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ATLANTIC OFFSHORE

DP FMEA PROVING TRIAL

M/V OCEAN KING

WPA Document No 71312-Rev. 6

6	21.05.14	Updated regarding test 2014	AU	HES	HES
5	11.11.05	Updated after test dated 12.10.05	HES	EZ	EZ
4	05.07.05	Updated after test 04.07.05	HES	EZ	EZ
3	29.06.05	Updated after new control system for	HES	EZ	EZ
		main propellers have been installed.			
2	21.09.04	Updated after sea trial	HES	EZ	EZ
1	15.06.04	Updated after comments from class	EZ	HES	HES
0	20.04.04	For approval	MB	HES	HES
Rev.	Date	Document issue and status	Made	Checked	Approved
			by	by	by



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"Specification for Redundancy in Position Keeping Ability"

12 Instruction

- 12.1.1 Westcon Power and Automation Stord AS (WPA) was instructed by Atlantic Offshore to witness the DP FMEA Proving Trial which is based on the test program in section 8.
- 12.1.2 The scope includes preparation/participation in:
 - DP FMEA Proving Trial program
 - Participation during trial
 - Final report with any findings

12.1 General

The following test programme is mainly made to confirm if the ship will fulfil the requirements stated in "Specification for Redundancy in Position Keeping Ability". This implies that after any single failure the vessel is to be able to produce sufficient transverse thrust, longitudinal thrust and yawing moment to keep its position and to safely terminate the operation.

Secondly, the test to prove that loss of signals to thrusters/propellers should not have any severe influence on manoeuvrability of the ship.

The test is divided in 4 parts:

12.2 Electrical

The configuration of generators, bustie breakers and thrusters normally is as follows when operating the vessel (see also dwg. no. 352-01 rev.D) This configuration has been changed since the first sea-trial where no aux generator was running.

- 1-one aux.generator running
- 1-one shaft generators running feeding 1-one bow thruster and respective cooling -& steering gear pumps
- 1-one shaft generators running feeding 1-one bow thruster and respective cooling -& steering gear pumps
- All relevant starter cabinets to be in "auto" or "remote" modus.



12.3 Thrusters etc.

Mainly the "order" and "feedback" signals will be disconnected (broken wire simulation) to see the effect of the thrusters/propellers.

Generally, RPM should freeze or go to zero, be de-selected from DP and alarm/warning should be activated.

12.4 DP control

UPS capacity is tested in addition to some "electronic card" (power failure). A "Box test" was performed for checking the reference system. Sensors was disconnected/changing between sensors during the test.

12.6 Added comments

Since FMEA-test performed 04.09.04 a new control system for the main propellers has been installed. Therefore this new test program will include all the tests related to the control system in addition to the tests that have to be retested due to the results from 04.09.04.

12.7 Template history

Revisjon	Date	Comments
0	20.04.04	For approval
1	15.06.04	Updated after comments from class
2	21.09.04	Updated after sea trial
3	29.06.05	Updated after new control system for main propellers have been installed.
4	05.07.05	Updated after test 04.07.05
5	11.11.05	Updated after test dated 12.10.05
6	21.05.14	Updated regarding test 2014



12.10 TEST PROGRAM MAIN PROPULSION/ELECTRICAL

Date: 21.05.14

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → Note: Run test for 30 min	10min in DP mode 10min in joystick mode	SG1 and SG2 running SG2 feeding the net	All thrusters/propellers running	Breakers for G1,G2,G3 open Breaker for SG1 closed
Note: Kun test for 50 min for side effects.	10min on levers	No aux generator in	Aft. thr. connected to	Breaker for SG2 closed
		standby mode	SG1	Busbreaker SG1 to MSB open Busbreaker SG2 to MSB closed
Fault condition	Method	Expected results	Actual test results	
Autostop of main engine 3	Emergency stop of main	-Port propeller will stop	-As expected	
& 4	engine 3 & 4 to be	-One bow thr. will stop		
	activated	-Blackout 440/220V main		
		swbd		
		-several alarms		
Comments:				
	Yard	Owner	Class	WPA



12.10 TEST PROGRAM SUB-SYSTEM ELECTRICAL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → Note: Run each test for 30 min.		SG1 and SG2 running One aux generator running feeding the main switchboard, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	One aux gen breaker closed, the others open Breaker for SG1 closed Breaker for SG2 closed Busbreaker SG1 to MSB open Busbreaker SG2 to MSB open
Fault condition	Method	Expected results	Actual test results	
Autostop of main engine 1 & 2 Comments:	Emergency stop of main engine 1 & 2 to be activated. Chang-over switch for stern	-Starb. propeller will stop -One bow thr. will stop -Stern thr. will stop -several alarms thruster to be checked in this	As expected. fail mode.	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.10 TEST PROGRAM MAIN PROPULSION/ELECTRICAL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → Note: Run test for 30 min for side effects.	10min in DP mode 10min in joystick mode 10min on levers	SG1 and SG2 running One aux generator running feeding the 440V msb.	All thrusters/propellers running Aft. thr. connected to SG1	Breakers for G1closed, G2,G3 open Breaker for SG1 closed Breaker for SG2 closed Busbreaker SG1 to MSB open Busbreaker SG2 to MSB open
Fault condition	Method	Expected results	Actua	al test results
Autostop of running aux generator Comments:			As expected d batteries thrusters immed	iately after disconnection/befor
	Battery for B1A and B1B Battery for B2 Battery for thrusters aft. Battery for fwd thrusters no.2 Battery for fwd thrusters no.2	25,1 V 26,8V 1 26,1V	Voltage when con 23,0V 26,2V 25,1V 25,1V	nected
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.10 TEST PROGRAM SUB-SYSTEM ELECTRICAL

	Operation mode	Gensets	Thrusters/propellers	misc.	
Setup →	10min in DP mode	SG1 and SG2 running	All thrusters/propellers		
•	10min in joystick mode	One aux generator running	running		
Note: Run each test for 30	10min on levers	feeding the 440V msb.	Aft. thr. connected to SG2		
min for side effects.					
Fault condition	Method	Expected results	Actual test	Actual test results	
1. No power on B1A or	1 Disconnect supply to	1. B1A: One bow tunnel - and	1. As expected.		
B1B	B1A/B1-B from fusebox	stern thrusters will stop	_		
	1	0 04 6	2 Ag aypagtad		
2. No power on div.	2 Disconnect supply to	2. Stop of respective thruster	2. As expected		

Comments:

	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.10 TEST PROGRAM SUB-SYSTEM ELECTRICAL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	10min in DP mode	SG1 and SG2 running	All thrusters/propellers	
Note: Run each test for 30	10min in joystick mode	One aux generator running	running	
min for side effects.	10min on levers	feeding the 440V msb.	Aft. thr. connected to SG2	
Fault condition	Method	Expected results	Actual test results	
1. No power on B2	1.Disconnection supply to B2	1.No influence on running machinery.	As expected	
	2.Disconnect supply to respective consumers	2.No influence on running machinery.	As expected	

	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.10 TEST PROGRAM SUB-SYSTEM ELECTRICAL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
•		SG1 feeding the net	running	energized
		No aux generator in	Aft. thr. connected to SG2	All normal auxiliaries
		standby mode		running
Fault condition	Method	Expected results	Actual te	est results
l. Earth failure on B1A	Simulate Earth failure on	No reduction of	Tested for B2 and As expect	ed
2. Earth failure on B1B	the 24VDC distribution	manoeuvrability for all		
3. Earth failure on B2	boards.	tests		
		local alarm for each test		
		alarm in alarmplant		
<u>Comments:</u>	Resistance to be used			
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On lever	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		One aux generator running,	running	energized
each method listed		the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries
				running
Fault condition	Method	Expected results	Actual te	st results
Various signal failure	1. Disconnect command	1. No change in pitch thrust	1. As expected	
	pitch signal to step-motor	Only possible to operate		
	from PCU. (X40-220-221.)	the pitch from the local		
		station on gearbox		
	2. Disconnect remote	2. No change in thrust. Still	2. As expected.	
	control feedback signal	able to operate. Several	2. Tis expected.	
	from propeller PCU	alarms.		
	(X40-123)			
	3. Disconnect indication	3. No change in thrust. Still	3. As expected	
	feedback signal from prop.	able to operate. Several	3. As expected	
	to PCU (X40-128)	alarms.		
	10100 (24-0-120)	ararins.		
Comments:	(see drawing LT7000A draw	vings 4340D0001-1/4340D00	01-3)	
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On joystick	SG1 and SG2 running One aux generator running, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	est results
Various signal failure	4. Disconnect command pitch order signal from joystick to joystick interf. module (disconnect X55.20) 5. Disconnect call signal from joystick to electronic cabinet in ecr (X55.26)	4. Pitch to zero.5. Change from joystick to lever control on ACS (main station)	4. As expected.5. As expected.	
Comments:	(see drawing LT7000A drav	vings 4355D0002-1)		
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.	
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar	
NOTE: reconnect after		One aux generator running,	running	energized	
each method listed		the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries	
				running	
Fault condition	Method	Expected results	Actual te	est results	
Various signal failure	7. Disconnect command	7. Pitch to zero.	7. As expected		
	pitch order signal from	- No Alarm			
	DP system to PCU				
	(Disconnect X40.350)				
	8. Disconnect ready signal	9 Changa from DD to layer	8. Alarm in DP cabinet. Alarm"port propeller not ready.		
	from DP system to PCU.	control	8. Alaini ili Dr Cabillet. Alai	in port propener not ready.	
	(Disconnect X40.352)	Control			
	(Disconnect X40.332)				
	9. Disconnect feedback	9. Lost in DP, failure in DP	9. Warning signal in DP cabi	inet. Still operated by DP.	
	signal from PCU to DP	signal, to be controlled by		1 3	
	(Disconnect X40.356)	levers.			
Comments:	(see drawing LT7000A draw	l vings 4340D0001-4)			
	,	,			
	Yard	Owner	Class	WPA	
Test verification		Aage Misje		Arne Urheim	
Date: 21.05.14					



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos. ME4 used only	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after	for generator. (Main clutch	One aux generator running,	running	energized
each method listed	4 disengaged.)	the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries
		·		running
Fault condition	Method	Expected results	Actual te	st results
Various signal failure ** To be disconnected in ecr.	10. Disconnect RPM command signal from LT7KA to Heinzmann governor (Disconnect X46.126)	10. RPM to idle. Generator will tripp due to under – voltage.	10. As expected.	
	11. Disconnect power supply to Heinzmann governor (Disconnect LHP 1&2)	11. Engine will stop, several alarms	11. As expected.	
	12. Disconnect power supply to shaft generator protection ps (circ.breaker in cabinet aft between ME)	12. Ps shaft generator will trip, consumers connected to ps will fail	12. As expected	
Comments:	(see drawing LT7000A RCD	DJ-HNZ/4346D0001-1)	I	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after	, -	One aux generator running,	running	energized
each method listed		the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries
				running
Fault condition	Method	Expected results	Actual te	est results
Various signal failure	12. Disconnect fuel rack	12. Alarm fuel rack sensor	12. As expected	
	feedback signal from	1 & 2. Loadsystem out of		
	inductive sensor to LT7KA	order. Ready for DP and		
	(Disconnect X40.132-	feedback to DP not affected		
	Eng.3 & 137 Eng.4)			
	13 Disconnect fuel rack	13. Alarm fuel rack sensor	13. As expected	
	feedback signal from	1 & 2. Loadsystem out of	_	
	inductive sensor to LT7KA	order. Ready for DP and		
	(Disconnect X40.404-	feedback to DP not affected		
	Eng.1 & 406 Eng.2)			
	14.Disconnect 230V main	14.Alarm "Failure 230V"	14. As expected	
	power supply from MSB	1 011 11 11 11 11 11 11 11 11 11 11 11 1	Alarm in ecr "battery-charge	er remote control failure"
	to LT7KA (Disconnect in			2 1 0 1 1 0 1 0 0 0 0 0 1 0 1 0 1 0 1 0
	MSB)			
Comments:	(see drawing LT7000A 4340	DD0001-2 / 4340D0001-4)	,	
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14		~		



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On lever	SG1 and SG2 running One aux generator running, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	est results
Various signal failure	1. Disconnect command pitch signal to step-motor from PCU. (Remove change-over relay Main/Back-up K7 in PCU cab.) 2. Disconnect remote control feedback signal	able to operate. Several	 Not tested. Ref test of por As expected. 	t side.
	from propeller PCU (remove sensor supply W4) 3. Disconnect indication feedback signal from prop. to PCU (X40-128)	alarms. 3. No change in thrust. Still able to operate. Several alarms.	3. As expected.	
Comments:	(see drawing LT7000A draw	rings 4340D0001-1/4340D00	01-3)	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje Endre Strand	Oddvar Ulvestad	Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On joystick	SG1 and SG2 running One aux generator running, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signal failure	 4. Disconnect command pitch order signal from joystick to joystick interf. module (disconnect X55.20) 5. Disconnect call signal from joystick to electronic cabinet in ecr L12-427** 	4. Pitch to zero.5. Change from joystick to lever control on ACS (main station)	4. As expected.5. As expected.6.	
Comments:	(see drawing LT7000A draw	vings 4355D0002-1)		
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje Endre Strand	Oddvar Ulvestad	Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running One aux generator running, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual	test results
Various signal failure	7. Disconnect command pitch order signal from DP system to PCU (Disconnect X40.350)	7. Pitch to zero Alarm	7. As expected.	
	8. Disconnect call signal from DP system to PCU. (Disconnect X40.352)	8. Change from DP to lever control	8. Alarm in DP cabinet. Ala	rm "starb. propeller not ready".
	9. Disconnect feedback signal from PCU to DP (Disconnect X40.356)	9. Lost in DP, failure in DP signal, to be controlled by levers.	9. Warning signal in DP cab	inet. Still operated by DP.
Comments:	(see drawing LT7000A draw	wings 4340D0001-4)	I	
	Yard	Owner	Class	WPA
Test verification		Aage Misje	Oddvar Ulvestad	Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos. ME4 used only	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after	for generator. (Main clutch	One aux generator running,	running	energized
each method listed	4 disengaged.)	the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries
				running
Fault condition	Method	Expected results	Actual te	est results
Various signal failure	10. Disconnect RPM	10. RPM to idle. Generator	10. As expected.	
_	command signal from	will tripp due to under –	_	
	LT7KA to Heinzmann	voltage.		
** To be disconnected in	governor (Disconnect	_		
ecr.	X46.126)			
	11. Disconnect power supply to Heinzmann governor (Disconnect LHP 1&2)	11. Engine will stop, several alarms.	11. As expected.	
	12. Disconnect power	12. Sb shaft generator will	12. As expected	
	supply to shaft generator	trip, consumers connected	12. The emperior	
	protection sb (circ. breaker	to sb will fail		
	in cabinet aft between ME)			
Comments:	(see drawing LT7000A RCD	DJ-HNZ/4346D0001-1)		
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

12.11.11. Starboard side M	ain propeller – Signal failur	re		
	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running One aux generator running, the others in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	est results
Various signal failure	12. Disconnect fuel rack feedback signal from inductive sensor to LT7KA (Disconnect X40.132-Eng.3 & 137 Eng.4)	12. Alarm fuel rack sensor 1 & 2. Loadsystem out of order. Ready for DP and feedback to DP not affected	12. As expected	
	13 Disconnect fuel rack feedback signal from inductive sensor to LT7KA (Disconnect X40.404-Eng.1 & 406 Eng.2)	13. Alarm fuel rack sensor 1 & 2. Loadsystem out of order. Ready for DP and feedback to DP not affected	13. As expected	
	14.Disconnect 230V main power supply from MSB to LT7KA (Disconnect in MSB)	14.Alarm "Failure 230V"	14. As expected Alarm in ecr "battery-charge	er remote control failure"
Comments:	(see drawing LT7000A 4340	DD0001-2 / 4340D0001-4)		
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On lever	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure Signals to be disconnected in instrument room	1. Disconnect command pitch signal from electronic unit UN41 to thruster (X41-30,32 & 33) 2. Disconnect feedback pitch signal from thruster to electronic unit UN41 (X41-F1, F2 & 26)	 Pitch freez, alarm prediction error.(Thruster should be stopped) Alarm (remote syst.fail.); auto stop of servopump & drive motor (Thruster stop) 	-	
<u>Comments:</u>	(see drwg. no. H500 321c ar	nd H311 275b from Liaaen/He Owner	elitron) Class	WPA
Test verification	Taru	Aage Misje	Class	Arne Urheim
Date: 21.05.14		1		



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Joystick	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in	Aft. thr. connected to SG2	All normal auxiliaries
		standby mode		running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure	3. Disconnect command signal from joystick computer to main bridge panel UN63 (X63-44 & 45) 4. Disconnect ready signal from joystick computer to main bridge panel UN63 (X63-42 & 43)	3. Pitch to zero4. Change from joystick to lever control.- Alarm on bridge	3. As expected4. As expected	
<u>Comments:</u>	(see drwg. no. H500 321c an	nd H311 275b from Liaaen/H	elitron)	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in	Aft. thr. connected to SG2	All normal auxiliaries
		standby mode		running
Fault condition	Method	Expected results	Actual te	est results
Various signals failure	5. Disconnect command	5. Prop.contr. will	5. As expected, prediction er	rror
	signal from DP computer	interpretend this as 0-order		
Signals to be disconnected	to main bridge panel UN63			
in instrument room	(X63-115 & 116)			
	6. Disconnect feedback	6. No surveillance of	6. As expected	
	signal from electr. unit to	propeller control signal,		
	DP computer (X63-117 &	continue to read orders		
	118)	from DP; "ready to DP" not affected		
	7. Disconnect power	7. Alarm (remote syst.fail.);	7. See test for B2	
	supply 24 V DC to	auto stop of servopump &		
	electr.unit (circ.breaker in	drive motor		
	B2)			
	8. Disconnect power	8. Alarm (remote syst.fail.);	8. Test deleted	
	supply 230 V to electr.unit	auto stop of servopump &		
	(circ.breakers in L8,L9)	drive motor		
Comments:	(see drwg. no. H500 321c an	nd H311 275b from Liaaen/He	elitron)	
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On lever	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure Signals to be disconnected in instrument room	1. Disconnect command pitch signal from electronic unit UN41 to thruster (X41-30,32 & 33) 2. Disconnect feedback pitch signal from thruster to electronic unit UN41 (X41-F1, F2 & 26)	auto stop of servopump & drive motor	1. 2. As expected (tested 04.09.04)	
<u>Comments:</u>	(see drwg. no. H500 321c ar	nd H311 275b from Liaaen/He Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Joystick	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure	3. Disconnect command signal from joystick computer to main bridge panel UN63 (X63-44 & 45) 4. Disconnect ready signal from joystick computer to main bridge panel UN63 (X63-42 & 43)	3. Pitch to zero4. Change from joystick to lever control.	3. As expected4. As expected.	
Comments:	(see drwg. no. H500 321c an	nd H311 275b from Liaaen/H	elitron)	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure Signals to be disconnected in instrument room	5. Disconnect command signal from DP computer to main bridge panel UN63 (X63-115 & 116) 6. Disconnect feedback signal from electr. unit to DP computer (X63-117 & 118) 7. Disconnect power supply 24 V DC to electr.unit (circ.breaker in B2)	5. Prop.contr. will interpretend this as 0-order, "ready 6. No surveillance of propeller control signal, continue to read orders from DP; "ready to DP" not affected 7. Alarm (remote syst.fail.); auto stop of servopump & drive motor		ror
Comments:	(see drwg. no. H500 321c an	nd H311 275b from Liaaen/He	elitron)	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On lever	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure Signals to be disconnected in instrument room	1. Disconnect command pitch signal from electronic unit UN41 to thruster (X41-30,32 & 33) 2. Disconnect feedback pitch signal from thruster to electronic unit UN41 (X41-F1, F2 & 26)	auto stop of servopump & drive motor (Thruster stop)	As expected As expected	
Comments: Test verification	Yard	Owner Aage Misie	Class	WPA Arne Urheim
Test verification Date: 21.05.14	Taru	Aage Misje	Class	Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Joystick	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure	3. Disconnect command signal from joystick computer to main bridge panel UN63 (X63-44 & 45) 4. Disconnect ready signal from joystick computer to main bridge panel UN63 (X63-42 & 43)	3. Pitch to zero 4. No changes in thr system.	3. As expected 4. As expected.	
<u>Comments:</u>	(see drwg. no. H500 321c an	id H311 2/56 from Liaaen/F	delitron)	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in	Aft. thr. connected to SG2	All normal auxiliaries
		standby mode		running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure	5. Disconnect command	5. Prop.contr. will	5. As expected, prediction er	ror
	signal from DP computer	interpretend this as 0-order,		
Signals to be disconnected	to main bridge panel UN63	"ready		
in instrument room	(X63-115 & 116)			
	6. Disconnect feedback	6. No surveillance of	6. As expected	
	signal from electr. unit to	propeller control signal,		
	DP computer (X63-117 &	continue to read orders		
	118)	from DP; "ready to DP" not		
		affected		
	7. Disconnect power	7. Alarm (remote syst.fail.);	7. As expected	
	supply 24 V DC to	auto stop of servopump &		
	electr.unit (circ.breaker in	drive motor		
	B2)			
Commonta	(see drive no U500 221e en	 nd H311 275b from Liaaen/He	litron)	
Comments:	(See urwg. 110. figure 321c an	iu 11311 2730 110111 Liaaen/ At	ziiuoii <i>)</i>	
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On lever	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in standby	Aft. thr. connected to SG2	All normal auxiliaries
		mode		running
Fault condition	Method	Expected results	Actual te	est results
Various signals failure	1. Disconnect command signal from electronic cabinet to steering gear (term. 30-31 in electronic cabinet instr.room) 2. Disconnect feedback signal from rudder to electronic cabinet steering gear (term. R1-R2 in electronic cabinet instr.room)	 Rudder freezes. Rudder freezes as long as no command is given. If any command is given, rudder will go to full angle. No alarm 	 As expected. As expected. 	
Comments:	(see Frydenbø drwg. no. 505	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual te	est results
Various signals failure	3. Disconnect command signal from DP computer to electronic cabine. (U41-TB3-10,11) 4. Disconnect feedback signal from electronic cabinet to DP computer (U41-TB1-7,8)	3. Rudder goes to center position, no alarm prediction)4. Rudder works as normal.	3. As expected4. As expected	
	5. Disconnect ready signal from electronic cabinet to DP computer (U31-TB1-9,10)	5. Change from DP to lever control, alarm in DP panel (Out of DP)	5. As expected	
<u>Comments:</u>	(see drwg. 19 & 20 of 23 from	m Kongsberg Simrad)		
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

12.11.23. Steering gear starboard side Signal failure

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On lever	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in standby	Aft. thr. connected to SG2	All normal auxiliaries
		mode		running
Fault condition	Method	Expected results	Actual te	st results
Various signals failure	1. Disconnect command	1. Rudder goes to centre	1. Rudder freez.	
	signal from electronic	position.		
	cabinet to steering gear			
	(term. 30-31 in electronic			
	cabinet instr.room)			
	2. Disconnect feedback	2. Rudder freezes as long as	2. As expected, no alarm	
	signal from rudder to	no command is given. If	-	
	electronic cabinet steering	any command is given,		
	gear (term. R1-R2 in	rudder will go to full angle.		
	electronic cabinet			
	instr.room)			
Commentes	(and Envidanted during the 505	11)	•	

Comments: (see Frydenbø drwg. no. 50511)

	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in standby	Aft. thr. connected to SG2	All normal auxiliaries
		mode		running
Fault condition	Method	Expected results	Actual te	est results
Various signals failure	3. Disconnect command signal from DP computer to electronic cabine. (U41-TB3-7,8)	3. Rudder goes to center position, no alarm prediction)	3. As expected	
	4. Disconnect feedback signal from electronic cabinet to DP computer (U41-TB1-5,6)	4. Rudder works as normal.	4. As expected	
	5. Disconnect ready signal from electronic cabinet to DP computer (U31-TB1-7,8)	5. Change from DP to lever control, alarm in DP panel (Out of DP)	5. As expected	
Comments:	(see drwg. 19 & 20 of 23 from	m Kongsberg Simrad)		
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.11 TEST PROGRAM SUB-SYSTEM THRUSTERS

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On joystick	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after		SG1 feeding the net	running	energized
each method listed		No aux generator in standby	Aft. thr. connected to SG2	All normal auxiliaries
		mode		running
Fault condition	Method	Expected results	Actual to	est results
Various signals failure	Set position for joystick Disconnect fwd thruster Increase load on thruster trying to move the heading position	Alarm in joystick panel	As expected	
<u>Comments:</u>				
	Vond	Owner	Class	WDA
Test verification	Yard	Owner Aage Misje	Class	WPA Arne Urheim



12.12 TEST PROGRAM SUB-SYSTEM DP CONTROL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup →	On Dynpos	SG1 and SG2 running	All thrusters/propellers	440V and 220V busbar
NOTE: reconnect after	, -	One aux generator running,	running	energized
each method listed. Run		the others in standby mode	Aft. thr. connected to SG2	All normal auxiliaries
method 2 for 30 min.				running
Fault condition	Method	Expected results	Actual te	st results
Various failure conditions	1. Simulate fuse failure	1. Alarm on DP, connected	1. As expected	
	(one by one)	equipment fails one by one.		
			2. Lost supply from batteries after about 11 min.	
	2. Simulate mains failure	2. UPS alarms	To be checked	
		- No loss of output		
		- No loss of equipment		
α				
Comments:				
	Yard	Owner	Class	WPA
Test verification	Yard	Owner Aage Misje	Class	WPA Arne Urheim



12.12 TEST PROGRAM SUB-SYSTEM DP CONTROL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual test results	
Failure on electronic cards in DPC-11 Comments:	-Disconnect power on card U41 -Disconnect power on card U51	Alarms, At least 1-one thruster fwd and 1-one thruster aft to operate normally	As expected	
	Yard	Owner	Class	WPA
Test verification Date: 21.05.14		Aage Misje		Arne Urheim



12.12 TEST PROGRAM SUB-SYSTEM DP CONTROL

	Operation mode	Gensets	Thrusters/propellers	misc.
Setup → NOTE: reconnect after each method listed	On Dynpos	SG1 and SG2 running SG1 feeding the net No aux generator in standby mode	All thrusters/propellers running Aft. thr. connected to SG2	440V and 220V busbar energized All normal auxiliaries running
Fault condition	Method	Expected results	Actual test results	
	Execute a 20 m box maneuver by keeping on heading, observe DGPS coordinates to check orientation. Change between DGPS 1	Satisfactory position keeping. Maximum overshoot at each new position shall be less than 3 m. Heading stability +/- 3	As expected Max overshot was 0,3 – 0,5 m With changing between DGS 1 and 2 max overshot was 2,9 m.	

Comments:

	Voud	Overnom	Class	WPA
	Yard	Owner	Class	WPA
Test verification		Aage Misje		Arne Urheim
Date: 21.05.14				

