Base Load Power Hub (BLPH)

DAVIT CRANE
FAT PROCEDURE

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Rev.	Date	Description	Prepared	Reviewed	Approved

REMAZEL ENGINEERING

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Revision / Change Log

Rev.	Description
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02	Accepted for Construction (AFC)

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No.	Description
1	
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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

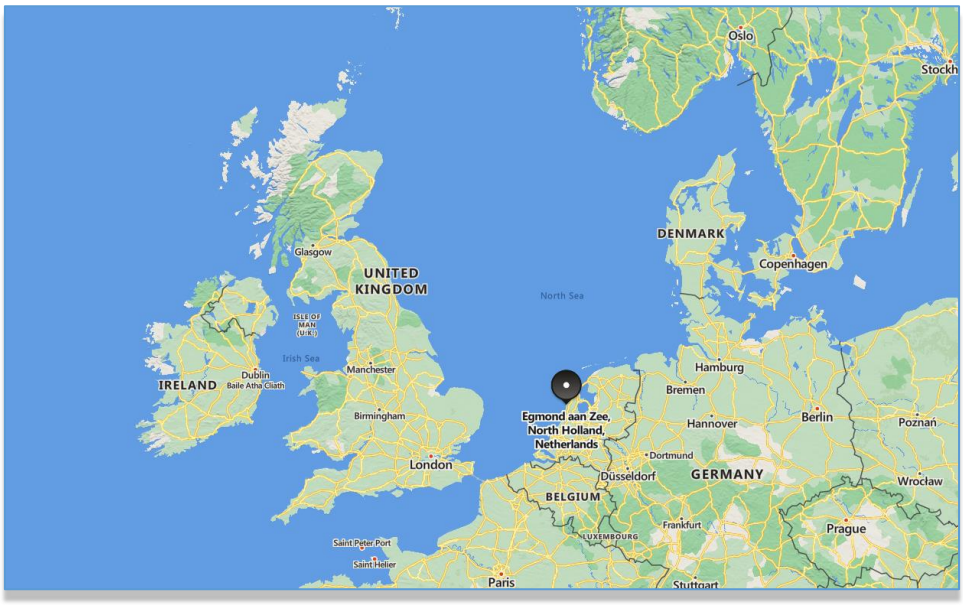


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

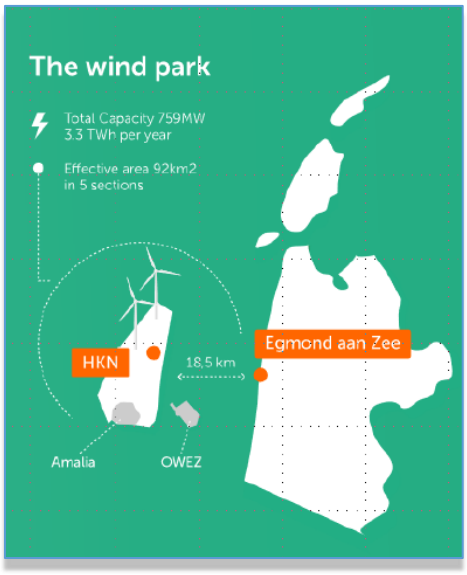


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

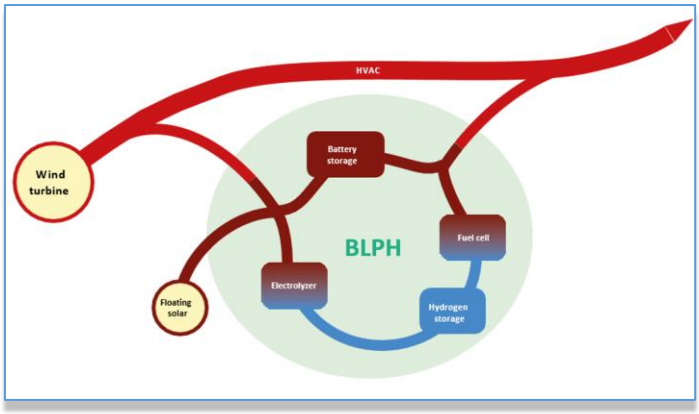


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

2 DOCUMENT SCOPE

The purpose of the document is to draw up a procedure suitable for verifying all the functions of the crane, its safety devices, and its structural strength

2.1 REFERENCES

Doc. No.	Description
1724001010-MAC-DA-00009	CRANE GENERAL ARRANGEMENT DRAWINGS AND DATA SHEETS AND LOAD CHART-DAVIT CRANE
1724001010-MAC-DG-00012	WIRING DIAGRAM -DAVIT CRANE
123A90-DDL-MAC-SP-50034	Technical Specification for DAVIT CRANE

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
MANUFACTURER:	REMAZEL ENGINEERING

Table 2 - Definitions and Abbreviations

3 FAT PROCEDURE

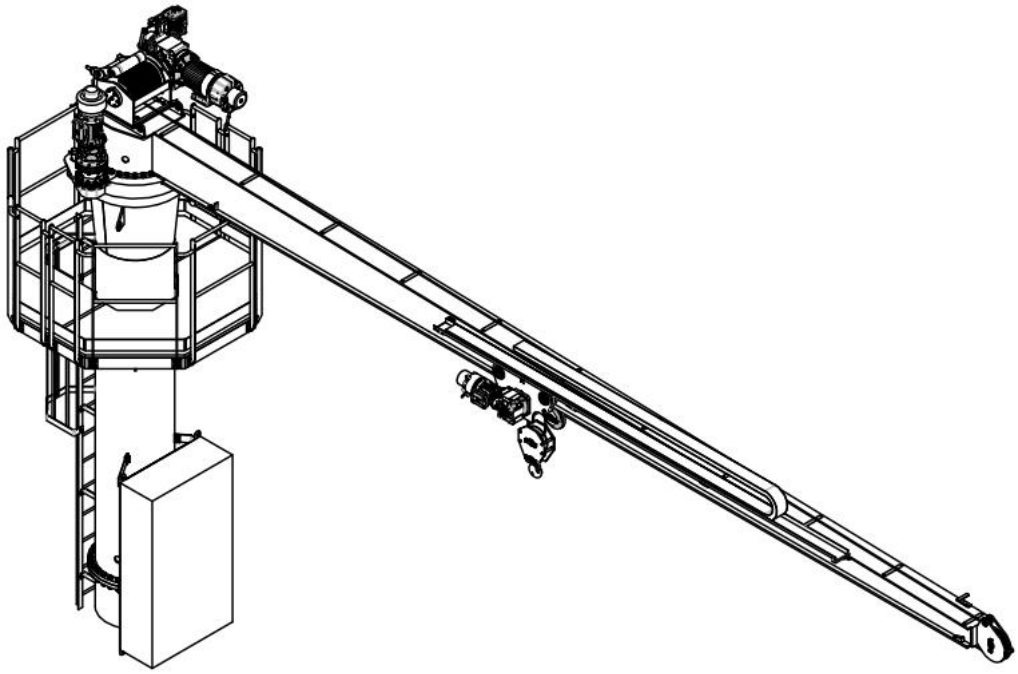
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BASE LOAD POWER HUB (BLPH) DAVIT CRANE C09-0001

JOB 24-27012

FACTORY ACCEPTANCE TEST (FAT) PROCEDURE



Rev.	Modify description	Issue	Approval	Date
02	Revision based on client comments	MPU	MTO	26/11/2024
01	Revision based on client comments	MPU	MTO	08/11/2024
00	First issue	IZA	MTO	30/09/2024

Signatures area

SUMMARY OF REVISION

Rev.	Date	Revised chapters	Revision description	Reason for revision
00	30/09/2024	All	First Issue	For approval
01	07/11/2024	All	Revision based on client comments	For approval
02	26/11/2024	All	Revision based on client comments	For approval

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1 Scope

The scope of this document is to define the tests that will be performed for the following customer and project:

Customer	Hull/Project	Company
ROSETTI MARINO	HOLLANDSE KUST NOORD WIND PARK Project	CROSSWIND

2 Definition and abbreviations

FAT	Factory Acceptance Test
CL	Rosetti Marino – Customer
RMZ	Remazel
SWL	Safety Working Load
PL	Proof Load
HKN	Hollandse Kust Noord
HSE	Health, Safety and Environment
CW	Clockwise
CCW	Counter-Clockwise
AOPS	Automatic Overload Protection System
MOPS	Manual Overload Protection System
DAF	Dynamic Amplification Factor

3 Documents reference

The last available revision of the documents below will be at disposal before the start of the FAT procedure.

REF.	DOCUMENT	REMAZEL CODE	ROSETTI MARINO CODE
[1]	CRANE GENERAL ARRANGEMENT DRAWINGS	24-27012-GA-001	1724001010-MAC-DA-00009
[2]	WIRING DIAGRAM incl JB TERMINALS	24-27012-WD-001	1724001010-MAC-LIS-00014
[3]	I/O LIST	24-27012-IOL-001	1724001010-MAC-DG-00012
[4]	HOOK ASSEMBLY	C09-0001-A0007	

4 Introduction

The “Attendees” are people involved during the test.

Attendees	Name	Title	Signature
REMAZEL			
REMAZEL			
ROSETTI MARINO			
ROSETTI MARINO			
CROSSWIND			
CROSSWIND			

5 Tests to be performed

1. Dimensional control
2. Check of decals and nameplates
3. Electrical board checks
4. Electrical test power supply
5. Power up procedure
6. Power up stop circuit procedure
7. Crane readiness check
8. Traslation, hoisting and slewing limit switch
9. MOPS testing
10. Load test at 3.5t and 1t
11. Blackout test at 3.5t and 1t
12. Emergency operation at 3.5t and 1t
13. Movement and speed checks at 3.5t and 1t
14. Overload device 110% of 3.5t and 1t
15. AOPS testing 140% of 3.5t and 1t
16. Overload test 3.5t and 1t
17. Final check of the crane
18. Electrical test on motors

6 Equipment main characteristics

Below the main characteristic of the BLHP Davit Crane.

TECHNICAL DATA		
Type	DAVIT CRANE	
Customer TAG		X-99001
General assembly	Drawing	C09-0001-A0002
DESIGN CRITERIA		DNV-ST-0378
Category of crane		Offshore crane
Ambient working temperature (min/max)	°C	-8°C to +25°C
Wind speed at davit crane[1]	m/s	Operative: 24 Out of service: 44
Crane static inclination angle heel/trim	deg	List / Trim = 0° / 0°
MECHANISMS CLASSIFICATION		
According to European Federation of Handling Industries FEM - 1.001 (10.1998)-Rules for design of hoisting appliances.	Equipment	A4
	Mechanism	M4
HOISTING		
General data		
Boom height from deck	m	4.85
Deck height from sea level	m	30.13
Max cargo lift	SWL	3.5 ton @ 5m | 1.0 ton @ 10m
Significant wave height	Hs	1.5
Hoisting 1st speed	m/min	3.75
Hoisting 2nd speed	m/min	15
Minimum Outreach	m	1.5
Maximum Outreach	m	10
Maximum hook stroke	m	40
Personnel handling		NO
AOPS		YES
MOPS		YES
Hook trolley (radial movement)		
1st speed	m/min	2
2nd speed	m/min	8
Slewing		
Slewing 1st speed	rpm	0. 5
Slewing 2nd speed	rpm	1
Slewing range angle (continuous)	deg	+/-90°
Electric motors		
Installed power (N. of motors x unitary power)	kW	1 x 15 for winch 1 x 4 for slewing 2 x1.5 for trolley and auxiliaries

[1] Wind conditions have been considered as per DNV-ST-0378 Appendix A, Table A-2 to be more conservative.

7 Equipment Data and Testing Loads

Below the main characteristics tested during FAT.

Items	Q.ty	Crane RMZ TAG (S/N)	ROSETTI MARINO TAG	SWL
BLPH DAVIT CRANE	1		X-99001	3.5t @ 5m / 1.0t @ 10m

Overload test (static)	Overload device alarm	AOPS Testing	MOPS Testing
5.3t @ 5m / 1.7t @ 10m	110% of SWL 3.85t @ 5m / 1.1t @ 10m	140% of SWL 4.9t @ 5m / 1.4t @10m	0.5t @ any outreach

8 Safety check

As soon as entering in the workshop and test bench area, as first, please check that all safety measure has been taken:

ID	Step/Test	Result	
8.1	Check all people involved wear proper PPE (protective shoes, hard hat, glasses, safety gloves, high visibility jacket)	OK	NOT OK
8.2	All persons involved in the test have received all information on the safety instructions to be given during test	OK	NOT OK
8.3	Check that the test area is identified, delimited, clean from residues or other clutter	OK	NOT OK
8.4	Check the workshop layout and identify emergency exits.	OK	NOT OK

9 Measurement instruments

Below the list of the tool and instruments used during the FAT with the related serial numbers and the relevant information.

Instrument	Maker	Serial Number	Remazel ID number	Calibration		
				Cert. No.	Issue Date	Expire Date
Dynamometer 9t	Dini Argeo Srl	0722200887	DNM-0015	2795/24	04/03/2024	04/03/2025
Voltage tester	Hioki	020431607	NDT-0036	2793/24	04/03/2024	04/03/2025
Insulation tester	Hioki	020504304	NDT-0037	2794/24	04/03/2024	04/03/2025
Rib	Stanley	34-296	NDT-0039	REM.815552	24/04/2024	24/04/2025
Current clamp meter	HT Italia	66401785	PZA-0016	1038-2022-9	06/05/2022	06/05/2025

10 Preliminary controls

Before testing the crane, personnel must execute the following controls:

10.1	**INTERNAL TEST REPORT REVIEW**				
10.1.1	Review of mechanical checks		OK	NOT OK	
10.1.2	Review of functional tests		OK	NOT OK	
10.2	**DIMENSIONAL CONTROL**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.2.1	Verify the distance from the center of the fixed pedestal to the hook with the trolley in first position (absolute minimum outreach)	1.5m (+50mm/-0mm)	OK	NOT OK	
10.2.2	Verify the distance from the center of the fixed pedestal to the hook with the trolley in second position (maximum outreach 3.5t)	5.0m (+50mm/-0mm)	OK	NOT OK	
10.2.3	Verify the distance from the center of the fixed pedestal to the hook with the trolley in third position (absolute maximum outreach)	10.0m (+50mm/-0mm)	OK	NOT OK	
10.3	**CHECK OF DECALS AND NAMEPLATES**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.3.1	RMZ decal fitted to crane	N/A	OK	NOT OK	
10.3.2	SWL decal fitted to crane	N/A	OK	NOT OK	
10.3.3	RMZ nameplate fitted to crane. Check it is legible and undamaged	N/A	OK	NOT OK	
10.3.4	Hazard warning decals fitted to, or adjacent to, electrical components	N/A	OK	NOT OK	
10.4	**ELECTRICAL BOARD CHECKS**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.4.1	Check for earth bonding between control panel enclosure / backplate and door	N/A	OK	NOT OK	
10.4.2	Visual and dimensional check	N/A	OK	NOT OK	
10.4.3	Dielectric test	N/A	OK	NOT OK	
10.4.4	Insulation test	N/A	OK	NOT OK	
10.5	**ELECTRICAL TEST POWER SUPPLY**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.5.1	Crane to be connected to power supply	N/A	OK	NOT OK	

10.5.2	Measurement of the voltage on the main switch	400V ±10% at 50Hz	OK	NOT OK	
10.6	**POWER UP PROCEDURE**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.6.1	Rotate the main switch from O position to I position	L1, L2 and L3 lights are on	OK	NOT OK	
10.7	**POWER UP STOP CIRCUIT PROCEDURE**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.7.1	Press RESET button on the electrical cabinet door	RESET blue blinking light turns off	OK	NOT OK	
10.7.2	Press EMERGENCY STOP button on electrical cabinet door	RESET light turns on	OK	NOT OK	
10.7.3	Press manouver buttons	Crane does not move	OK	NOT OK	
10.7.4	Release EMERGENCY STOP button on electrical cabinet door	RESET light starts blinking	OK	NOT OK	
10.7.5	Press manouver buttons	Crane does not move	OK	NOT OK	
10.7.6	Press RESET button on the electrical cabinet door	RESET blue blinking light turns off and crane is ready to start	OK	NOT OK	
10.7.7	Press manouver buttons (hoisting or traslation)	Crane does move	OK	NOT OK	
10.8	**CRANE READINESS CHECK**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.8.1	Remove slewing locking pin	Pin engaged light turns off	OK	NOT OK	
10.8.2	Check that either 1t or 3.5t light is on	N/A	OK	NOT OK	
10.9	**TRASLATION, HOISTING and SLEWING LIMIT SWITCH (no load)**				
ID	**Test**	**Expected value**	**Result**		**Notes**
10.9.1	Simulate 3.5t on hook and test the traslation forward limit switch	Trolley in second position	OK	NOT OK	
10.9.2	Remove the simulation of 3.5t and test the traslation forward limit switch	Trolley in third position	OK	NOT OK	
10.9.3	Test the traslation backward limit switch	Trolley in first position	OK	NOT OK	
10.9.4	Test the CW rotation limit switch	Boom +90°	OK	NOT OK	
10.9.5	Test the CCW rotation limit switch	Boom -90°	OK	NOT OK	
10.9.6	Test the hoisting up limit switch, verify clearance between hook center and pavement	Hook up, 4.0m	OK	NOT OK	
10.9.7	Test the hoisting down limit switch, verify 40m of rope are out and at least 3 dead coils are left on the winch	Hook down, 40m	OK	NOT OK	

10.9.8	Hoist up the hook and verify engagement of anti-to-block system	Anti-to-block system engages correctly	OK	NOT OK	

11 Testing

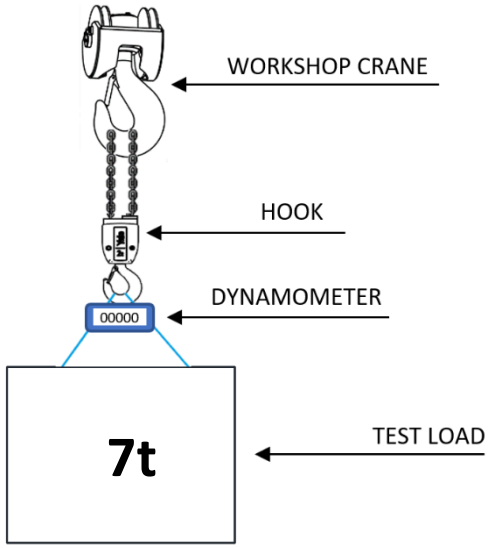
11.1	MOPS TESTING				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.1.1	With no load, push the MOPS switch, start the 5 minutes timer and manually pull the hook down. Leave the MOPS switch in position for 5 minutes.	After 5 minutes the hook can still be pulled down, MOPS is functioning correctly	OK	NOT OK	
11.1.2	Apply 0.5t on the hook, turn off the power supply to the crane and operate the MOPS switch	The winch will release the load and the MOPS alarm will sound	OK	NOT OK	
11.1.3	Repeat the test for 3 times	UPS is expected to last for the whole duration of the tests	OK	NOT OK	
11.2	**LOAD TEST (SWL 3.5t) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.2.1	Hoist about 2m up the SWL	Verify load force of 3.5t has been applied	OK	NOT OK	
11.2.2	Traslate the trolley about 1m forward	Verify movement forward under load	OK	NOT OK	
11.2.3	Traslate the trolley about 1m backward	Verify movement backward under load	OK	NOT OK	
11.3	**BLACKOUT TEST (SWL 3.5t) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.3,.1	Lift the nominal load (3.5t) with the winch, disconnect the main power line (blackout simulation).	The load will remain motionless due to the negative brake action of the winch	OK	NOT OK	
11.4	**EMERGENCY OPERATION (SWL 3.5t) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.4.1	With the nominal load (3.5t) hanged, act the levers on the hoisting motors to de-activate the brakes	The load can be lowered	OK	NOT OK	
11.4.2	With the nominal load (3.5t) hanged, act the levers on the slewing motors to de-activate the brakes and move the crane	Crane can rotate	OK	NOT OK	

11.5	MOVEMENT AND SPEED CHECKS (SWL 3.5t) at outreach = 5m				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.5.1	With 3.5t on the hook, time how long it takes to lift the load through 1m in first speed Note, do not time from a starting start.	1.5 m/min ± 5%	OK	NOT OK	
11.5.2	With 3.5t on the hook, time how long it takes to lift the load through 1m in second speed Note, do not time from a starting start.	15 m/min. ± 5%	OK	NOT OK	
11.5.3	With 3.5t on the hook, rotate the boom clockwise 90° and time it. If necessary, repeat the operation by rotating the boom counter-clockwise.	0,5 rpm ± 5%	OK	NOT OK	
11.5.4	With 3.5t on the hook, move the trolley in first speed and time it	2 m/min ± 5%	OK	NOT OK	
11.5.5	With 3.5t on the hook, move the trolley in second speed and time it	8 m/min ± 5%	OK	NOT OK	
11.5.6	Check the current intensity during hoisting	< /= motor nominal current	_ _ _ _ _ _ A		
11.5.7	Check the current intensity during slewing	< /= motor nominal current	_ _ _ _ _ _ A		
11.5.8	Check the current intensity during traslation	< /= motor nominal current	_ _ _ _ _ _ A		
11.6	**OVERLOAD DEVICE (110% of NOMINAL LOAD 3.5t = 3.85t) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.6.1	Apply on the hook 3.85t and try to lift with the winch only	The winch will not lift the load and the OVERLOAD alarm will sound	OK	NOT OK	
11.7	**AOPS TESTING (140% of NOMINAL LOAD 3.5t = 4.9t) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.7.1	From deck level, apply 4.9t on the hook, check that the load is still.	The AOPS is disabled so the winch will not release the load.	OK	NOT OK	
11.7.2	Simulate off-board position, apply 4.9t on the hook, check that the load is lowering	The AOPS is enabled so the winch will release the load.	OK	NOT OK	
11.8	**OVERLOAD TEST (1.25x0,75xDAFxSWL 3.5t) – (DAF=Dynamic Amplification Factor) at outreach = 5m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.8.1	Apply on the hook 5.3t (1.25x0.75x1.6x3.5t) without using the winch. Leave for 5 minutes	Load is supported for 5 minutes. No visible damage to the crane.	OK	NOT OK	

11.9	LOAD TEST (SWL 1t) at outreach = 10m				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.9.1	Hoist about 2m up the SWL	Verify load force of 1t has been applied	OK	NOT OK	
11.9.2	Traslate the trolley about 1m forward	Verify movement forward under load	OK	NOT OK	
11.9.3	Traslate the trolley about 1m backward	Verify movement backward under load	OK	NOT OK	
11.10	**OVERLOAD DEVICE (110% of NOMINAL LOAD 1t = 1.1t) at outreach = 10m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.10.1	Apply on the hook 1t and try to lift with the winch only	The winch will not lift the load and the OVERLOAD alarm will sound	OK	NOT OK	

11.11	AOPS TESTING (140% of NOMINAL LOAD 1t = 1.4t) at outreach = 10m				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.11.1	From deck level, apply 1t on the hook, check that the load is still.	The AOPS is disabled so the winch will not release the load.	OK	NOT OK	
11.11.2	Simulate off-board position, apply 1t on the hook, check that the load is lowering	The AOPS is enabled so the winch will release the load.	OK	NOT OK	
11.12	**OVERLOAD TEST (1.25x0,75xDAFxSWL 1t) at outreach = 10m**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.12.1	Apply on the hook 1.7t (1.25x0.75x1.8x1t) without using the winch. Leave for 5 minutes	Load is supported for 5 minutes. No visible damage to the crane.	OK	NOT OK	
11.13	**FINAL CHECK OF THE CRANE**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.13.1	Visual check the components of the davit after testing to ensure the crane is in good condition and fit to operate	Crane is in good state	OK	NOT OK	

11.14	ELECTRICAL TEST ON MOTORS				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.14.1	Perform dielectric test on motors for 60"	2000V	OK	NOT OK	
11.14.2	Perform electric insulation test on motors	> 10 Mohm	OK	NOT OK	
11.15	**HOOK TEST (2xSWL)**				
ID	**Test**	**Expected value**	**Result**		**Notes**
11.15.1	Hang 7t on the hook for 60" (hook will be tested disassembled from the crane)	Hook supports the load and is in a good state after the test	OK	NOT OK	



12 Punch List

ITEM	PUNCH POINT DESCRIPTION	PUNCH POINT SOLUTION	COMPANY IN CHARGE OF RESOLVING	PERSON RESPONSIBLE FOR THE SOLUTION

SIGNATURE FOR APPROVAL					
	REMAZEL	**ROSETTI MARINO**	**ROSETTI MARINO**	**CROSSWIND**	**CROSSWIND**
Name					
Signature					
Position					
Date					