SECTION 8
IMO – EQUIPMENT CLASS
ABS
DNV

2 IMO DEFINITIONS (REF. MSC/CIRC. 645. 6 JUNE 1994)

2.1 DEFINITIONS

In addition to the definition in the MODU Code 1989 the following definitions are necessary for the guidelines:

2.1.1 Dynamically positioned vessel (DP-Vessel) means a unit or a vessel which automatically maintains its position (fixed location or predetermined track) exclusively by means of thruster force.

2.1.2 Dynamic positioning system (DP-system) means the complete installation necessary for dynamically positioning a vessel comprising the following sub-systems:

.1 Power system
.2 Thruster system, and
.3 DP-control system

2.1.3 Position keeping means maintaining a desired position within the normal excursions of the control system and the environmental conditions.

2.1.4 Power system means all components and systems necessary to supply the DPsystem with power. The power system includes:

.1 Prime movers with necessary auxiliary systems including piping,
.2 Generators.
.3 Switchboards, and
.4 Distributing system (cabling and cable routing)

2.1.5 Thruster system means all components and systems necessary to supply the DP-system with thrust force and direction. The thruster system includes:

.1 Thruster with drive units and necessary auxiliary systems including piping.
.2 Main propellers and rudders if these are under the control of the DPsystem.
.3 Thruster control electronics,
.4 Manual thruster controls, and
.5 Associated cabling and cable routing

2.1.6 DP-control system means all control components and systems, hardware and software necessary to dynamically position the vessel. The DP-control system consists of the following:

.1 Computer system/joystick system.
.2 Sensor system,
.3 Display system (operator panels),
.4 Position reference system, and
.5 Associated cabling and cable routing.

2.1.7 Computer system means a system consisting of one or several computers including software and their interfaces.

2.1.8 Redundancy means ability of a component or system to maintain or restore its function, when a single failure has occurred. Redundancy can be achieved for instance by installation of multiple components, systems or alternative means of performing a function.

2.2 Other definitions

Flag State

is the country in which the vessel is registered by the National Authority. The vessel shall carry the Flag State's flag, and show the port of registry at the stern, but may have no other apparent connection to the Flag State.

Coastal State

is the country where the vessel is located when it is not in international waters, i.e. when in harbour or in some country's territorial water. The Coastal State may apply restrictions that exceed those of the Flag State.

Main Class

is the set of rules that are compulsory for any vessel classified by the specific Classification Society. Each part or section of the Rules that are within Main Class will be identified as such. Typically, for DNV, Part 4 Machinery and Systems is marked Main Class. This Part includes both Electrical Installations and Instrumentation and Automation Chapters.

Additional Class

is sets of rules that are optional to a vessel to document a specific type of vessel or specific capabilities of the vessel. The DP rules is a typical case of Additional Class rules, which the vessel owner has chosen to apply for his vessel.

Class Notation

is another name used for Additional Class. Thus, DYNPOS-AUTR is a Class Notation, and it will be stated in the vessel's Class Certificate.

Segregation

means that two or more units of equipment are located physically separated, without stating the degree of separation. For instance, A60 is a case of segregation where there are specific requirements to the degree of protection regarding propagation of fire.

Independence,

in relation to technical systems, means that one unit or system will operate without assistance from another system such that the one system will remain in operation after the other has failed. Mutual independence signifies that this will be true both ways.

Redundancy

signifies that there are at least two units or systems that are able to serve a specific function, so that this function will remain operable if the one unit or system fails. See definition under 2.1.8. Thus, there can hardly be redundancy without independence. But redundancy can be achieved with a minimum of segregation, e.g. redundant components in a common cabinet.

IMO CERTIFICATION

IMO's DP-Classification Guidelines.

MSC/Circ. 645, 6 June 1994. (Still valid by January 2004)

These guidelines for vessels with dynamic positioning systems have been developed to provide an international standard for dynamic positioning systems on all types of new vessels.

A Flag State Verification and Acceptance Document (FSVAD) for the dynamic positioning system will document compliance with the Guidelines. The purpose of a FSVAD is to ensure that the vessel is operated, surveyed and tested according to the vessel specific procedures and that the results are properly recorded.

A Coastal State may permit any vessel whose dynamic positioning system is designed to a different standard than that of these Guidelines to engage in operation.

The purpose of these Guidelines is to recommend design criteria, necessary equipment, operating requirements, and a test documentation system for the dynamic positioning to reduce the risk to personnel, the vessel, other vessels or structures, sub-sea installations and the environmental conditions while performing operations under dynamic positioning control.

The responsibility for ensuring that the provisions of the Guidelines are complied with rests with the owner of the DP-vessel.

IMO DP Equipment Class notations are as follows:

Class 1 For equipment class 1, the DP-control system need not to be redundant.

Class 2 For equipment class 2, the DP-control system should consist of at least two independent computer systems. Common facilities such as self-checking routines, data transfer arrangements, and plant interfaces should not be capable of causing the failure of both/all systems.

Class 3 For equipment class 3, the DP-control system should consist of at least two independent computer systems with self-checking and alignment facilities. Common facilities such as self-checking and routines, data transfer arrangements and plant interfaces should not be capable of causing failure at both/all systems. In addition, one back-up DP-control system should be arranged. An alarm should be initiated if any computer fails or is not ready to take control.

Table 1 Equipment Class

For a description of the equipment classes in this table, see IMO/MSC Circular 645, Chapter 2, Equipment Classes.

ACTIVITY	Class
a) Manned underwater operations where loss of position entails a high risk for divers or diver platforms	**3**
b) Other manned underwater operations where loss of position entails risk for divers or diver platforms	**2**
c) Support vessels for manned underwater operations conducted from work boats where loss of position for the support vessel has direct consequences for the work boat	**2**
d) Drilling and well activities where well control is handled by a facility with dynamic positioning	**3**
e) Facilities that produce hydrocarbons	**3**
f) Flotels with gangway connected Two reference systems may be accepted for arrival and departure	**3**
g) Activities carried out by lifting vessels or pipelaying vessels within the safety zone Two reference systems may be accepted for arrival and departure	**3**
h) Other activities within the safety zone, where the vessel represents a risk to the facility The requirement applies if the vessel exceeds the vessel size the facility is designed for with regard to withstanding a collision. Two reference systems may be accepted for arrival and departure	**2**
i) Loading operations from floating storage units (FSUs) and floating production, storage and offloading facilities (FPSOs) The requirement applies to the tank vessel	**2**
j) Loading operations from buoys	**1**
k) Other well activities The requirement applies to well maintenance facilities if well control is handled by another facility	**2**
l) Shallow drilling if one does not expect to encounter hydrocarbons	**1**

Notes to the table

1) For dynamic position, consideration should be given to the reference systems' limitations as regards reliability, accessibility and quality.

2) High risk as mention in this table litera a, means the cases when the diver does not have an unrestricted return to the diving bell, or where loss of the vessel's position can lead to loss of or damage to the diving bell, and possibly the associated bottom weight.

3) The requirement to Equipment Class 3 for drilling and well activities as mentioned in this table litera d, does not apply to shallow drilling and core drilling. For shallow drilling, however, other requirements in the table may be relevant, such as the requirement to Equipment Class 2 for other activities within the safety zone without risk to health, environment and safety. Well activities that require Equipment Class 3, are, inter alia, well intervention including wireline oper

Classification principles and practice

The following section is guidance upon general principles and practice applied by Classification Societies, and in particular how these affect DP system. This situation is both simplified and complicated by the introduction of IMO Guidelines for Dynamic Positioning Systems. It is simplified in the sense that the various Class rules are converging upon the IMO Guidelines, as seen in the DP Rules comparisons, which has brought about so much similarity that it is possible to state equivalence between most Class Notations and IMO.

The complication is that confirmation of compliance with the IMO Guidelines is the responsibility of the Flag State Authorities, which in most bases is very difficult to obtain because few Flag States have engaged themselves in DP matters at all. The Flag State Authority has the option of delegating the responsibility of approval to the Classification Society. That is a common approach, particularly for so-called “Flags of convenience”, e.g. Liberia, Cayman Islands, but this is seldom done in the case of DP. This situation has left room for Guideline interpretations to be introduced from various non-official parties, with differing results.

In 2.1 DEFINITIONS, 2.1.2 and 2.1.6 is highlighted the difference between “DP system” and “DP-control system”; a difference that is often overlooked by involved parties. That can cause misunderstanding about the placing of responsibilities in a project. To sort that out, one should go back to classification fundamentals.

In classification work there is an overall differentiation between certification and classification. The *certification* is a product qualification, and *classification* is a vessel qualification, and there is a vast difference between being responsible for the certification of the DP-control system and the classification of the DP-system. For a new building project, the classification of the vessel, and hence the DP-system, is normally a contract between the Yard and the Classification Society. For a conversion project, the formal relationship is normally between the Ship Owner and Class, but the classification project could still be handled between the Conversion Contractor, not necessarily a yard, and Class.

Kongsberg Maritime will be responsible for the certification of the DP-control system, according to the requirements for the applicable Class Notation, assuming that the vessel will have a DP Class Notation at all. That decision is taken by the Ship Owner, and it is also the Owner who decides which notation he will adopt. It is also the Owner who decides with which IMO Class his vessel shall comply. If the contract makes reference to both Class and IMO, and there are differences, the most demanding requirement is applicable.

Subsystem or Component			Minimum Requirement for each Class (IMO)					
					CLASS 2	CLASS 2	CLASS 3	
Power System	Generator and prime movers				Non-redundant	Redundant	Redundant, in separate compartments	
	Main switchboard				1	1 with bus tie	2 with normally open bus ties in separate compartments, A60	
	Bus tie breaker				0	1	2	
	Distribution system				Non-redundant	Redundant	Redundant, through separate compartments	
	Power Management		Note 1		No	Note 1	Note 1	
Thrusters	Arrangement of thruster				Non-redundant	Redundant	Separate compartments redundant	
Control	Auto control; no. of computer systems		Note 2		1	2	2 + 1 back-up	
	Manual control; joystick with auto heading		Note 3		Yes	Yes	Yes	
	Single levers for each thruster				Yes	Yes	Yes	
Sensors	Pos.ref. Systems		Note 9		1	3	3 whereof 1 in alternate control station directly connected to Back-up system	
	External Sensor	Wind			1	2	3	Whereof 1 in alternate control station
		VRS	Note 4		1	Note 4 2/3	3	As above
		Gyro compass	Note 4		1	3	3	As above
UPS			Note 5		1	2	2+1 separate compartment	
Alternative control station for backup unit					No	No	Yes	

IMO Guidelines	Minimum requirements for each class (IMO)				
			CLASS 1	CLASS 2	CLASS 3
Consequence Analysis	Note 6		No	Yes Note 6	Yes Note 6
FMEA	Note 7		No	Note 7	Note 7
Installation manual/systems drawings			Yes	Yes	Yes
FAT/CAT			Yes	Yes	Yes
Approval of cable routing for power and control circuits			No	Yes	Yes
No single fault can result in more than 50% loss of DP capability			No	Yes	Yes
Equivalence with NMD consequence class			1	2	3

IMO CLASS	KONGSBERG MARITIME SYSTEM TYPE	ADDITIONAL EQUIPMENT
DP Class 1	K-Pos DP-11/12 or cPos	Independent joystick w/Auto heading
DP Class 2	K-Pos DP-21/22 or K-Pos DP-31/32	Independent joystick w/Auto heading
DP Class 3	K-Pos DP-21/22 or K-Pos DP-31/32	Back-up K-Pos DP-11/12 and Independent joystick w/Auto heading

Notes and Comments
See note 8 concerning requirements for printer.

Note 1: Power management, ref. IMO Guidelines 3.2.6

There is no definite requirement for a power management system. The reference states: "*If a power management is installed, adequate redundancy or reliability to the satisfaction of the Administration should be demonstrated."*

This reflects that there are power systems that have no need for power management; there is really nothing to "manage". This should not be confused with the need for pitch/RPM reduction for black-out prevention.

Note also that there is no strict requirement for the power system to be redundant.

Note 2: Computer systems, ref. IMO Guidelines 3.4.2.5 and 3.4.2.6

Redundant computer systems should be arranged with automatic transfer of control after a detected failure in the computer currently in control. The automatic transfer of control from one computer system to another should be smooth, and within the acceptable limitations of the operations.

For Equipment Class 3, the back-up DP control system should be in a room separated by A60 class division from the main DP control station. During DP operations, this back-up control system should be continuously updated by input from sensors, position reference systems, thrusters feedback, etc, and be ready to take over control. The switch-over of control to the back-up system should be manual, situated on the back-up computer, and should not be affected by failure of the main DP control system.

Note 3: Manual control, joystick, ref. IMO Guidelines 3.4.1.7

The reference states: "*It should be possible to control the thrusters manually, by individual joysticks and a common joystick, in the event of failure of the DP control system."*

This is understood to mean the manual levers for each thrusters and the independent joystick that is required in the Class rules.

Note 4: External sensors, VRS, ref. IMO Guidelines 3.4.4.2

The reference states: "*When an equipment class 2 or 3 DP-control system is fully dependent on correct signals from vessel sensors, then these signals should be based on three systems serving the same purpose (i.e. this will result in at least three gyro compasses being installed).*

It is generally accepted that this requirement applies to gyro compasses. If it should also apply to VRS has to be considered in view of the chosen position reference systems and how these are dependent on roll and pitch compensation.

Note 5: UPS, ref. IMO Guidelines 3.4.2.7

The reference states: "*An uninterruptible power supply (UPS) should be provided for each DP-computer system to ensure that any power failure will not affect more than one computer. UPS battery capacity should provide a minimum of 30 minutes operation following a mains supply failure."*

The requirement refers to "DP-computer system" and also "one computer". This is understood as one UPS for each of the two DP-computer systems in Class 2, and one more for the back-up DP-control system in Class 3, ignoring the fact that each of these systems may contain more than one "computer".

The requirement means that the large, central UPS installations found in some major automation systems may not be acceptable.

Note 6: Consequence analysis, ref. IMO Guidelines 3.4.2.4

The reference states: "*For equipment classes 2 and 3, the DP-control system should include a software function, normally known as "consequence analysis", which continuously verifies that the vessel will remain in position even if the worst case failure occurs. This analysis should verify that the thrusters remaining in operation after the worst case failure can generate the same resultant thrusters force and moment as required before the failure. The consequence analysis should provide an alarm if the occurrence of a worst case failure would lead to a loss of position due to insufficient thrust for the prevailing environmental conditions. For operations which will take a long time to safely terminate, the consequence analysis should include a function which simulates the thrust and power remaining after the worst case failure, base on manual input of the weather trend".*

Note 7: FMEA

There is no requirement for FMEA in the IMO Guidelines, the name is not even used. It is, however, difficult to see how the worst case failure can be determined without some form of failure analysis. In addition, most Classification DP rules include a requirement for an FMEA for Class 2 and 3. The few exceptions are noted in the tabular Class presentations.

Note 8: Printer, ref. IMO Guidelines 3.4.1.5

The reference states: *"Alarms and warnings for failures in systems interfaced to and/or controlled by the DP-control system are to be audible and visual. A permanent record of their occurrence and of status changes should be provided together with any necessary explanations."*

This is understood as a requirement for a paper printer. A corresponding requirement is found in the DP-rules for BV, RINA, and DNV. ABS and LR have no specific requirement for an alarm printer in their DP-rules, but a general requirement should be found in their Main Class rules for automation systems. Hence, it is recommended to include the printer in any system delivered to IMO standards.

Note 9: The following is quoted from Paragraph 3.4.3 Position reference systems:

.1 Position reference systems should be selected with due consideration to operational requirements, both with regard to restrictions caused by the manner of deployment and expected performance in working situation.

.2 For equipment classes 2 and 3, at least three position reference systems should be installed and simultaneously available to the DP-control system during operation.

.3 When two or more position reference systems are required, they should not all be of the same type, but based on different principles and suitable for the operating conditions.

.4 The position reference systems should produce data with adequate accuracy for the intended DP-operation.

ABS CERTIFICATION

based on:

ABS Rules for Building and Classing Steel Vessels Part 4 Chapter 3 Section 5 Thrusters and Dynamic Positioning System (Valid January 2007)

http://www.eagle.org/rules/downloads.html

The Rules for DP have been unchanged since 2004.

ABS Notations are as follows:

DPS-0	For vessel which are fitted with a dynamic position system with centralized manual position control and automatic heading control to maintain the position and heading under the specified maximum environmental conditions.
DPS-1	For vessels which are fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel under specified maximum environmental conditions having an independent centralized manual position control with automatic heading control.
DPS-2	For vessels which are fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel within a specified operating envelope under specified maximum environmental conditions during and following any single fault excluding a loss of compartment or compartments.
DPS-3	For vessels which are fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the vessel within a specified operating envelope under specified maximum environmental conditions during and following any single fault including complete loss of a compartment due to fire or flood.

Subsystem or Component			Minimum Requirement for each Class Notation (ABS)					
			Note 1	**DPS-0** Note 1	**DPS-1**	**DPS-2**	**DPS-3**	
Power System	Generator and prime movers			Non-redundant	Non-redundant	Redundant	Redundant, in separate compartments	
	Main switchboard			1	1	1 with bus tie	2 with normally open bus ties in separate compartments	
	Bus tie breaker			0	0	1	2	
	Distribution system			Non-redundant	Non-redundant	Redundant	Redundant, through separate compartments	
	Power Management			No	No	Yes	Yes	
Thrusters	Arrangement of thruster			Non-redundant	Non-redundant	Redundant	Redundant, in separate compartments	
Control	Auto control; no. of computer systems			1	1	2	2 + 1 in alternate control station	
	Manual control; joystick with auto heading			No	Yes	Yes	Yes	
	Single levers for each thruster			Yes	Yes	Yes	Yes	
Sensors	Pos.ref. Systems		Note 2+8	1	2	3	3 whereof 1 in alternate control station	
	External Sensor	Wind	Note 3	1	2	2	2	Whereof 1 in alternate control station
		VRS	Note 4	1	1	2/3	3	As above
		Gyro compass	Note 5	1	2	2	3	As above
UPS			Note 6	0	1	1	1 + 1 separate compartment	
Alternative control station for backup unit				N/A	N/A	N/A	Yes	

Sub system or compartment	Minimum requirements for each Class Notation (ABS)				
		DPS-0	DPS-1	DPS-2	DPS-3
Consequence Analysis		No	No	Yes	Yes
FMEA	Note 7	Yes	Yes	Yes	Yes
Installation manual/systems drawings		Yes	Yes	Yes	Yes
FAT/CAT		Yes	Yes	Yes	Yes
Approval of cable routing for power and control circuits		No	No	Yes	Yes
Single failure not to cause a critical situation for the vessel or personnel		No	No	Yes	Yes *includes also fire and flooding
Equivalent to IMO class:		N/A	1	2	3

ABS CLASS	KONGSBERG MARITIME SYSTEM TYPE	ADDITIONAL EQUIPMENT
DPS-0	cPos (see Note 1)	One position reference system
DPS-1	K-Pos DP-11/12 or cPos	Independent joystick w/Auto heading
DPS-2	K-Pos DP-21/22 or K-Pos DP-31/32	Independent joystick w/Auto heading
DPS-3	K-Pos DP-21/22 or K-Pos DP-31/32	Back-up K-Pos DP-11/12 and Independent joystick w/Auto heading

Notes and Comments

Requirements concerning printer are found in “IMO certification” chapters 7, note 8.

Note 1: DPS-0
This is a “dynamic positioning system” according to ABS definition. It is understood to be a joystick system with a free-standing position reference system.

Note 2: Position reference system
There is a requirement for two pos. refs. For DPS-1, one is required for IMO Class 1.

Note 3: External sensors, Wind sensor
Compared to IMO, there is one more wind sensor in DPS-1, and one less in DPS-3.

Note 4: External sensors, VRS
The ABS rules do not state any requirement for VRS. It is recommended to apply IMO Guidelines requirements.

Note 5: Gyro compass
Compared to IMO, there is one more gyro in DPS-1 and one less in DPS-2.

Note 6: UPS
Compared to IMO, there is one UPS less in DPS-2 and DPS-3.

Note 7: FMEA
There is a requirement for FMEA in all DPS-classes. Ref. ABS DP-rules 15.1.3 and 15.1.4. The FMEA results are to be tested, ref. DP-rules 15.15.2.

Note 8: Position reference systems
To assist in discussions on selection of position reference systems, the relevant rule elements are quoted:

15.7 *Environment Sensor and Position Reference System*

15.7.1 *Vessels with DPS-0 or DPS-1 Notation*
For DPS-0 notation, a position reference system, a wind sensor and a gyro compass are to be fitted. For DPS-1 notation, they are to be provided in duplicate.

15.7.2 *Vessels with DPS-2 Notation*
In addition to the systems in 4-3-5/15.7.1 for DPS-1 notation, a third independent position reference system is to be provided. Two of the position reference systems may operate on the same principle. A single failure is not to affect simultaneously more than one position reference system, i.e. no common mode failures.

15.7.3 *Vessels with DPS-3 Notation*
In addition to the requirements in 4-3-5/15.7.2 for DPS-2 notation, a third gyro-compass is to be fitted. The third gyro-compass and the third independent position reference system are to be located in the back-up control station with their signals repeated in the main control station.

15.7.4 *Signal Processing*
When three position reference systems are required, the control computers are to use signal processing techniques to validate the data received. When out of range data occurs, an alarm is to be given.

The requirements to position reference systems are limited to an escalation in numbers, and when there are three, only two of them can operate on the same principle.

For DPS-1, the position reference systems shall be in “duplicate”. It is assumed that this means two, but not necessarily that they are equal.

DNV CERTIFICATION

based on

**"Rules for Classification of Ships,
Part 6 Chapter 7. January 2004, with amendments dated January 2006.**

www.dnv.no

DNV Notations are as follows:

DYNPOS-AUTS	Dynamic positioning system without redundancy.
DYNPOS-AUT	Dynamic positioning system with an independent joystick system back-up and a position reference back-up.
DYNPOS-AUTR	Dynamic positioning system with redundancy in technical design and with an independent joystick system back-up.
DYNPOS-AUTRO	Dynamic positioning system with redundancy in technical design an with an independent joystick back-up. Plus a back-up dynamic positioning control system in an emergency dynamic positioning control centre, designed with physical separation for components that provide redundancy.

General note: Previous class notation DYNPOS T has been deleted since the 2001 rule issue, and is not replaced by something similar.

In the 2001-issue, the DYNPOS "family name" had been deleted, which has only caused confusion. In the 2004-issue, "DYNPOS" has been recovered, now with a "-" in the names.

Subsystem or Component			Minimum Requirement for each Class Notation (DNV)					
				DYNPOS-AUTS	DYNPOS-AUT	DYNPOS-AUTR	DYNPOS-AUTRO	
Power System	Generator and prime movers			Non-redundant	Non-redundant	Redundant	Redundant, in separate compartments	
	Main switchboard			1	1	1 with bus tie	2 in separate compartments	
	Bus tie breaker			0	0	1	2, 1 breaker in each MSB	
	Distribution system			Non-redundant	Non-redundant	Redundant	Redundant, through separate compartments	
	Power Management		Note 1	No	No	Yes	Yes	
Thrusters	Arrangement of thruster		Note 9	Non-redundant Note 9	Non-redundant Note 9	Redundant	Redundant - in separate compartments	
Control	Auto control; no. of computer systems			1	1	2	2 + 1 in alternate control station	
	Manual control; joystick with auto heading		Note 2	No	Yes	Yes	Yes	
	Single levers for each thruster			Yes	Yes	Yes	Yes	
Sensors	Pos.ref. Systems		Note 3 and Note 8	1	2	3	3 whereof 1 in alternate control station	
	External Sensor	Wind	Note 4	1	1	2	2	Whereof 1 in alternate control station
		VRS	Note 5	1	1	2 Note 5	3	As above
		Gyro compass	Note 6	1	1	3 Note 6	3 Note 6	As above
UPS			Note 7	0	1	2	3 whereof one in separate compartment	
Alternative control station for backup unit				No	No	No	Yes	

Sub system or compartment	Minimum requirements for each Class Notation (DNV)				
		DYNPOS-AUTS	DYNPOS-AUT	DYNPOS-AUTR	DYNPOS-AUTRO
Consequence Analysis		No	No	Yes	Yes
FMEA and FMEA Tests		No	No	Yes	Yes
Installation manual/systems drawings		Yes	Yes	Yes	Yes
FAT/CAT		Yes	Yes	Yes	Yes
Approval of cable routing for power and control circuits		No	No	Yes	Yes
Single failure not to cause a critical situation for the vessel or personnel		No	No	Yes	Yes *includes also fire and flooding
Equivalent to IMO class:		N/A	1	2	3

DNV CLASS	KONGSBERG MARITIME SYSTEM TYPE	ADDITIONAL EQUIPMENT
DYNPOS-AUTS	K-Pos DP-11/12 or cPos	
DYNPOS-AUT	K-Pos DP-11/12 or cPos	Independent joystick w/Auto heading
DYNPOS-AUTR	K-Pos DP-21/22 or K-Pos DP-31/32	Independent joystick w/Auto heading
DYNPOS-AUTRO	K-Pos DP-21/22 or K-Pos DP-31/32	Back-up K-Pos DP-11/12 and Independent joystick w/Auto heading

Notes and Comments

Requirements concerning printer are found in “IMO certification” chapters 7, note 8.

Note 1: Power Management. Ref. DNV DP-rules, Pt.6 Ch.7 Sec. 1 Table D1

In addition to requirement for the over-all FMEA, a separate FMEA is required for the Power Management System.

Note 2: Independent joystick, ref. DNV DP-rules, Pt. 6 Ch.7 Sec. 2 table C1

Requirements are introduced to ensure the independence between the joystick and the DP control system. Of particular interest is that the joystick cannot share the network of the DP control system, and it cannot be powered from one of the DP UPS’s.

The independent joystick shall be certified, ref. Pt. 6 Ch.7 Sec. 1 C. Certification.

Note 3: Position reference systems

There is a requirement for two pos.refs for DYNPOS-AUT, one is required for IMO Class 1.

Note 4: External Sensors, Wind sensor

Compared to IMO Class 3, there is one less in DYNPOS-AUTRO.

Note 5: External sensors, VRS, ref. DNV DP-rules

Table C1 System arrangement in the Rules Section 2 contain a foot-note stating: “*Where necessary for the correct functioning of position reference systems, at least three vertical reference sensors are to be provided for the notation AUTR”*

This is included to comply with IMO Guidelines 3.4.4 Vessel sensors.
The definition of “necessary” is understood to be the operator’s responsibility.

Note 6: Gyro compass

Table C1 System arrangement in the Rules Section 2 contains a foot-note stating that one gyro may be substituted by a heading device based upon another principle. For DYNPOS-AUTRO, this device is not to be the gyro placed in the alternate control station.

Note 7: UPS

The certification requirement for DP-UPS has been deleted. The general certification requirement is limited to units of 100 KVA and upwards. Power input to the UPS's shall be taken from different sides of the main switchboard. Also, the UPS for the independent joystick shall not be shared with the DP-control system.

Note 8: There are few, if any, requirements to the suitability of the position reference system for their intended/expected operational conditions. From Rule Section 3 Control System, C. Positioning Reference System, the following is quoted:

C 100 General

101 Where more than one positioning reference system is required, at least two shall be based on different principles.

This requirement will prevent system failure due to a common failure mode, which could have defeated the redundancy just in numbers. There will, however, also be possibilities for redundancy in operational suitability.

104 Positioning reference systems shall provide new position data with a refresh rate and accuracy suitable for the intended DP-operations.

This is the only reference to suitability in intended operations.

Note 9: DNV does not approve the use of two main prop and rudders without additional "thruster(s)" in the stern/aft of the vessel (tunnel, azimuth).

Pt. 6 Ch.7 Section 1 GENERAL REQUIREMENTS, B. Definitions

B 100 General

104 Dynamically positioned vessel (DP-vessel): A vessel which automatically maintains its position (fixed location or predetermined track) exclusively by means of thruster force.

Guidance note: *In this context thruster force may include propulsion and steering (rudder) forces, see Sec.4.*

Pt. 6 Ch.7 Section 4 THRUSTER SYSTEMS, A. General

A 200 Thruster configuration

201 The thruster configuration shall include thrust units which together will produce, at any time, transverse and longitudinal thrust, and a yawing moment.

Guidance note: *The rules do not specify the number or size of thrusters to make up the configuration. The position holding capability resulting from a chosen configuration will be documented by the "environmental regularity numbers" (**ern**). Thrusters should be located with consideration of effects, which will reduce their efficiency, e.g. thruster-hull, and thruster-thruster interaction, and shallow-immersion effects.*

202 In a thruster configuration, provided with redundancy in design and physical arrangement, there shall be transverse and longitudinal thrust, and yawing moment after any single failure.

Guidance note: *Transverse thrust generated by the combined use of propellers and rudders may upon special consideration, be accepted as equivalent to a side thruster for back-up purposes, but should not be taken into consideration when calculating the first **ern** number, and should be proven on trials.*