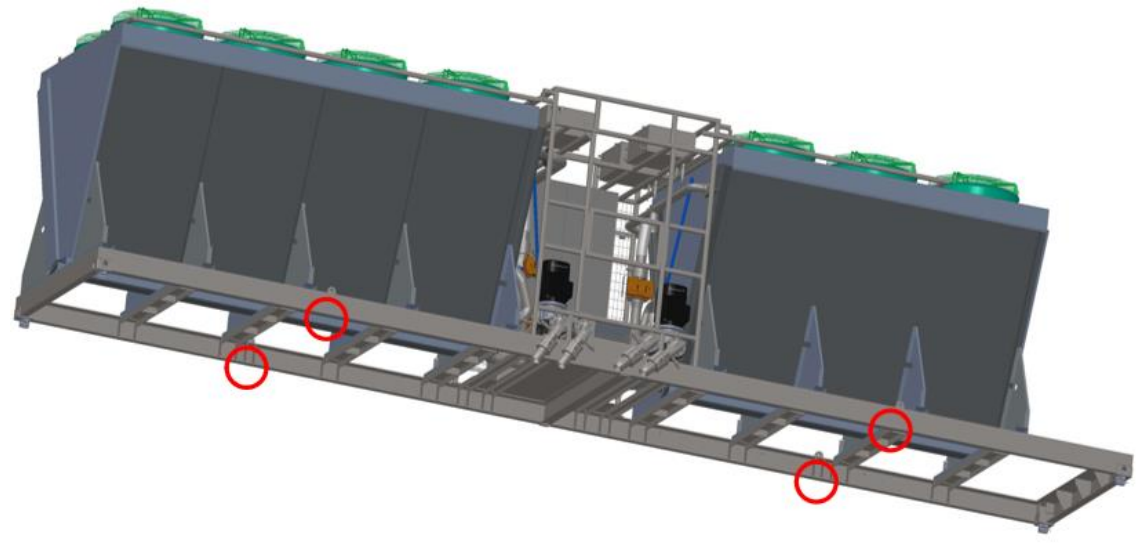
Support points of the Cooler skid, consisting of standard ISO container corners, and flat plates near the middle. Measurements in mm.

6.3.2 On-ground maneuvering

Maneuvering the platform on ground is possible with the use of Dolley's, Machine Skates, or rollers.

Placement of these must be under the designated lifting-points, as indicated in Figure 6.

Figure 6: Platform support points for on-ground maneuvering



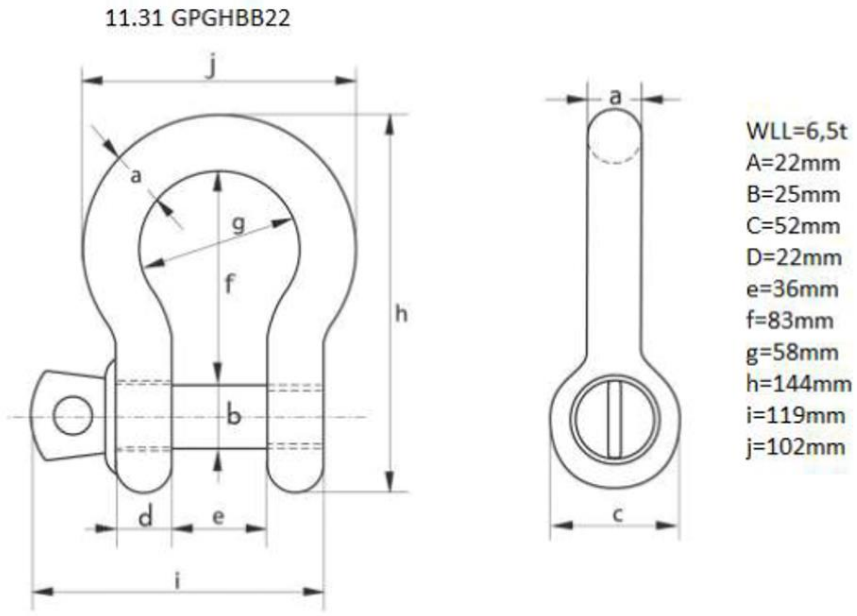
The platform may be supported directly below the 4 lifting points during storage or for maneuvering on Dolley’s, machine skates, or rollers.

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6.3.3 Craning/Lifting

	**Using any other method of lifting than described in the following is prohibited.**
	**Do not use the standard ISO corners as lifting points, as the platform frame may deform.**
	**The center of gravity is displaced from the center of the platform. See section 6.1.**
	**It is recommend to use of bow shackle in the provided lifting points, Approved for minimum 6T, maximum pin diameter 25,4 mm**

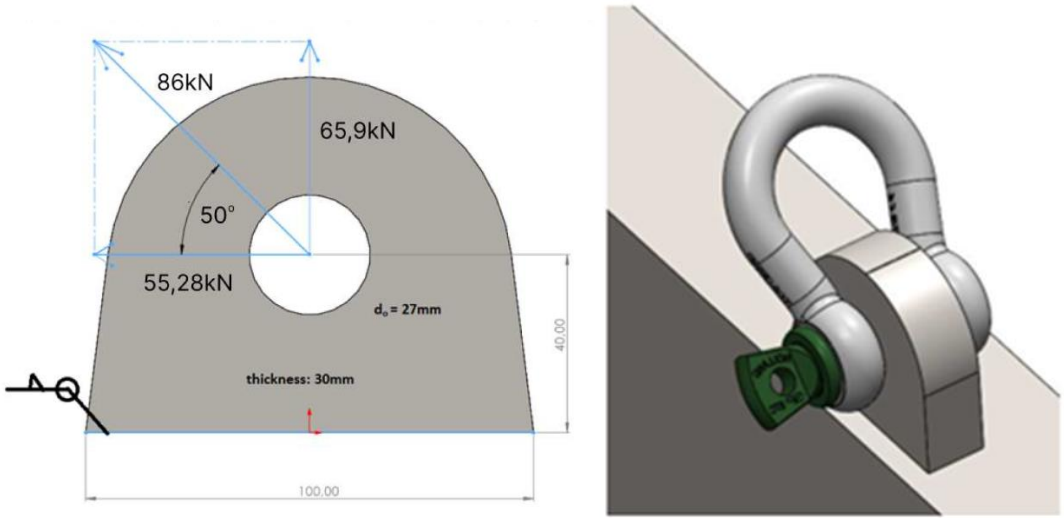
Figure 7: Example of mounted Bow shackle



Safety factor assumed by manufacturer: 6:1
WLL of the product: 6,5 ton

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Figure 8: Example of mounted Bow shackle

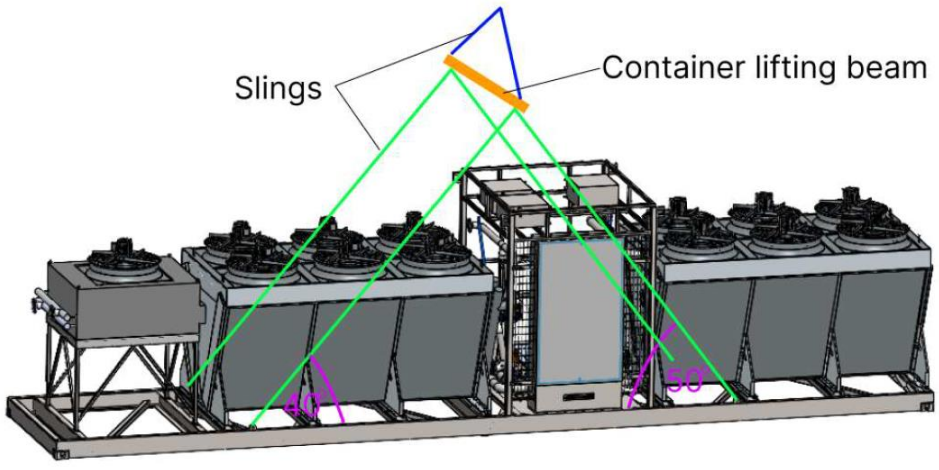


Indicative figure if needed bow shackles and worst-case scenario of forces applied to padeye with the following lifting scenarios.

6.3.3.1 Single lift

Requires one Container Lifting Beam (2368mm between green slings at lifting beam) to prevent damage on coolers.

Figure 9: Cooler platform single lift



Colors in the figure **does not** indicate any recommended lifting capacity

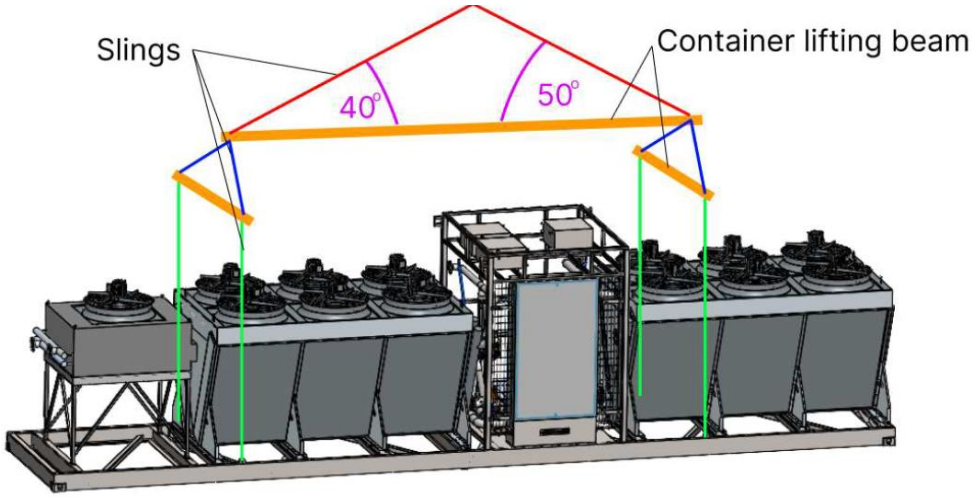
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6.3.3.2 Vertical lift

Requires two lifting beams no. 1: 2368mm between green slings at lifting beam

Require one container lifting beam no 2: 6692mm – distance between blue slings at lifting beam

Figure 10: Cool platform vertical lift



A Cross-lifting beam or H-lifting beam must be used to prevent slings to damage the coolers. Colors in the figure **does not** indicate any recommended lifting capacity

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6.3.4 Transportation method

Transportation of the Cooling Platform is recommended to be done with a semi-trailer for standard ISO containers, enabling fixation with the use of the standard ISO 1161 corners.

The driver must make sure that the platform is adequately secured for transport.

	**Transporting the platform mounted on top of an applicable Fuel Cell Container is prohibited.**
	**During transport, the Cooling platform must always be supported as described in section 6.3.1.**
	**The semitrailer needs locks for ISO corners for anchoring and appropriate middle support.** **Or** **Applicable fixations points and appropriate middle support.**

6.4 Anchoring/assembly on designated site

The Cooling skid is to be permanently mounted onto the 40ft Fuel Cell container.

Tools needed:

4x Twist-lock.

1. The 40ft Fuel Cell container needs to be placed and anchored to the designated site, prior to mounting of the Cooling skid.
2. Place the 4 twist-lock in the container corners
3. Lift and handle the cooling skid as described in this manual.
4. Line-up the twist-lock-applied container corners with the corners of the Cooling skid and lower the cooling skid onto the twist-locks.
5. Lock all 4 twist locks

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7.0 Grid Interface Container

7.1 Technical Data

Table 7-1: Key figures of Grid Interface Container	
Container type	Modified 10ft High Cube ISO Container
Dimensions (l/w/h)	3.0/2.5/2.9 m
Weight (dry)	7350 kg

Refer to General Arrangement CoG or attached document.

7.2 Packaging

The Grid Interface Container needs proper packaging, and this is the responsibility of Ballard when transporting from manufacturer.



The cooling circuits shall be drained from coolant to the extent possible prior to transportation and handling

7.2.1 Loose parts

No loose parts may be placed or temporarily fixated in the container for transport.

7.2.2 Preparation for transport

Preparing the Grid Interface Container for transportation is a Ballard responsibility.

The following must be completed:

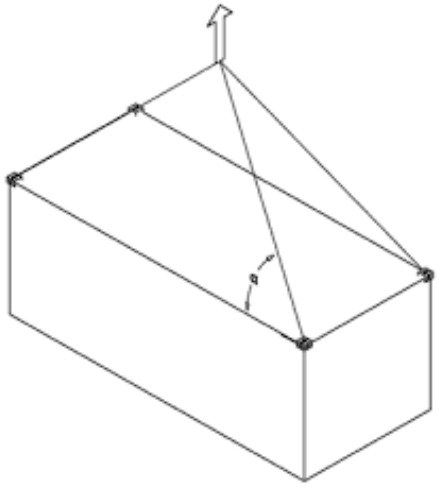
- Disassembly and packaging of cooling pipes.
  Open pipes must be covered by a protective plug/cover.
- All wall passthroughs must be covered to ensure no ingress
- Check that air intake and exhaust are closed.
- Check that 24VDC UPS batteries are securely fastened
- Ensure that the State of Charge on the UPS is <30%.
- Isolate the UPS batteries by noting the placement of fuses and remove them
- Fixated the MV transformer with the transportation spacer (Item 7003674-04).
- Check that all cabinets are securely locked.
- Check that access doors and container doors are securely locked against unauthorized access.
- Wrap the container if needed, to prevent dust and dirt from entering the container during transport.

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7.3 Handling and Transport

The Grid Interface Container can be transported and craned using ordinary truck and craning equipment, suitable for handling an ISO container as per ISO 3874. It is the responsibility of the handler to read and decide the applicable method.

Figure 11: 40ft Container lifting example



Recommended lifting method, since the bottom corners might need to meet anchor points of the designated site.

The driver must make sure that the container is adequately secured on the truck for transport.

Standard safety procedures, approved tools and Personal Protective Equipment must be used. Ballard will inform the crane operator of any additional on-site regulations that must be adhered to.

Craning must always be supervised by Ballard responsible, however this does not remove the responsibility for the crane operator to ensure that the craning and crane equipment in use is done safely, and it does not remove the responsibility for damages incurred during craning from the operator.

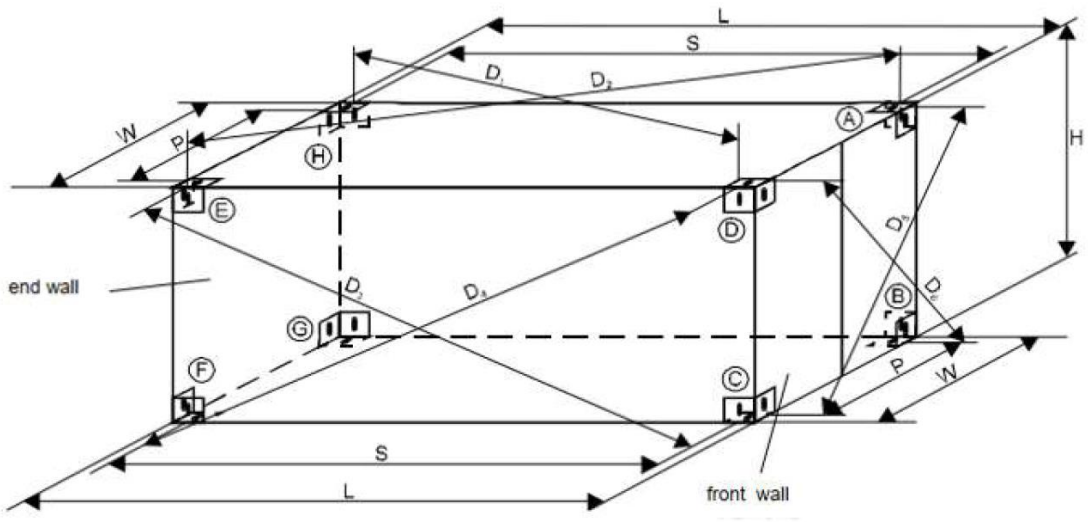
7.4 Anchoring on designated site

To anchor the Grid Interface Container on the designated site, integrator must use the standard ISO corners of the container.

Integrators of the system are recommended to anchor the container onto the designated site with ground-plate twist-locks. If anchoring is done using the bottom-side of the ISO corners (B, C, F, G in Figure 12), e.g. ground-plate twist-locks, verify the corner-distances of the containers prior to design of site.

Figure 12: 10ft Container ISO corners distances

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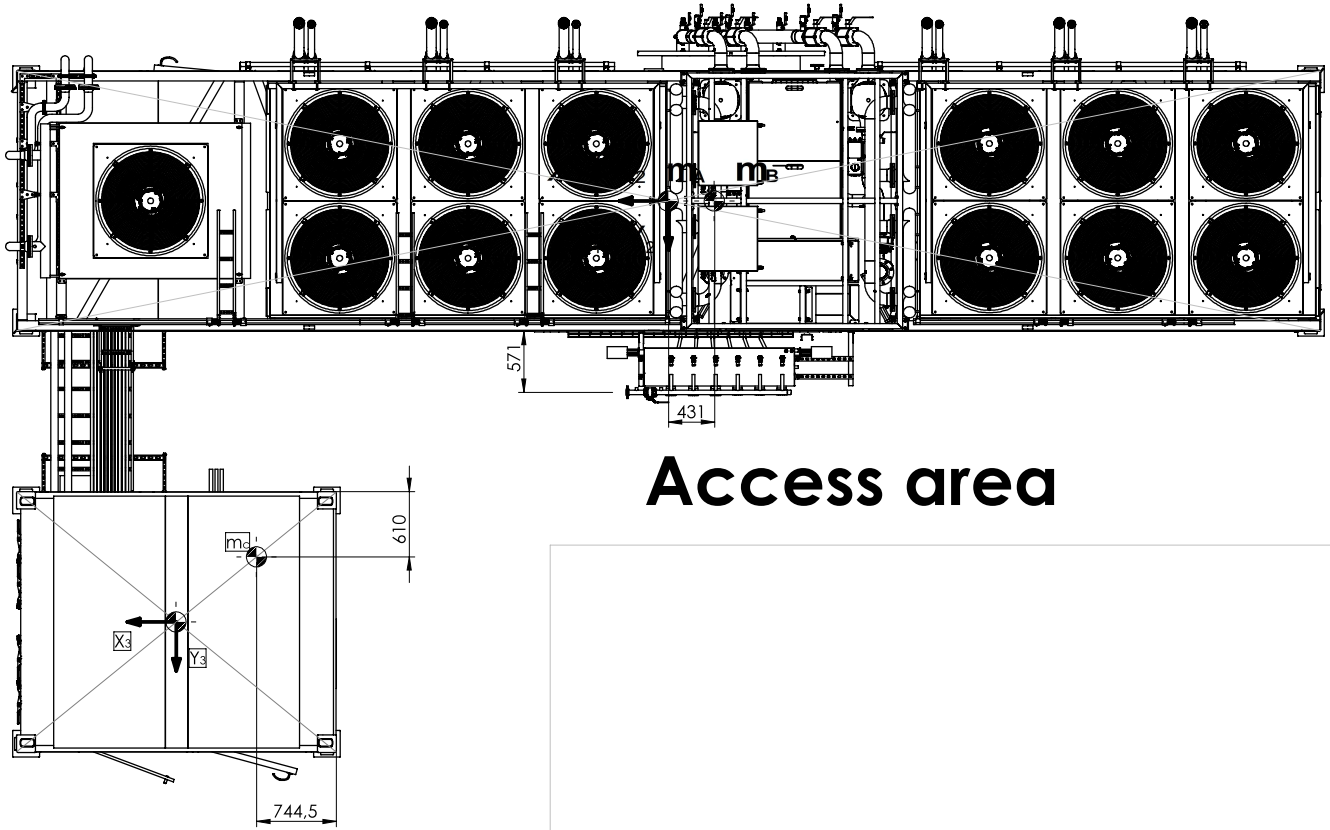


P = 2260 (+3) (-5) mm.
S = 2787 (+3 (-10) mm.

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TOP VIEW - Center of Gravity

Access area



Access area



NOTE:
1.) Location relative to the directions of the world on the top view (sheet 3/14)
2.) Reactions forces and mounting details are described on sheets 13 and 14
3.) A ladder is required to access the platform above 40ft Container
4.) 40ft flatbed structure meets requirements of EN1090-2 - Execution class: EXC2.

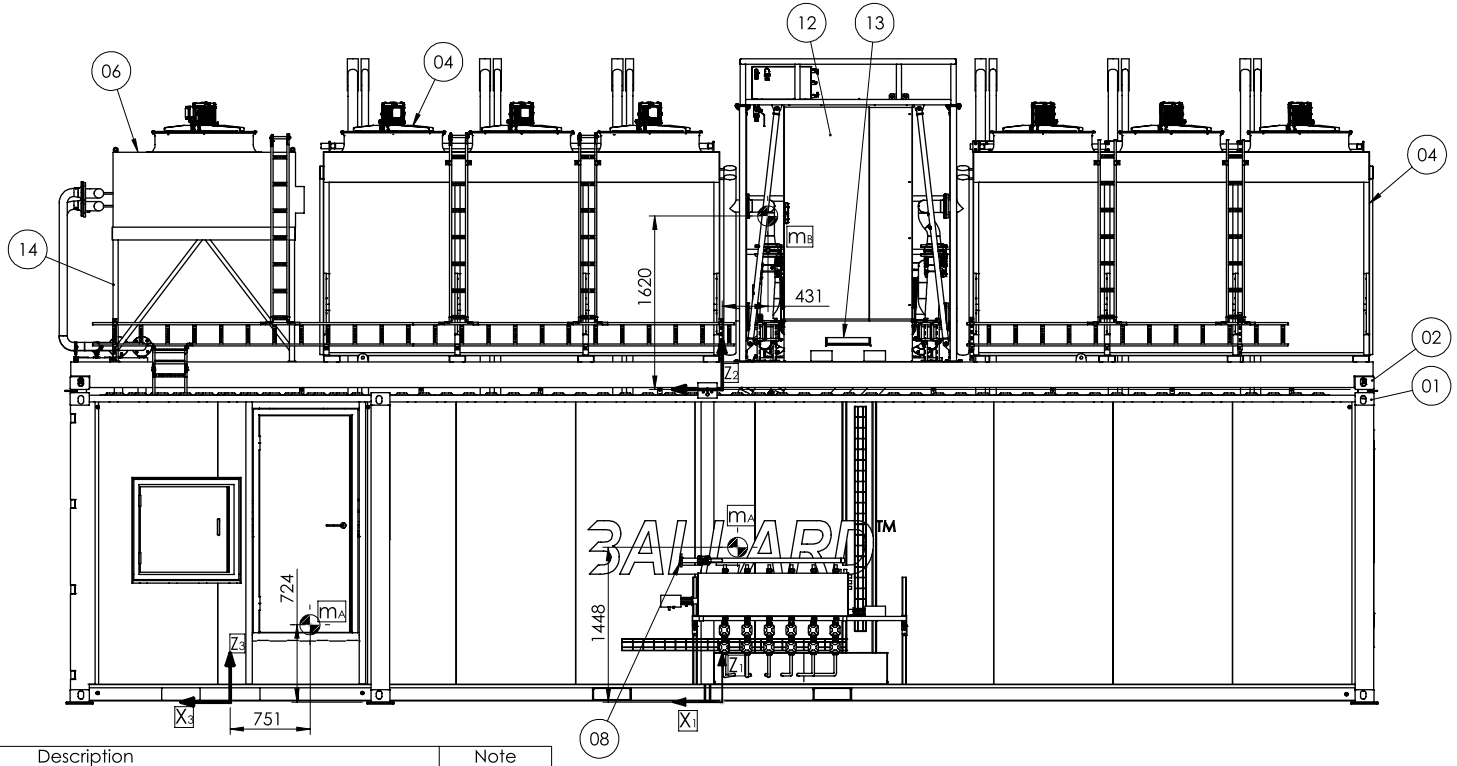
MATERIAL			
Material must comply to Directive 2002/95/EC of the European Parliament (RoHS) and to Regulation (EC) No 1907/2006 of the European Parliament (Reach)			
Tolerances for linear and angular dimensions without individual tolerance according to ISO 668		By	Date
	Drawn	ASM	20-02-2024
Surface appearance, if not specified, according to reference table LZT 142 0001, category 6	Revision		
	Released		
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WEIGHT		SIZE	SHEET	SCALE	PART NUMBER:	REVISION
24943288 g	1st angle projection	A3	9/14	1:50	601456B	8

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General arrangement

FRONT VIEW - Center of Gravity
(LOOKING SOUTH)



	Description	Note
01	40ft High Cube Container	
02	40ft Custom Designed Flatbed	
03	10ft High Cube Container	
04	HT (High Temperature) Cooler - 1050kW (Evapco)	
05	High Temperature Coolant IN/OUT (CHS 114,3x3 [mm])	
06	LT (Low Temperature) Cooler - 110 kW (Evapco)	
07	Low Temperature Coolant IN/OUT (CHS 88,9x3 [mm])	
08	H2 supply interface - TP 010	CIP
09	Process exhaust (CHS 88,9x2 [mm])	
10	H2 Enclosure; Ventilation Exhaust (CHS 60,3x2 [mm])	
11	Ventilation Unit (Air Intake) - 40ft container	
12	Coolant System Electrical Cabinet	
13	Coolant System Cabling (400V 3P-N-PE, Ethernet, Hardwired)	
14	Structure below LT Cooler	
15	Container Interconnect Cabling (750V DC)	
16	Container Interconnect Cabling (400V 3P-N-PE, Ethernet, Hardwired)	
17	Aux Power Supply Input (400V 3P-N-PE, 32A)	CIP
18	Customer Interface Cabling (Ethernet, Hardwired)	CIP
19	Drain interface - TP 015	CIP
20	~~Cover of hydrogen manifold~~	Optional
21	Customer MV Connection (6,6kV AC 3P, 92A)	CIP
22	Customer MV Connection (6,6kV AC 3P, 92A)	CIP
23	Ventilation Unit (Air Intake) - 10ft container	
	CHS = Circular Hollow Section	
	CIP - Customer Interface Point	

NOTE:
1.) Location relative to the directions of the world on the top view (sheet 3/14)
2.) Reactions forces and mounting details are described on sheets 13 and 14
3.) A ladder is required to access the platform above 40ft Container
4.) 40ft flatbed structure meets requirements of EN1090-2 - Execution class: EXC2.

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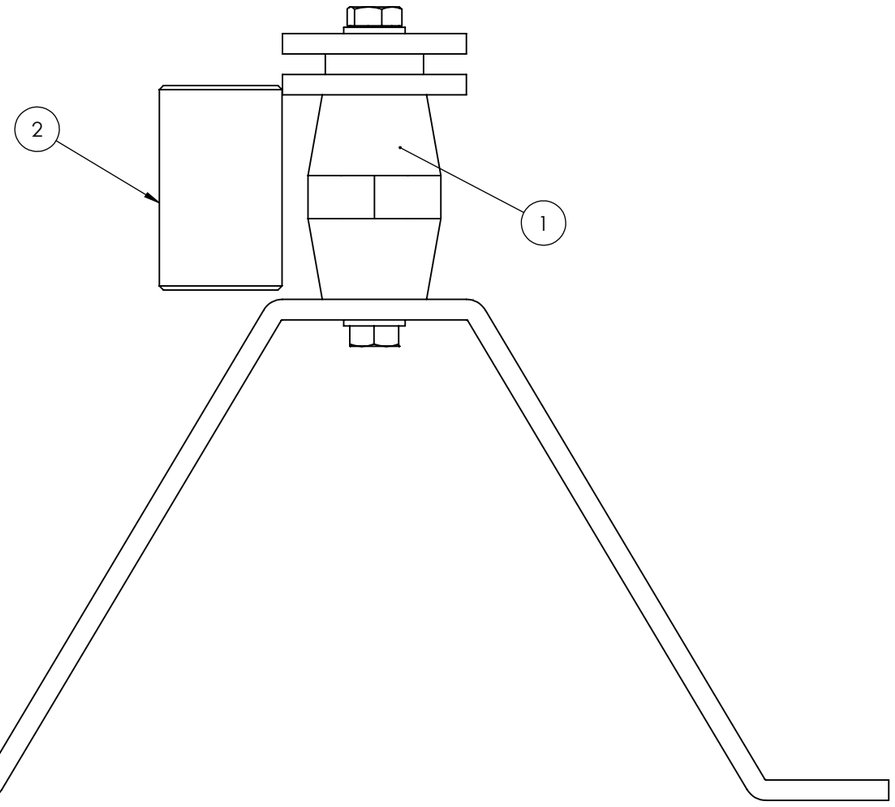
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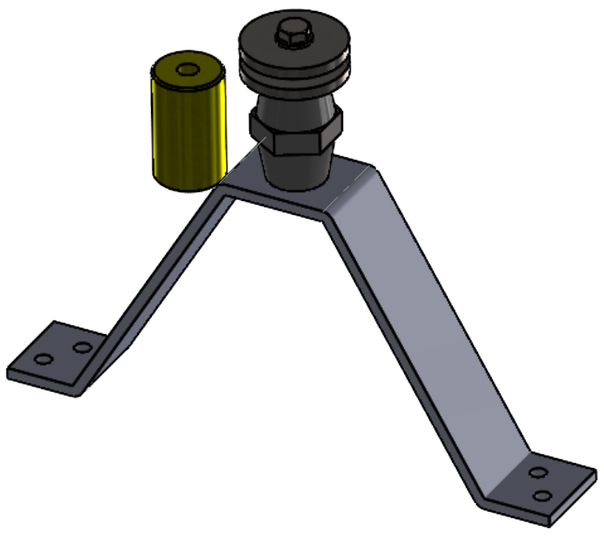
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General arrangement

SIZE	SHEET	SCALE	PART NUMBER:	REVISION
A3	10/14	1:50	601456B	8





ITEM	Number	DESCRIPTION	QTY.
1	7003673	ISO - INSULATORS	1
2	7003674-04	Spacer used under transpotation (Swap with 7003673)	1

MATERIAL

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Main Transformer Bracket

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