Transfer of Offshore Personnel at Sea
What are the options? Certification of OAS

Offshore Vessel & Rig Connect Asia
Offshore Accommodation & Access
Singapore, 19-20 April 2016

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BUREAU VERITAS

Context

- Growing demand for offshore transfer of personnel
- Driven by development of offshore wind farms
- Transfer done on small unmanned platforms
- Need for safer means of transfer
- Increased operational weather window
- Development of smart gangways

Swing (or sling) rope

- Used in early days as main means to lighthouse keepers
- Pilot ladders also used for ship to ship transfer, but with special procedure
- Still used in a few areas today
- Not recommended by IMCA (IMCA SEL 025 Rev. 1, June 2014)
- Safety issues

Helicopter transfer

- Advantages
  - Less influenced by waves
  - Very fast
- Issues
  - Climatic conditions: Icelandic volcano Eyjafjallajökull disrupted traffic in 2010
  - When landing on ship affected by waves
  - Cannot transfer heavy cargo
  - Needs helideck on offshore facility
  - Expensive
  - Safety record

Personnel transfer carrier

- New generation of robust personnel transfer carriers (frog)
- Issues
  - Crane design & technology
    → *Crane to be certified for man-riding*
  - Vessel heave motions
  - Swinging motions
- Applied lifting procedure
- Requirement for risk analysis

CTV/crew boat step-over (bump-and-jump)

- Fast and efficient high speed CTVs developed for offshore wind market
  → *Cross over to oil & gas*
- New design for carriage of more than 12 industrial personnel
  → *Pending national regulation!*
- Safety issues
  - Potentially hazardous operation when done in waves
    → *Limiting significant wave height*
  - Position keeping relies on ship propulsion and bow friction
  - Boat may fall suddenly

Walk-to-Work (W2W)

- Advantages
  - Increased operability of active motion compensated gangways compared to vessel step-over
  - Personnel and cargo/equipment transfer
  - Access to unmanned installations → *No need for helideck*
  - High operational flexibility/mobility
- Issues
  - Complex and expensive kit
  - Testing of software control system
  - Compatibility with DP system

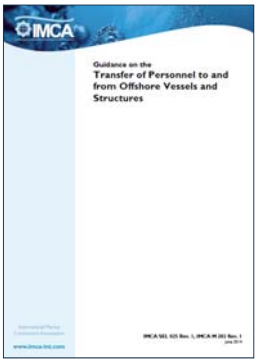
Industry guidelines

- Industry concerns regarding safe transfer of offshore personnel between vessels and offshore installations

Recently issued documents		
IMCA International Maritime Contractors Association	SEL 025, M 202 June 2014	Guidance on transfer of personnel to and from offshore vessels
OMHEC Offshore Mechanical Handling Equipment Committee	OMHEC G05 April 2014	Guidance for lifting of personnel offshore Transfer between installation and vessel
G9 Offshore Wind Health and Safety Association	1st edition November 2014	Safe management of small service vessels used in offshore wind industry
W2W JIP DNV-GL	April 2015	Guidance for gangway access to offshore facilities

Industry guidelines – IMCA SEL 025

- Guidance for offshore industry on safe transfer of personnel at sea, covering risk assessment, training and competence, responsibility, equipment and communications
- Primary transfer methods:
  - Personnel transfer carrier: cranes to be suitable for man-riding
  - Gangways, bridge or accommodation ladders, including motion-compensated hydraulic gangways
  - Smmall boat or launch
  - Larger crew boat or support vessel
  - Mating 'surfer' structures allowing personnel to transfer safely
    → *Extended to assessment of wind turbine landings*



Industry guidelines – OMHEC G05

- Committee involving North Sea operators and regulators
- Context
  - Use of existing cranes for man-riding
  - 2010 helicopter traffic interruption caused by Icelandic volcano
- Requirements for man-riding cranes
  - Compliance with EN 13852 as applicable
  - Gap analysis for other crane types
  - In line with European Machinery Directive
- Procedural requirement
  - Standby rescue vessel
  - Means for communication

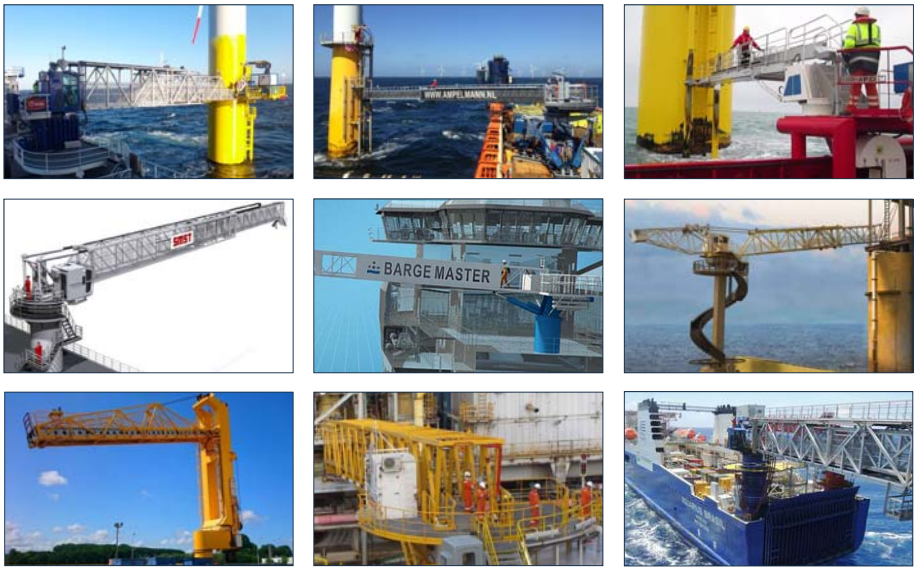
EN 13852 – Offshore cranes used for man-riding

- Rated capacity shall not exceed 50 % of normal rated capacity (2x cargo crane safety factor)
- Winch with fully redundant brakes
- Selection of “Personnel lifting mode”
  - Manual key selection switch for purpose of lifting personnel
  - All brakes to be automatically activated when controls in neutral position, emergency stop activated and in case of power failure
  - Emergency load release system to be overridden (pay out)
  - Heave / tension compensation system to be overridden
- Emergency power system to be provided

BV NR526 – Lifting appliances for personnel hoisting

- Winch to be fitted with double brakes
- Non-rotating cables
- Hoisting speed ≥ wave height to period ratio
- In case of emergency overriding of braking system shall be possible
- Single control location + control foreman to supervise
- For emergency control system
  - Damage to machinery/electrical equipment shall not cause the load to drop
  - Automatic brake when power failure
  - Emergency load lowering system
- Operating instructions
- Overall test including simulation of power failure

Offshore Access Systems (OAS)



New technologies, new risks…

- Rapid growth of OAS market, in particular for gangways (W2W)
- Regulatory framework generally unclear
  - No international technical standard for OAS certification
  - Current certification based on standards and class rules for offshore lifting appliances (e.g. EN 13852) with limited scope
- Special consideration required for:
  - Type of operation: wind turbine ≠ floating production unit, environmental conditions, …
  - Compatibility between OSV & OAS (operating envelope)
  - Safety systems: redundancy principles, emergency procedures, etc.
  - Control systems and system integration (active systems)
- Standards needed before accidents happen (could jeopardize entire walk-to-work concept!)

Active & passive OAS

- Active OAS
  - Fully motion compensated system which remains activated in connection phase and in personnel transfer phase
  - Active systems require continuously power to stay connected

- Passive OAS
  - System put in free-flow after connection to the offshore facility
  - May be motion compensated during connection phase
  - Passive systems require no power when connected

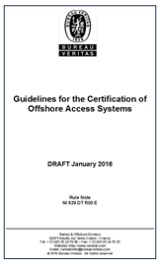
Non-routine & routine transfer

- Category 1 – Non-routine transfer
  - Engineered transfer with control over number of persons on gangway
  - Permanent presence of a gangway operator
- Category 2 – Routine transfer
  - Routine transfer with limited control over number over persons on gangway

Background from lifting operations guidance

BV NI629 – Guidelines for certification of OAS

- Gangways types:
  - Active OAS: motion compensation during transfer
  - Passive OAS: free-flow during transfer
- Transfer categories:
  - Cat 1 – Non-routine transfer: control of the number of persons on gangway and permanent presence of gangway operator
  - Cat 2 – Routine transfer: limited control over number of persons on gangway
- Safety principles to be supported by risk analysis (FMEA)
- Guidance for design, structural assessment, control systems and testing
- Vessel station keeping capabilities (DP2)
- Additional class notation **OAS**
- Publication March 2016



BV NI629 – Table of Contents

BV NI629 – Referenced technical standards

Offshore cranes		
EN 13852-1	General offshore canes	Widely adopted in Europe Presumption of conformity with Essential Health and Safety Requirements (EHSRs) of European Machinery Directive
BV NR526	Certification of lifting appliances	Most European classification societies have adopted EN13852-1 requirements in their rules for cranes/lifting appliances

Accommodation gangways		
ISO 7061	Shipbuilding	Aluminum shore gangways for seagoing vessels
ISO 5488	Shipbuilding	Accommodation ladders

Offshore structures		
NR445	Offshore rules	Structural assessment (based on API)
NR426	Offshore rules	Survey/inspection, NDT

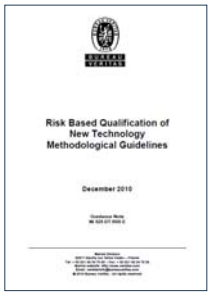
Active OAS – Motion compensation system

- Issue with EN 13852-1 when used as design standard for motion compensated gangways:
  5.10.5 Mode selection for personnel lifting
  When the mode for personnel lifting is selected, the following shall apply:
  […]
  *c) where fitted, motion compensator systems and or constant tension systems **shall be overridden**, i.e. activation of these systems shall be prevented*
- NI629 provides safety principles
- Compliance to be demonstrated based on risk assessment

NI525 – Risk based qualification of new technology

- Objectives
  - Perform criticality assessment of new or unproven technology
  - Assess risks associated to personnel safety, environment, loss of production, loss of assets, etc.
  - Elaborate recommendations regarding design, qualification and inspection/ maintenance of equipment as to reduce /maintain the risk to/under an acceptable level
- Typically applied to novel offshore systems
  - Subsea processing equipment, offloading systems
  - Motion compensated deck equipment, including offshore access systems (gangways, cranes for man riding)

	Application conditions	
Technology maturity	Similar	Different
Proven	0	1
Limited field history	1	2
New	2	3


Risk Based Qualification of New Technology Methodological Guidelines

December 2010

NI629 – Applicable requirements

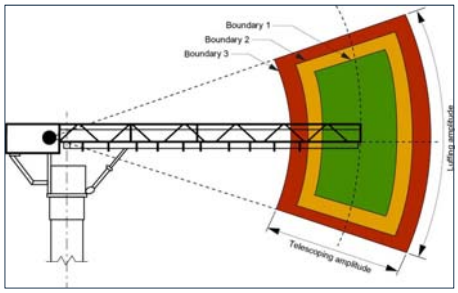
Scope	Description	BV rules
Design assessment	Safety principles	Sec 2
	Design requirements	Sec 3
	Structural assessment	Sec 4 & NR445
	Machinery	Sec 5 & NR526
	Electrical installations and control systems	Sec 6 & NR526
Construction survey	Materials and welding	NR216
	Components certification	Sec 1 & NR266
	Inspection and Non Destructive Testing	NR426
Testing	Testing at Manufacturer's workshop	Sec 7
	On-board testing	Sec 7
In-service inspection	Annual and class renewal surveys	Sec 8

NI629 – Certification of materials and components

N°	Item	Design	Material	Testing	Product	Remarks
1.1	Main load bearing structure	DA	C	X ndt	C	
2.1	Mechanical gears		C	X	C	
2.2	Bearings		W	X	W	
2.3	Slewing ring		C	X	C	
2.4	Connection / disconnection device		W	X	W	
3.1	Hydraulic system components of class I		(1)	X h ndt	C (1)	(1) as per relevant requirements of Pt C of Ship rules
3.2	Hydraulic cylinders		C (1)	X h ndt	C	(1) Cylinder shell and piston rod only
3.3	Winches		C	X	C	
4.1	Electric system components		(1)			(1) as per relevant requirements of Pt C of Ship rules and NR266
4.2	Control and monitoring system		(1)			(1) as per relevant requirements of Pt C of Ship rules and NR266
4.3	Motion Reference Unit			X (1)	W / C (2)	(1) Calibration test report (2) Product certificate required for active OAS
5.1	Wire ropes			X (1)	C	(1) As per NR 216 or in compliance with an international standard.
5.2	Loose gear and accessories			X (1)	C	(1) Proof load as per NR526

BV NI629 – Safety Principles

- Functional requirements
  - Operating envelope to allow for maximum ship motions
  - Motions amplitude consistent with DP system offset
  - Emergency disconnection system
  - Return to safe position in case of loss of contact or power

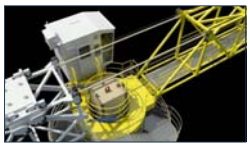


- Control and monitoring systems
  - Availability in case of power loss (UPS)
  - Two level alarms: evacuation (1st) and emergency disconnection (2nd)
  - Traffic light system: green, amber, red
  - Safety features ranking (EN 13852)

Order of precedence	Safety feature
1st	Emergency stop Manual disconnection
2nd	Automatic disconnection
3rd	Other limiters
4th	Indicators

BV NI629 – Safety principles

- Mechanical and machinery systems
  - Single failure should not lead to dangerous situation
  - Failure detection
- Operator control
  - Dedicated and permanent operator control mandatory for OAS Cat 1 (non-routine transfer)
  - Communication systems



- Risk analysis
  - Compliance with safety principles to be demonstrated by FMEA
- Control software
  - PLC considered safety critical (NI425 Cat III system)
  - Control software testing for active OAS in accordance with NR632 “Hardware-in-the-loop testing”

BV NI629 – General gangway design

- Effective width
  - OAS Cat 1 – Non-routine transfer = 600 mm
  - OAS Cat 2 – Routine transfer = 1200 mm
- Means of anti-slip
- Handrail: ICLL compliant
- Maximum inclination: +/-*15° recommended*

BV NI629 – Structural assessment

- Structural strength check according to BV offshore rules NR445 and NR526 as applicable for man-riding cranes
- Design loads
  - Normal load (personnel + equipment/cargo)
  - Maximum operating load (evacuation)
  - Environmental load
  - Impact
  - Ice accretion
- Load cases
  - Transit conditions
  - Normal operation
  - Exceptional situations (evacuation, system failure, extreme conditions)
  - Accidental situations

BV NI629 – Design loads

Working loads	OAS Category 1 Non-routine transfer	OAS Category 2 Routine transfer
Normal load	**Number of person (+ goods)** for normal operation	**4.0 kN/m²**
Evacuation load	**Maximum number of persons** in case of evacuation with one person on stretcher	**4.8 kN/m²**
Load application	Mass and footprint of 100 kg person Mass of person on stretcher is supported by stretcher bearers	Load distributed over walking surface: effective width x nominal length

BV NI629 – Loading conditions

Loading condition	System condition	Load case	OAS Cat*	Operating load	Wind load	Other
Transit	Stowed	N/A	1/2	None	Transit	Transit
Connection / disconnection	Disconnected	II	1/2	None	Max	OAS self-motions
Operating conditions	Operating	I	1	2x Normal	None	None
			2	Normal		
Extreme environmental conditions	Operating	II	1	2x Normal	Max	Max
			2	Normal		
Emergency evacuation	Operating	III	1	2x Evacuation	Max	Max
			2	Evacuation		
Emergency evacuation + disconnection	Disconnected	III	1	2x Evacuation	Max	Max
			2	Evacuation		
Failure in compensation system	No compensation system	III	1	2x Normal	Max	Max
Failure in connection system	Disconnected	III	1	2x Normal	Max	Max
Testing	As per Sec 6	IV	1/2	As per Sec 6	None	None
Minor impact	Disconnected	III	1/2	None	None	Minor impact
Major impact	Disconnected	V	1/2	None	None	Major impact

N/A = Not Applicable
* 1 = Non-routine transfer , 2 = Routine transfer

BV NI629 – Allowable stress levels

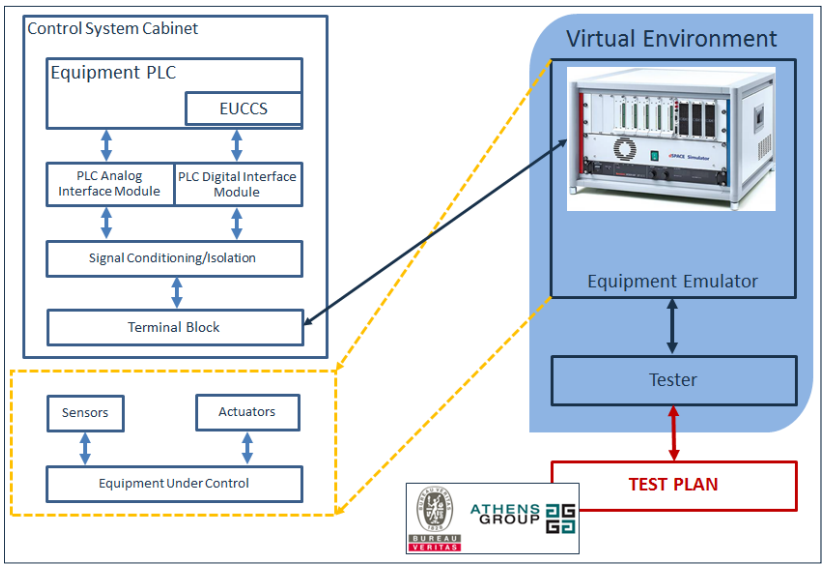
Load case		Allowable stress
Normal operation without wind	I	0.67 Re
Normal operation with wind	II	0.75 Re
Exceptional condition	III	0.90 Re
Testing condition	IV	0.90 Re
Accidental situations	V	1.00 Re

Background from lifting operations guidance

BV NI629 – Control system testing

- Mandatory testing for active OAS to verify reliability and dependability
  - Complex equipment managed by computerized control systems
    → *Embedded software is safety critical (Cat III software system, NI425)*
  - Possible interactions with other shipboard systems depending on design (e.g. power supply, information exchange with DP system)
    → *Modern complex offshore vessel as integrated system of systems*
- BV NR632 Hardware-in-the-loop (HWIL) testing
  → *Check proper working of control systems according to specifications in simulated environment*
  - Early in the process (cost and schedule control)
  - Controllability vs. functionality
  - Fault mode testing
  - Real scenario training
  - Integrated operational testing

HWIL test architecture



BV NI629 – Testing

- Functional tests
- Deployment – motion compensation system
- Emergency disconnection
- Overload test OAS Cat 1 – Non routine:
  - 200% evacuation load (2 persons holding third person on stretcher)
  - Gangway motions tested up to maximum amplitude at normal speed
- Overload test OAS Cat 2 – Routine:
  - 125% evacuation load (500 kg/m²)
  - Distributed along gangway
- On-board commissioning