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1 Scope

This Linde Standard (LS) defines operational and procedural minimum requirements for lifting, stowing and securing of all Linde cargo units in preparation for their sea transport. Furthermore, it specifies documentation and approval requirements as well as operational requirements for a planned sea transport.

This Linde Standard serves for the following basic purposes:

- Guidance to masters and officers of the carrier for handling, bedding and securing of Project Cargo units and other non-standardized cargo,
- Guidance to Linde contractors, such as carriers, surveyors and *Logistics Service Providers*, for all heavy lift or oversized cargo unit sea transportation,
- General standard for avoiding any cargo damage or loss,
- Guide to execution of cargo pre-planning as well as operations.

NOTE The requirements in this Linde Standard shall be understood as defining minimum requirements. They shall not be construed as instructions limiting any contractual and / or statutory duties of the *Logistics Service Providers*. The *Logistics Service Providers* shall review this Linde Standard and – in case of identifying a potential conflict between (i) any of their statutory duties or their duty of care under the contract and (ii) any specific requirements in this standard – shall raise such conflict with Linde: When raising such conflict, the *Logistics Service Providers* shall establish in writing why and to what extent the compliance with specific requirements of this Linde Standard would lead to non-compliance with any statutory duties or their contractual duty of care, explaining to what extent a waiver from the Linde Standard is required to remedy such non-compliance. This document shall not limit the *Logistics Service Providers'* responsibility for safe practice, common sense and good seamanship.

2 Normative references

This LS contains undated references to incorporate provisions of other publications. The normative references are cited at the respective place in the text and the publications are listed below. Issues valid at the effective date of contract shall apply.

ISO 17638	Non-destructive testing of welds - Magnetic particle testing
ISO 23278	Non-destructive testing of welds - Magnetic particle testing - Acceptance levels
IMO CSS Code	IMO Code of safe practice for cargo stowage and securing
IMO IS Code	IMO intact stability code
IMO SOLAS	International convention for the safety of life at sea, 1974 and amendments; chapter VI carriage of cargoes
IMO IMDG Code	International maritime dangerous goods code
DNV-GL ST-N-001	Marine operations and marine warranty
EN 1990:2002	Eurocode - Basis of structural design
LEEA	Lifting Equipment Engineers Association; Code of Practice for the Safe Use of Lifting Equipment

3 Definitions and abbreviations

Definitions

<i>Critical Project Cargo</i>	<p>Cargo or equipment that may be large, heavy or out of gauge. <i>Critical Project Cargo</i> requires special stowage, lifting and handling. It may consist of critical items and is typically involved with a quantity of goods connected to the same project, which may be loaded from different ports.</p> <p>Critical items are items which comply with one or more of the following points:</p> <ul style="list-style-type: none"> • high value items, • long replacement time, • Items that require special provisions for safe loading, stowage, securing or discharge.
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<i>General Project Cargo</i>	Cargo or equipment that may be large, heavy or out of gauge. <i>General Project Cargo</i> may require special stowage, lifting and handling.
<i>General Transport Conditions</i>	Minimum conditions and requirements applicable to <i>General Project Cargo</i> under this Linde Standard. Six different classes of <i>General Transport Conditions</i> are defined in this document
<i>Linde Specific Transport Conditions</i>	Designation which may be specified by Linde for cargo which Linde considers to be <i>Critical Project Cargo</i> , informing the <i>LSP</i> that the <i>General Transport Conditions</i> , applicable to the particular cargo unit, shall not be determined according to the usual classification, but following the specific classification for <i>Linde Specific Transport Conditions</i> (usually meaning an increase of such requirements).
<i>Logistics Service Provider (LSP)</i>	Organisation or person that provides logistics services under the according orders from Linde.
<i>Metacentric height (GM')</i>	Vertical distance between the center of gravity (G) of a ship and its metacenter (M).
<i>Method Statement (MoS)</i>	Document which states the procedure to carry out a specific activity, in the context of this standard generally related to transportation, handling and safety. It also includes preparation, materials and tools to be used. Risk assessment for an activity is usually included.

Abbreviations

CoG	Center of Gravity
FEM	Finite Element Method
IMO	International Maritime Organization
MIG	Metal Inert Gas Welding
MPI	Magnetic Partial inspection
MSL	Maximum Securing Load
MWS	Marine Warranty Surveyor
PPE	Personal protective equipment
Ro-Ro	Roll on - Roll off
SPMT	Self-propelled modular transport
SWL	Safe Working Load

4 General requirements

4.1 General description

Linde reserves the right to assign a surveying company to approve all technical documentation, *Method Statements (MoS)* and site operations in question.

All cargo operations shall be authorized by Linde or Linde's assigned surveyor. Cargo operations without an authorization will be declined and all resulting costs shall be borne by the *Logistics Service Provider*.

Linde and its surveyors reserve the right to stop any cargo operation in which any 'Health and Safety' concerns are raised. All resulting costs shall be borne by the *Logistics Service Provider*.

Linde and its surveyors reserve the right to suspend any cargo operation where said operation deviates from the approved technical documentation and/or *Method Statement* or any associated approved 'Change Management' procedures. All associated costs resulting from the above-mentioned suspension will be borne by the *Logistics Service Provider*.

Linde will provide all appropriate cargo information sufficiently in advance before loading, to enable the necessary precautions for proper stowage and safe carriage of the cargo. Where the *LSP* believes any such information to be incomplete or missing, an immediate query shall be sent to Linde.

All methods of the calculation for e.g. lifting, ship stability or cargo securing shall be certified by a Classification Society or responsible approval authority. If recommended by Linde or its appointed surveyor, carrier or LSP shall provide comparative calculation to proof compliance with relevant Codes and Guidelines. Certificates shall be attached to the *Method Statement (MoS)*.

The *Système International d'Unités (SI-units)* applies for use of all symbols and units.

Linde has defined minimum conditions and requirements for the transport of cargo items:

General Transport Conditions shall apply where Linde does not provide an explicit statement about the transport conditions applicable to that specific transport. There are six different classes of *General Transport Conditions* and the class applicable shall depend on the cargo characteristics pursuant to the criteria provided in section 4.2 [General transport conditions].

Linde Specific Transport Conditions shall apply if specified by Linde prior to transportation. There are three different classes of *Linde Specific Transport Conditions* and the class applicable shall (unless indicated otherwise by Linde) depend on the cargo characteristics pursuant to the criteria provided in section 4.3 [Linde Specific Transport Conditions]

4.2 General transport conditions

General Transport Conditions of Project Cargo for Linde are provided in six different classes of general conditions. These *General Transport Conditions* apply without exception to every transport, unless a Linde specific classification is explicitly issued/specified in accordance with the *Linde Specific Transport Conditions* (if applicable see section 4.3 Linde Specific Transport Conditions).

Table 1 shows the six classes of *General Transport Conditions* for general cargo items, the applicable class being based on the cargo characteristics:

Table 1: General Transport Conditions

<i>General Transport Conditions</i>	Cargo characteristics
1	Cargo items within dimensions of > 13,5 m length and/or > 2,4 m width and/or > 2,4 m height and/or a weight > 20 until maximum 120 mt
2	Cargo items within a weight of 120 – 250 mt
3	Cargo items within a weight of 250 – 500 mt
4	Cargo items within a weight of 500 – 750 mt
5	Cargo items within a weight of 750 – 1000 mt
6	Cargo items within a weight of over 1000 mt

Based on these *General Transport Conditions*, the transport documents shall be provided to Linde acc. Table 3: Content of Method Statement depending on cargo condition.

4.3 Linde Specific Transport Conditions

The *Linde Specific Transport Conditions* shall apply if specified by Linde prior to transportation.

NOTE If *Linde Specific Transport Conditions* are specified, it is assumed that the relevant cargo consists of *Critical Project Cargo*.

Transportation of *Critical Project Cargo* items requires attention, assessment and planning of the operations for:

- Loading/unloading during port operations and assets
- Vessel, barge or tug selection
- Cargo loading/ unloading operations
- Stowage of cargo
- Securing of cargo

Table 2 shows the three classes of *Linde Specific Transport Conditions* for specific sensitive, high value cargo items or those with a high cost impact (in the sole assessment of Linde):

Table 2: Linde Specific Transport Conditions

<i>Linde Specific Transport Condition</i>	Cargo characteristics
1	Cargo items within l x w x h = 13,5m x 2,4m x 2,4m and/ or a weight below 20mt that need special transportation procedure due to high value or other critical cargo
2	Cargo items that have a high value or high cost impact within heavy cargo/ oversized cargo definitions
3	Very sensitive cargo items with critical impact to projects or values to Linde and its customer

Based on these *Linde Specific Transport Conditions*, the transport documents shall be provided to Linde acc. to Table 3: Content of Method Statement depending on cargo condition.

I Transportation planning

5 General planning provisions

5.1 General

Linde cargo shall not be stowed on top of other cargo or other cargo on Linde cargo (unless clearly marked as overstackable / stackable).

Shifting of cargo during other port operations or any shifting after loading shall not be performed.

Transshipment of any Linde cargo to another vessel shall not be performed unless applied for in writing by LSP in advance together with a comprehensive explanation as to why it is deemed necessary, and written confirmation of same has been issued by Linde.

5.2 Documents and certificates for equipment

The following documents and certificates shall be presented to Linde prior loading, either as hard copy or PDF file.

- 5.2.1 Certificates of lifting and securing equipment
- 5.2.2 Crane certificates including runners, toppers and crane hook
- 5.2.3 Cargo gear book
- 5.2.4 All maintenance and inspection records of annual inspections as well as thorough examination to be carried every 5 years and yearly visual examination by competent person
- 5.2.5 Certificate of stability computer
- 5.2.6 Cargo ship safety certificate
- 5.2.7 International load line certificate

6 Method Statement (MoS)

6.1 Content of Method Statement to be provided

The *LSP* shall prepare a *Method Statement (MoS)* and shall timely (in accordance with the below requirements) provide such *MoS* to Linde for review and approval.

The content of the *Method Statement (MoS)* may vary depending on the class of cargo conditions applicable to the respective transport, as specified in Table 3:

Table 3: Content of Method Statement depending on cargo condition

Transport Conditions	Documents/Requirements of <i>Method Statement</i>	Comments
General Transport Condition 1	Carriers standard documentation including the following minimum: <i>IMO</i> CSS code for cargo accelerations and securing Lifting in accordance with LEEA or equipment manufacturer's guidance; i.e. Crosby, Van Beest etc. Seagoing stability Management of Change procedure	-
General Transport Condition 2	Acc. to Annex A MoS: Requirements for General Transport Condition 2	-
General Transport Condition 3 OR, if applicable LINDE Specific Transport Condition 1	Acc. to Annex B MoS: Requirements for General Transport Condition 3 and Linde Specific Transport Condition 1	If Module transportation see General Transport Condition 4
General Transport Condition 4 OR, if applicable LINDE Specific Transport Condition 2	Acc. to Annex C MoS: Requirements for General Transport Condition 4 and Linde Specific Transport Condition 2	If Module transportation see General Transport Condition 5
General Transport Condition 5 OR, if applicable LINDE Specific Transport Condition 3	Acc. to Annex D MoS: Requirements for General Transport Condition 5 and Linde Specific Transport Condition 3	If Module Transportation and <i>Ro-Ro</i> see General Transport Condition 6
General Transport Condition 6	Fully engineered solution for handling, securing and transportation of cargo in accordance with DNVGL-ST-N001 ASD/WSD or LRFD approach depending on suitability of cargo/module for transportation. Relevant sections/chapters of this Standard to be used as appropriate for contractor's scope.	Including Module and <i>Ro-Ro</i> Transportation

6.2 Timeline for provision of Method Statements and notifications on commencement of cargo operations

MoS shall be provided to Linde at least 40 working days prior to the cargo operation, in order to allow for an approval by Linde.

Unless otherwise agreed, the commencement of cargo operations needs to be advised to Linde in advance, narrowing the indication down in accordance with the following scheme:

- 6 months notice for a 30-day starting period (for the planned commencement date)
- 1 month notice for a 1 week starting period
- 2 weeks notice for a 3-day starting period
- 1 week notice for the specific commencement date, i.e. the day of starting cargo operations

6.3 Complete content of Method Statement

In addition to the mandatory Content of *Method Statement* depending on cargo condition in Table 3, the entire documentation of the scope of the *Method Statement* can be consulted. Linde reserves the right to supplement the Transport Conditions with additional content.

6.3.1 Job details

6.3.1.1 Cargo details; dimensions, weight and CoG location

6.3.1.2 Vessel details including crew details (relevant qualification of key personnel) and planned crew change during voyage

6.3.1.3 Description of route with a plot indicating safe havens and refuelling arrangements

6.3.1.4 Anti-piracy measures to be described (in general terms) if route is via known piracy areas

6.3.2 Sailing/voyage details (see 6.3 for further details)

6.3.2.1 Metocean conditions for route with consideration to time of the year if weather restricted

6.3.2.2 Limiting conditions like draught, water depth, bridges, obstructions etc.

6.3.3 Ship stability (see 6.5 for further details)

6.3.3.1 Description of vessel and cargo

6.3.3.2 Description of *IMO* standards applicable to transportation

6.3.3.3 Description of additional standards applied, e.g. Noble Denton, DNV etc.

6.3.3.4 Description of software being used for calculations and method of analysis

6.3.3.5 Stability calculation for both intact and damaged condition, including wind effects and all relevant graphs

6.3.3.6 Model validation vs. vessel published data, where non-Class approved software is being used

6.3.3.7 Longitudinal strength check of vessel in seagoing condition for various load cases (static in harbour, seagoing accelerations)

6.3.3.8 Ship torsion strength checks on a case by case basis

6.3.4 Lifting procedures (see 6.6 for further details)

6.3.4.1 Roles & responsibilities, including contact details

6.3.4.2 Organogram of involved persons

6.3.4.3 Lifting design standard used

- 6.3.4.4 Description of cargo being lifted (including lift point details and CoG)
- 6.3.4.5 Crane specification
- 6.3.4.6 Rigging specification
- 6.3.4.7 Ground loading specification, if applicable
- 6.3.4.8 Limiting weather criteria for lift and crane operation
- 6.3.4.9 Calculation of lifted weight; including rigging
- 6.3.4.10 Load spreading calculation for lift
- 6.3.4.11 Crane set-up & lift preparation procedure (step-by-step)
- 6.3.4.12 Crane lift procedure (step-by-step)
- 6.3.4.13 Lift order including vessel operations such as tween deck shifting and other operations that may interfere with planned cargo operations
- 6.3.4.14 Lifting arrangement incl. drawings, bill of material and certificates for all planned equipment
- 6.3.4.15 Clear marked clash points or advantages of the planned lift
- 6.3.4.16 Lift plan drawings including hook height requirements
- 6.3.4.17 Safe lifting operations procedure
- 6.3.5 Stowage plans and loading sequence (see 6.4 for further details)
- 6.3.5.1 Drawing(s) shall include dimensions of cargo CoG from vessel Aft Perpendicular, Centreline and Baseline
- 6.3.6 Securing procedures including (see 6.7 for further details)
- 6.3.6.1 Description of vessel and cargo
- 6.3.6.2 Definition of limiting structural criteria; allowable stresses, limit state etc.
- 6.3.6.3 Material specification and design standard used; including material yield stress, allowable stresses, limit state stresses etc.
- 6.3.6.4 Limiting motion criteria; period, angle and accelerations for roll, pitch and heave
- 6.3.6.5 Description of software used for calculations and method of analysis
- 6.3.6.6 Detailed calculation/derivation of seagoing forces
- 6.3.6.7 Description, calculation and sketches of sea fastening designs
- 6.3.6.8 Description, calculation and sketches of support structure / grillage
- 6.3.6.9 Deck strength checks including checks on under deck welds
- 6.3.6.10 Relevant design drawings
- 6.3.7 Environmental conditions (as relevant for operation limits)
- 6.3.7.1 Limiting wind conditions
- 6.3.7.2 Limiting waves & swell
- 6.3.7.3 Limiting currents
- 6.3.7.4 Tide levels and range for all operations
- 6.3.8 Trailer operations procedures
- 6.3.8.1 Description of trailers and cargo
- 6.3.8.2 Limiting weather criteria
- 6.3.8.3 Limiting stability criteria; incline of road and slope, min/max stoke heights
- 6.3.8.4 Description of trailer route with description of any potential obstructions
- 6.3.8.5 Roles & responsibilities (including contact details)

- 6.3.8.6 Organogram of involved personnel
- 6.3.8.7 Management of change process
- 6.3.8.8 Contingency plans, i.e. machinery breakdown, bad weather, trailer recovery plan from linkspan etc.
- 6.3.8.9 *SPMT* set-up & preparation procedure (step-by step)
- 6.3.8.10 *SPMT* loadout procedure (step-by-step), with reference to marine procedures
- 6.3.8.11 *SPMT* specifications
- 6.3.8.12 Description of software being used for calculations and method of analysis
- 6.3.8.13 Stability calculation for each trailer move
- 6.3.8.14 Structural check on *SPMT*'s when loaded
- 6.3.8.15 Relevant design drawings
- 6.3.8.16 Traction calculation
- 6.3.8.17 Trailer lashing calculation
- 6.3.8.18 Route ground loading check/calculations
- 6.3.8.19 Quayside ground loading check/calculations, trailers and linkspan
- 6.3.8.20 Linkspan loading checks
- 6.3.8.21 Abort procedure, recovery and time in contingency for tide
- 6.3.9 *Ro-Ro* loadout procedures
 - 6.3.9.1 Description of vessel and cargo
 - 6.3.9.2 Roles & responsibilities (including contact details)
 - 6.3.9.3 Organogram of involved personnel
 - 6.3.9.4 Tidal data for dates of loadout
 - 6.3.9.5 Operational limits, such as max/min height of deck above quay during operation
 - 6.3.9.6 Description of ballasting operation
 - 6.3.9.7 Description of software being used for calculations and method of analysis
 - 6.3.9.8 Ballasting plans for load-out/load-in of cargo
 - 6.3.9.9 Vessel/barge stability calculations at each stage of ballast plan
 - 6.3.9.10 Pump capacity and specification
 - 6.3.9.11 Contingency plan and ballast reserve
 - 6.3.9.12 Ballast plan drawings
 - 6.3.9.13 Vessel longitudinal strength checks for each stage of load-out and load-in
- 6.3.10 Mooring arrangement for *Ro-Ro* operations
 - 6.3.10.1 Description of vessel and quay/site
 - 6.3.10.2 Limiting environmental criteria
 - 6.3.10.3 Mooring equipment specification, including bollard and winch specifications
 - 6.3.10.4 Description of software being used for calculations and method of analysis
 - 6.3.10.5 Description of mooring arrangement
 - 6.3.10.6 Mooring equipment installation method statement
 - 6.3.10.7 Mooring calculation for intact condition
 - 6.3.10.8 Mooring calculations for damaged condition

- 6.3.10.9 Contingency arrangements for failure of mooring arrangement
- 6.3.10.10 Relevant design drawings
 - 6.3.11 Risk assessments
 - 6.3.11.1 Description of risk analysis process
 - 6.3.11.2 Identified hazards
 - 6.3.11.3 Mitigations to risks that will be implemented
 - 6.3.11.4 Responsibilities for each mitigation
 - 6.3.12 Operational aspects
 - Specific control measures for operation and task to ensure a safe and controlled job
- 6.3.13 Quality assurance and document control
 - For all documentation, revision numbers and originator shall be clearly stated.

6.4 Voyage description

The route of the voyage should be critically assessed in terms of weather conditions, areas of navigation danger, exposure to weather, as well as areas of known piracy activity.

The voyage route should include contingency plans in case of emergency events or forecasted weather exceeding the limits defined in the stowage and sea-fastening calculations.

6.5 Stowage plan and loading sequence

- 6.5.1 As a minimum, the stowage plan:
 - shall clearly indicate the final position of each cargo unit
 - shall show clear dimensions of cargo CoG relative to ships Aft Perpendicular, centreline and baseline
 - shall distinguish between on deck cargo and under deck cargo
- 6.5.2 Loading sequence:

Cargo operation including vessel operations such as hatch covers, tween deck shifting and other operations that may interfere with planned cargo operations.
- 6.5.3 Planned loading sequence shall be presented before operation.

6.6 Ship stability

The ship stability shall always be in accordance with the IMO Code of Intact Stability. Stability calculations shall be carried out by a certified program only.

- 6.6.1 General:
 - The stability calculation sheet shall indicate vessel name and basis vessel data
 - The intact stability calculation shall be retraceable and be based on the latest data update of the assigned vessel
 - All calculation should be based on assigned vessel/vessel type
 - Sufficient stability and reserve buoyancy shall be ensured for all vessels and floating objects in all stages of the marine operations
 - Dynamic effects shall be considered if relevant
- 6.6.2 Stability calculations within the *MoS*
 - Voyage condition:
 - Arrival condition
 - Departure condition

- Loading condition:
 - Intact lifting stability of worst-case scenario shall be calculated (e.g. Maximum outreach with heaviest unit on hook and maximum boom up with heaviest unit on hook)
 - Minimum GM' shall not be less than 1.00 m at all times
 - Water ballast sufficient for counteracting heeling moments shall be indicated within stability calculations
- Barge stability:
 - Verification of calculated stability model vs. published stability book
 - Intact and damaged stability (single compartment)
 - Ballast plans and ballast arrangement drawings
 - Ballast pump capacity and specifications

6.7 Lifting plan

- General crane limits such as outreach and lifting height shall be clearly indicated
- Bill of material shall be shown
- Single lift or Tandem lift lifting plans shall indicate maximum hook load for each crane
- For cargo <100mt lifting and rigging arrangements are to be in accordance with LEEA
- For a fully engineered lift, the lift plan and hook loads should be in accordance with DNVGL-ST-N001 and Figure 1

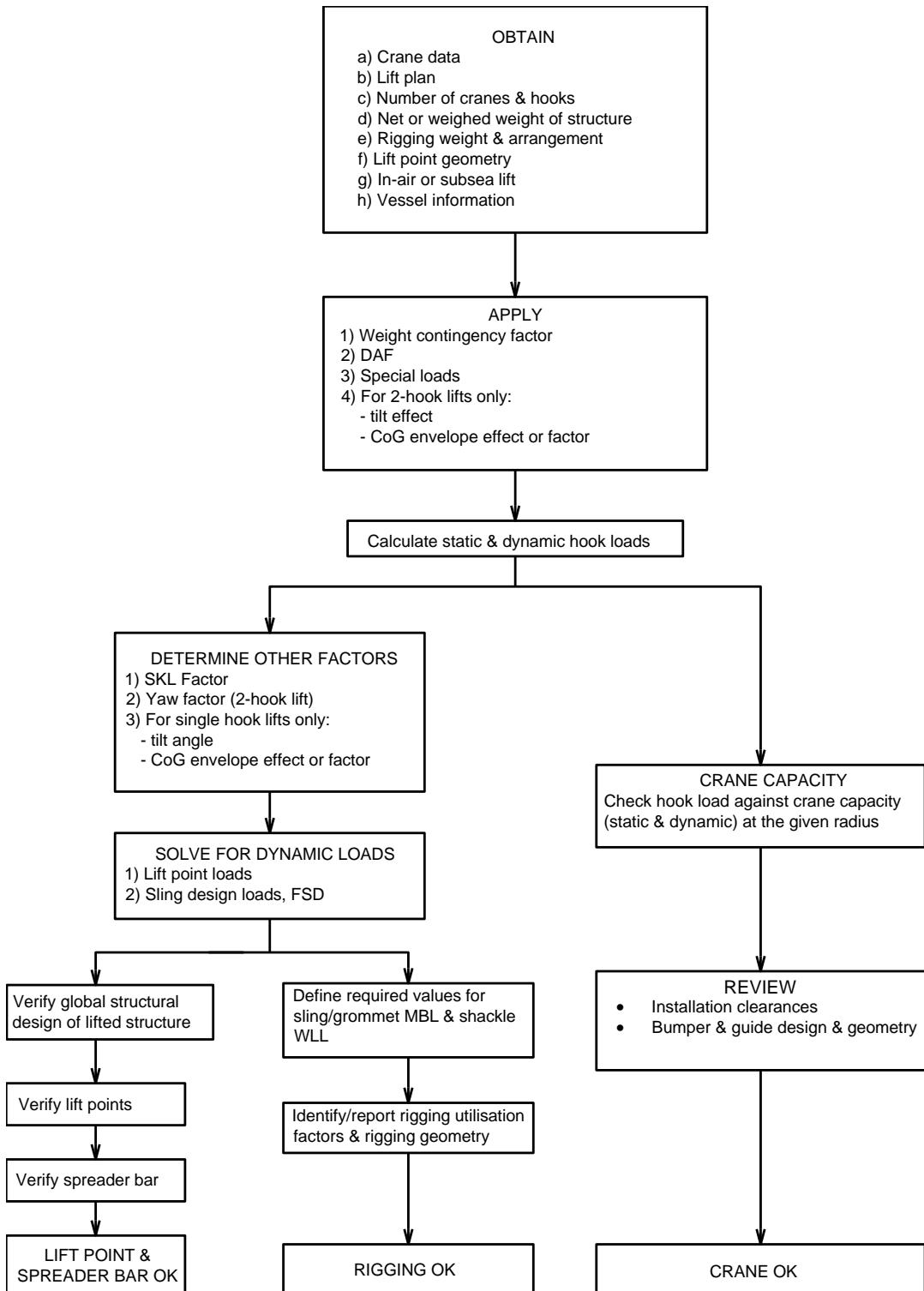


Figure 1: Lifting Safety Factors

- Loads in lift points and slings, and the total loading on the crane should be based on hook loads, where:
 - Static hook load = gross weight of unit + rigging weight
 - Dynamic hook load = static hook load x DAF
- DAF factors can be used according DNVGL-ST-N001 Table 16-1:

Table 4: DAF factors according to DNVGL-ST-N001

Static Hook Load (SHL) (tonnes)			DAF		
			Onshore ^{2), 3)}	Inshore ^{4), 6)}	Offshore ^{5), 6)}
3 ¹⁾	< SHL ≤	100	1.10	$1.07+0.05 \sqrt{(100/\text{SHL})}$	$1+0.25 \sqrt{(100/\text{SHL})}$
100	< SHL ≤	300	1.05	1.12	1.25
300	< SHL ≤	1000	1.05	1.10	1.20
1000	< SHL ≤	2500	1.03	1.08	1.15
SHL > 2500			1.03	1.05	1.10

¹⁾ For lifted items weighing less than 3 tonnes, it is recommended to assume that the item weighs 3 tonnes, and this is used throughout the calculations for the rigging design.
²⁾ For onshore crawler cranes travelling with load, possible dynamic effects should be evaluated thoroughly. Crane speeds and surface conditions should be considered. If not documented, the factors for “inshore lifts” should be used.
³⁾ Onshore is also applicable to a lift to/from a vessel moored alongside a quay using a land-based crane. If a ship’s crane is used, inshore factors apply.
⁴⁾ Inshore is applicable to a lift with a crane vessel to/from a vessel in sheltered waters and is also applicable to lifting from the deck of a crane vessel onto a fixed platform at an offshore location
⁵⁾ Offshore is applicable to a lift by a crane vessel from another vessel to a fixed platform.
⁶⁾ SHL refers to the Static Hook Load.

- Other lift factors should be determined from the DNV standards as appropriate and applied to the rigging and crane calculations for the lift plan.
- Rigging weight should be indicated clearly. Rigging weight includes all items between the lift points and the crane hook, including slings, shackles and spreaders as appropriate.
- Sling load diagram including utilizations of each lifting equipment component should be included on lifting drawings.
- Crane limits for designated lift:
 - Maximum outreach
 - Maximum lifting height
 - Maximum lifting load
 - Cut out limit; the percentage utilization at which the crane will automatically stop

6.8 Securing plan

6.8.1 Cargo securing drawings shall show:

- all securing elements. The use of cut outs is allowed
- dimensions from cargo CoG to securing point
- alignment with underdeck structure of vessel

6.8.2 Cargo securing calculations:

- Any provided calculation for cargo securing shall be transparent and comprehensible

- Calculations shall include description of load path
- Securing calculations shall include sketches of the securing arrangement and the load path
- Securing calculations shall account for the load distribution on securing equipment/material with respect to cargo *CoG*
- Securing calculations shall balance applied securing moments and forces against calculated acceleration moments and forces for each item, to clearly show that planned securing is sufficient

II Transportation operation

7 Safe operations

7.1 General provisions for safe cargo operations

- PPE shall be worn and used always. Safety shoes, helmet, gloves, long sleeve clothing and goggles shall be used by all involved personnel.
- Specified PPE, such as hard hats, gloves, and safety goggles, equipment for working aloft, welding and hot works shall be available. Masters and officers are responsible for correct use and shall supervise all crew and personnel.
- Crew or other personnel involved in lifting operations shall not be distracted in any way, especially by use of mobile phones or other electronic devices.
- VHF / UHF radio communication in English only.
- Toolbox meeting should be held before cargo operations with all involved persons (lifting or *Ro-Ro*).
- Toolbox talk shall cover as a minimum:
 - Introductions to all personnel – roles and responsibilities: Identify who is responsible for the operation and lines of communication
 - Site inductions
 - Sign in system
 - Welfare
 - Shelter points
 - First Aiders / Responders
 - Briefly run through what to do in emergency situations
 - PPE requirements
 - Operational overview covering entire scope
 - Hazards of marine operations
 - Hazards of lifting operations
 - Hazards of work at height
 - Hazards of hot work
 - Hazards of Manual Handling
 - Main hazards and risks, and the main mitigations in place
 - Be sure to highlight any important things people need to watch out for, do, or avoid.
 - Weather – overview of forecast and weather window for weather sensitive operations.

7.2 Voyage requirements

- During the voyage, the stowage and securing of the cargo shall be regularly checked, if safety during inspection can be guaranteed.
- Linde reserves the right to specify limiting weather conditions, safe speed and other special requirements for critical units. In that case, the LSP shall adhere to such requirements.

8 Lifting operations

8.1 General lifting requirements

- 8.1.1 *GM'* shall be not less than 1.00 m during lifting operation.
- 8.1.2 Listing of vessels during lifting operations shall be within the crane manufacturer's requirements but shall not exceed 3° to any side.
- 8.1.3 Tandem lift shall be in level at all time, MoS shall detail how this is achieved, monitoring procedure and control.
- 8.1.4 All crane and lifting wires/runners during lifting operations shall be vertical at all times.
- 8.1.5 Cargo units shall be protected from damage/paint scratches caused by lifting gears and tag lines at all times.
- 8.1.6 Suitable and appropriate tag lines shall be used. Tag lines shall not be attached to lifting equipment.
- 8.1.7 Crane driver may only accept commands of lifting instructions from the appointed flag man / banksman.
- 8.1.8 The amount of transferable ballast water shall be sufficient for the lifting operation and for counteracting the heeling moment. This shall be clearly indicated in the stability calculation.
- 8.1.9 Ballast operator, person in charge for lifting and crane drivers shall have a clear line of communication.
- 8.1.10 Stop rule shall be in place.
- 8.1.11 Never use running slings for heavy lift units.
- 8.1.12 All shackles shall have suitable safety pins, i.e. welding rods are not acceptable.
- 8.1.13 All equipment shall be marked/tagged and corresponding certificates be available.

8.2 Crane operations

- 8.2.1 Crane operations shall only be carried out by qualified crane drivers.
- 8.2.2 All communication shall be in English language. VHF / UHF radio communication shall be preferred during the lifting operations.
- 8.2.3 Person in charge for lifting operations shall be clearly assigned.
- 8.2.4 Only qualified officers or assigned person shall be allowed as person in charge.

8.3 Ballast operation during lifting

- 8.3.1 Sufficient capacity of ballast water shall be calculated and a plus margin of 10% shall be available.
- 8.3.2 Maximum heeling should be not more than 3 degrees, or not more than allowable heeling moment given by crane manufacturer, whichever is less.
- 8.3.3 Heeling and ballast system shall be in workable condition.

8.4 Lifting with spreader beam or traverses

- 8.4.1 No running lifting grommets/slings at throw over operation allowed, except equipment is certified for this operation.
- 8.4.2 Safety latches, flaps or pins shall be in operational condition and shall be used.

9 Bedding, grillage and weight spreading

If the cargo weight exceeds the allowable deck strength or stresses, suitable load spreading shall be provided. Grillage and load spreading shall be applied if the cargo shape or structure needs to be supported.

If the cargo weight reaches an amount corresponding to 90% or more of the allowable deck load a detailed stress calculation shall be provided in accordance with structural design standards.

All calculation for a suitable load spreading shall be comprehensible and shall consider underdeck structure of ship's deck.

Clear drawing indicating material used, detailed construction and position on deck shall be provided to Linde.

10 Securing of cargo units

10.1 General requirements

- 10.1.1 There shall be a quantity of reserve cargo securing devices on board the ship.
- 10.1.2 Only certified securing equipment shall be used.
- 10.1.3 Combination of lashing equipment like chains and wire lashings at single cargo unit is prohibited.
- 10.1.4 D-Rings and eye-plates should be applied in correct direction and in line with the lashing direction.
- 10.1.5 Steel to steel contact (steel cradle to ship's deck) should be avoided.
- 10.1.6 Deck cargo securing should be calculated with a friction factor of not more than 0. Certified friction increasing material (e.g. mats) can be considered if the material is designed for the respective load.
- 10.1.7 If friction increasing materials (e.g. rubber mats) are used, the materials shall be certified for the designated load with certification for both dry and wet friction coefficient. Additionally, any material being used to reduce seagoing loads based on friction shall be checked whether they are suitable against shear loading.
- 10.1.8 Cargo's protruding parts shall not be touched by lifting or lashing equipment.
- 10.1.9 No metal parts of lifting or lashing equipment shall touch cargo units at any time (cargo shall be protected from ladders, lashing wires etc.).
- 10.1.10 Suitable cargo protection like burlap or other shear resistant material shall be used to protect cargo from scratches or any other damage risk from lashing gear.
- 10.1.11 Securing points fitted to the vessel and the surrounding structure to which they are fitted shall be strong enough to withstand the loads (static and dynamic) imposed by the cargo during voyage. This is particularly important in the case of 'hard' sea fastenings such as welded stoppers. Securing points at strong beams, frames or girders should be chosen.
- 10.1.12 Where critical lashings are secured to ship's structure, e.g. welded D-rings, the underdeck structure and welds shall be analysed for tension loads.
- 10.1.13 Wire and chain lashings should have a clear line between the cargo unit and the securing points on the vessel. They shall not run around corners of vessel structure or other cargo units.
- 10.1.14 All securing operations shall be completed before the ship leaves the berth. Securing shall be checked by the responsible ship officer/captain and the assigned supercargo/surveyor. Any unsafe or insecure lashing will be not accepted.
- 10.1.15 The master shall take care of and supervise the stowage and securing of cargoes.
- 10.1.16 Lashings shall not be released for unloading before the ship is secured at the berth, without the master's, MWS's or Linde's appointed surveyor's express permission.

10.2 Securing of drums, tanks and columns

- 10.2.1 Drums and columns may only be secured at the designated securing points as indicated in the transport drawings according to the transport drawing.
- 10.2.2 Securing and lashing at flange and other salient parts, other than securing points are strictly prohibited.
- 10.2.3 Lashing in longitudinal direction at temporary transport saddles is prohibited.
- 10.2.4 Lashing on construction beams at the foot ring of a column is prohibited.
- 10.2.5 Belly lashing with chains around columns or drums is prohibited.
- 10.2.6 Welded stoppers shall be equipped with head / shear plates if possible.

10.3 Securing of cold boxes and box shaped units

- 10.3.1 Due to flexible construction of cold boxes, sea-going accelerations shall be reported back to Linde for FEM analysis of loads in each support foot.
- 10.3.2 Each cold box shall be secured against longitudinal, transverse and uplift loads.
- 10.3.3 Where cold box length exceeds 1/3 of the ship's length, ship deflections shall be considered for the sea fastening design.
- 10.3.4 Only welded sea fastening should be considered.
- 10.3.5 The shimming level under each foot should be considered in sea fastening design.
- 10.3.6 If required, any need for fully welded sea fastening to cold boxes, shall be passed to Linde and be subject to approval by Linde.

10.4 Special requirements for module transport

- 10.4.1 IMO CSS code for transportation accelerations and securing design shall not be applied.
- 10.4.2 Transportation accelerations shall be calculated in accordance with DNVGL-ST-N001 ship motions analysis.
- 10.4.3 For transportation of modules, sea-going accelerations shall be reported to Linde for FEM analysis of load induction into module.
- 10.4.4 Where the module length exceeds 1/3 of the ship's length, ship deflections shall be considered for the module support and the sea fastening design.
- 10.4.5 Only welded sea fastenings shall be considered, in particular if modules are not providing for suitable securing points.
- 10.4.6 The shimming level under module supports shall be considered in the sea fastening design.
- 10.4.7 NDT of welded sea fastening shall be in accordance with DNVGL-ST-N001.
- 10.4.8 The module integrity during loading, transportation and offloading shall be checked.

10.5 Special requirements of wire lashings

A standard wire lashing consists of a wire rope forming a grommet. There is no strength reduction in the wire rope, if the bend diameter on the cargo is equal to or greater than $5 \times d$. The small bend diameter in the turnbuckle is compensated by doubling the rope in that bend. The MSL-figures of turnbuckle, shackle and deck ring should fairly correspond to the MSL of the wire rope grommet.

- 10.5.1 Securing equipment shall be certified and Linde reserves the right to request all certification.
- 10.5.2 Hamburger turnbuckles shall not be used.
- 10.5.3 Turnbuckles shall be equipped with counter nut or similar counter device.
- 10.5.4 Special requirements of wire lashings shall be re-checked immediately before departure.

10.5.5 Special requirements of wire lashings shall be checked daily and lashings be re-tensioned during voyage.

10.5.6 "La Paloma" lashings are not permissible.

10.5.7 Wire clips:

- Minimum 4 wire clips shall be applied per strand.
- All U-bolts of wire clips shall rest on the dead end of the wire rope.
- The size of wire clips shall match the wire diameter.
- The dead end of the wire ropes should be not less than 30 cm.
- The dead end of the wire rope should be taped against untwisting.
- The distance of clips shall not be less than 6 times the wire rope diameter.

10.6 Special requirements of combined lashings

10.6.1 Lashings shall not be considered and calculated for taking combined loads in the same moment, i.e. transverse and longitudinal loads together. Each lashing shall be designed to secure against one load direction only, i.e. transverse or longitudinal or uplift loads only, and not a combination of any of those.

10.6.2 Where lashings are made up from different materials, i.e. D-ring + bottle-screw + shackle + chain etc., then the SWL of the lashing is based on the lowest SWL component.

10.6.3 For cylindrical cargo, such as pressure vessels or columns without lashing points, the lashing should be passed around the cargo, back to the deck connection. Chain lashing should not be used. Suitable protection should be used between cargo and lashing.

10.7 Special requirements of chain lashings

10.7.1 Chains shall be used only in direct "line of sight" way, via securing points. Any "over/around edges" or other contact to cargo unit or ship parts are not permissible.

10.7.2 Chain lashings shall be connected to lashing points on cargo and deck by shackles with securing pins.

10.7.3 Hook-hook connections are not permissible.

10.7.4 Lever tension systems shall be avoided, bottle screw systems to be used instead.

10.8 Special requirements of web belts and span sets

10.8.1 Synthetic web lashings are single use lashings and shall not be re-used.

10.8.2 Hook-hook style of synthetic web lashings shall be avoided. Endless type is preferred.

10.8.3 Span-sets or synthetic fibre belt lashings shall be used according to the requirements of manufacturers.

10.8.4 The fastening of lashing belts by means of knots reduces their strength considerably and shall therefore not be applied. Any knotted synthetic belts are not permissible.

10.8.5 Synthetic belt lashing shall be protected against chafing at sharp corners and against mechanical wear.

10.8.6 Synthetic belt lashings showing extreme dirty spots, time-worn, scribed or partly cut shall not be used.

10.9 Special requirements of welded sea fastening

10.9.1 Hot work permit is required in accordance with locally applicable fire prevention rule; at places where there are no correspondent rules, a reasonable scheme shall be implemented.

- 10.9.2 Welding shall only be performed by suitably qualified welders.
- 10.9.3 Welding areas shall be suitably cleaned by angle grinder as a minimum. Any rust, dirt, paint or similar must be completely removed in welding area. This includes welding area on stoppers and d-ring cups.
- 10.9.4 Stick or MIG welding is permissible, subject to welder's qualifications.
- 10.9.5 Welding areas shall be kept dry.
- 10.9.6 The following applies to NDT of welds:
- NDT shall be done by an independent third party.
 - All critical welds shall be 100% visually inspected and 100% MPI tested as a minimum for fillet welds. All other welds shall be tested in accordance with DNVGL-ST-N001.
 - The cooling period of welds shall be in accordance with EN 17638 and ISO 23278 for smaller cargoes.
 - The cooling periods of large cargoes, cold boxes and modules shall be in accordance with DNVGL-ST-N001.

10.10 Special requirements of chocking and form fitting

- 10.10.1 Where timber is being used for sea fastening or load spreading, the timber strength shall be checked by calculation for crushing effects.
- 10.10.2 Timber chocking shall not be used where the span between cargo or hold sides and bulkheads is greater than 1.5 m.
- 10.10.3 Timber chocking should consist of vertical upright timber with horizontal timbers filling the gaps.
- 10.10.4 Minimum cross-section size of timber shall be 200 mm x 200 mm.

Annex A

(normative)

MoS: Requirements for General Transport Condition 2

The documents listed in Table A.1 are mandatory for General Transport Condition 2.

**Table A.1: Requirements for General Transport Condition 2
(Cargo items within a weight of 120 – 250 mt)**

Para. number	Document to be provided
Job details	
6.3.1.1	Cargo details; dimensions, weight and CoG location
Ship stability (see 6.5 for further details)	
6.3.3.1	Description of vessel and cargo
Lifting procedures (see 6.6 for further details)	
6.3.4.3	Lifting design standard used
6.3.4.4	Description of cargo being lifted (including lift point details and CoG)
6.3.4.6	Rigging specification
6.3.4.9	Calculation of lifted weight; including rigging
6.3.4.16	Lift plan drawings including hook height requirements
Stowage plans and loading sequence (see 6.4 for further details)	
6.3.5	Drawing(s) shall include dimensions of cargo CoG from vessel Aft Perpendicular, Centreline and Baseline
Risk assessments	
6.3.11	Description of risk analysis process, Identified hazards, Mitigations to risks that will be implemented, Responsibilities for each mitigation
Operational aspects	
6.3.12	Specific control measures for operation and task to ensure a safe and controlled job
Quality assurance and document control	
6.3.13	For all documentation, revisions numbers and Originator shall be clearly marked

Annex B
(normative)

**MoS: Requirements for General Transport Condition 3
and Linde Specific Transport Condition 1**

The documents listed in Table B.1 are mandatory for General Transport Condition 3 (Cargo items within a weight of 250 – 500 mt) and Linde Specific Transport Condition 1 (Cargo items within l x w x h = 15 m x 2,4 m x 2,4 m and/ or a weight below 20 mt that need special transportation procedure due to high value or other critical goods).

Table B.1: Requirements for General Transport Condition 3 and Linde Specific Transport Condition 1

Para. number	Document to be provided
Job details	
6.3.1.1	Cargo details; dimensions, weight and CoG location
6.3.1.3	Description of route with a plot indicating safe havens and refuelling arrangements
Sailing / Voyage Details	
6.3.2.1	Metocean conditions for route with consideration to time of the year if weather restricted
6.3.2.2	Limiting conditions like draught, water depth, bridges, obstructions etc.
Ship stability (see 6.5 for further details)	
6.3.3.1	Description of vessel and cargo
Lifting procedures (see 6.6 for further details)	
6.3.4.3	Lifting design standard used
6.3.4.4	Description of cargo being lifted (including lift point details and CoG)
6.3.4.5	Crane specification
6.3.4.6	Rigging specification
6.3.4.9	Calculation of lifted weight; including rigging
6.3.4.13	Lift order including vessel operations such as tween deck shifting and other operations that may interfere with planned cargo operations
6.3.4.14	Lifting arrangement incl. drawings, bill of material and certificates for all planned equipment
6.3.4.16	Lift plan drawings including hook height requirements
Stowage plans and loading sequence (see 6.4 for further details)	
6.3.5.1	Drawing(s) shall include dimensions of cargo CoG from vessel Aft Perpendicular, Centreline and Baseline
Risk assessments	
6.3.11	Description of risk analysis process, Identified hazards, Mitigations to risks that will be implemented, Responsibilities for each mitigation
continued	
continued	

Table B.1: Requirements for General Transport Condition 3 and Linde Specific Transport Condition 1

Para. number	Document to be provided
Operational aspects	
6.3.12	Specific control measures for operation and task to ensure a safe and controlled job
Quality assurance and document control	
6.3.13	For all documentation, revisions numbers and Originator shall be clearly marked
If applicable:	
6.3.7	Environmental conditions (as relevant for operation limits)
6.3.8	Trailer operations procedures
6.3.9	<i>Ro-Ro</i> loadout procedures
6.3.10	Mooring arrangement for <i>Ro-Ro</i> operations

Annex C
(normative)

**MoS: Requirements for General Transport Condition 4
and Linde Specific Transport Condition 2**

The documents listed in Table C.1 are mandatory for General Transport Condition 4 (Cargo items within a weight of 500 – 750 mt) and Linde Specific Transport Condition 2 (Cargo items that have a high value or high cost impact within heavy cargo/ oversized cargo definitions).

Table C.1: Requirements for General Transport Condition 4 and Linde Specific Transport Condition 2

Para. number	Document to be provided
Job details	
6.3.1.1	Cargo details; dimensions, weight and CoG location
6.3.1.2	Vessel details including crew details (relevant qualification of key personnel) and planned crew change during voyage
6.3.1.3	Description of route with a plot indicating safe havens and refuelling arrangements
6.3.1.4	Anti-piracy measures to be described (in general terms) if route is via known piracy areas
Sailing/voyage details (see 6.3 for further details)	
6.3.2.1	Metocean conditions for route with consideration to time of the year if weather restricted
6.3.2.2	Limiting conditions like draught, water depth, bridges, obstructions etc.
Ship stability (see 6.5 for further details)	
6.3.3.1	Description of vessel and cargo
6.3.3.2	Description of <i>IMO</i> standards applicable to transportation
6.3.3.3	Description of additional standards applied, e.g. Noble Denton, DNV etc
Lifting procedures (see 6.6 for further details)	
6.3.4.1	Roles & responsibilities, including contact details
6.3.4.2	Organogram of involved persons
6.3.4.3	Lifting design standard used
6.3.4.4	Description of cargo being lifted (including lift point details and CoG)
6.3.4.5	Crane specification
6.3.4.6	Rigging specification
6.3.4.9	Calculation of lifted weight; including rigging
6.3.4.12	Crane lift procedure (step-by-step)
6.3.4.13	Lift order including vessel operations such as tween deck shifting and other operations that may interfere with planned cargo operations
continued	

Table C.1: Requirements for General Transport Condition 4 and Linde Specific Transport Condition 2

Para. number	Document to be provided
continued	
6.3.4.14	Lifting arrangement incl. drawings, bill of material and certificates for all planned equipment
6.3.4.15	Clear marked clash points or advantages of the planned lift
6.3.4.16	Lift plan drawings including hook height requirements
6.3.4.17	Safe lifting operations procedure
Stowage plans and loading sequence (see 6.4 for further details)	
6.3.5.1	Drawing(s) shall include dimensions of cargo CoG from vessel Aft Perpendicular, Centreline and Baseline
Risk assessments	
6.3.11	Description of risk analysis process, Identified hazards, Mitigations to risks that will be implemented, Responsibilities for each mitigation
Operational aspects	
6.3.12	Specific control measures for operation and task to ensure a safe and controlled job
Quality assurance and document control	
6.3.13	For all documentation, revisions numbers and Originator shall be clearly marked
If applicable:	
6.3.7	Environmental conditions (as relevant for operation limits)
6.3.8	Trailer operations procedures
6.3.9	Ro-Ro loadout procedures
6.3.10	Mooring arrangement for Ro-Ro operations

Annex D (normative)

MoS: Requirements for General Transport Condition 5 and Linde Specific Transport Condition 3

The documents listed in Table D.1 are mandatory for General Transport Condition 5 (Cargo items within a weight of 750 – 1000 mt) and Linde Specific Transport Condition 3 (Very sensitive cargo items with critical impact to projects or values to Linde and its customer).

Table D.1: Requirements for General Transport Condition 5 and Linde Specific Transport Condition 3

Para. number	Document to be provided
Job details	
6.3.1.1	Cargo details; dimensions, weight and CoG location
6.3.1.2	Vessel details including crew details (relevant qualification of key personnel) and planned crew change during voyage
6.3.1.3	Description of route with a plot indicating safe havens and refuelling arrangements
6.3.1.4	Anti-piracy measures to be described (in general terms) if route is via known piracy areas
Sailing/voyage details (see 6.3 for further details)	
6.3.2.1	Metocean conditions for route with consideration to time of the year if weather restricted
6.3.2.2	Limiting conditions like draught, water depth, bridges, obstructions etc.
Ship stability (see 6.5 for further details)	
6.3.3.1	Description of vessel and cargo
6.3.3.2	Description of <i>IMO</i> standards applicable to transportation
6.3.3.3	Description of additional standards applied, e.g. Noble Denton, DNV etc.
6.3.3.7	Longitudinal strength check of vessel in seagoing condition for various load cases (static in harbour, seagoing accelerations)
6.3.3.8	Ship torsion strength checks on a case by case basis
Lifting Procedures (see 6.6 for further details)	
6.3.4.1	Roles & responsibilities, including contact details
6.3.4.2	Organogram of involved persons
6.3.4.3	Lifting design standard used
6.3.4.4	Description of cargo being lifted (including lift point details and CoG)
6.3.4.5	Crane specification
6.3.4.6	Rigging specification
6.3.4.8	Limiting weather criteria for lift and crane operation
6.3.4.9	Calculation of lifted weight; including rigging
6.3.4.10	Load spreading calculation for lift
continued	

Table D.1: Requirements for General Transport Condition 5 and Linde Specific Transport Condition 3

Para. number	Document to be provided
continued	
6.3.4.12	Crane lift procedure (step-by-step)
6.3.4.13	Lift order including vessel operations such as tween deck shifting and other operations that may interfere with planned cargo operations
6.3.4.14	Lifting arrangement incl. drawings, bill of material and certificates for all planned equipment
6.3.4.15	Clear marked clash points or advantages of the planned lift
6.3.4.16	Lift plan drawings including hook height requirements
6.3.4.17	Safe lifting operations procedure
Stowage plans and loading sequence (see 6.4 for further details)	
6.3.5.1	Drawing(s) shall include dimensions of cargo CoG from vessel Aft Perpendicular, Centreline and Baseline
Risk assessments	
6.3.11	Description of risk analysis process, Identified hazards, Mitigations to risks that will be implemented, Responsibilities for each mitigation
Operational aspects	
6.3.12	Specific control measures for operation and task to ensure a safe and controlled job
Quality assurance and document control	
6.3.13	For all documentation, revisions numbers and Originator shall be clearly marked
If applicable:	
6.3.7	Environmental conditions (as relevant for operation limits)
6.3.8	Trailer operations procedures
6.3.9	<i>Ro-Ro</i> loadout procedures
6.3.10	Mooring arrangement for <i>Ro-Ro</i> operations