ABS Guide for Dynamic Positioning Systems - EHS & SKP Notations

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ABS DPS Guides & Notations

- ABS Guide for Dynamic Positioning Systems
- DPS Basic Notations
  - DPS-0, DPS-1, DPS-2, DPS-3
- Supplement Notations
  - EHS-P, EHS-C, EHS-F
  - SKP, SKP(a,b,c,d,e,f)
Section 8: Enhanced System

- New Optional Notations
  - EHS-P for enhanced power plant and thruster system
  - EHS-C for enhanced control system
  - EHS-F for fire and flood tolerance design

- Supplement information for DPS-2/DPS-3 Notations

- Provide three groups for flexibility and easy recognition

- Can be combined as EHS-PC, etc.

- Objective
  - Improve reliability, operability and maintainability
  - Recognize safety features that beyond minimum requirements
  - Encourage higher safe design standard
EHS-P Requirement

- Enhanced generator protection
  - Failure detection and discrimination of failed components before a full or partial black-out situation occurs
  - Open bus-tie if the faulty generator fails to trip
  - One protection system per generator

- Robust redundancy design
  - Autonomous generator sets
  - Autonomous thruster sets

- Blackout prevention and automatic recovery (60s)
  - Power management system
  - Thruster phase back
  - System ride through capability (short circuit)
EHS-P Requirement

- Autonomous
  - Control and automation – to be decentralized to the point that each item of main machinery (generators and thrusters) is capable of making itself ready for DP operations independently of any centralized control system
  - Auxiliary – to be provided in a manner that makes the machinery (generators and thrusters) as independent as practical to minimize the number of failures that can lead to the loss of more than one main item of machinery
EHS-C Requirement

- Three position reference systems and sensors available at any given time and location
- Four position reference systems and four sensors with combination of different systems
- Redundancy of relative reference system for offshore support vessels
- Three DP control computers (one backup)
- Equipment from different suppliers or using different principles of operation
- DP Data Logger
- Integration of the centralized control system with sub-control systems
EHS-F Requirement

- DPS-3 automatically meets EHS-F requirements
- A-0 separation along boundary of redundancy groups
- No A-0 separation required between main and backup DP control station
- A-60 separation for high fire risk spaces
  - The high fire risk area is the area defined by SVR 4-8-4/1.11 including
  - Machinery spaces as defined by 4-7-1/11.15 and 4-7-1/11.17
  - Spaces containing fuel treatment equipment and other highly flammable substances
# Summary of Enhanced DP Systems

<table>
<thead>
<tr>
<th>EHS-P</th>
<th>EHS-C</th>
<th>EHS-F</th>
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<tr>
<td>Autonomous Generator Set</td>
<td>2+1 Backup DP Control computers and controllers</td>
<td>Generators and Prime Movers</td>
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<tr>
<td>Bus Tie Breaker redundantly configured between bus segments</td>
<td>Wind Sensors 3 + 1 in back up control station</td>
<td>Separate compartments, A60 for high fire risk area. Watertight below damage waterline.</td>
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<tr>
<td>Enhanced Generator Protection</td>
<td>Gyros 3 + 1 in backup control station</td>
<td>Power Distribution System A0 between redundant groups. Watertight below damage waterline.</td>
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<tr>
<td>Enhanced Power Management</td>
<td>MRU 3 + 1 in backup control station</td>
<td>Thruster System A0 between redundant groups. Watertight below damage waterline.</td>
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<tr>
<td>Autonomous Thruster Set</td>
<td>Position Reference Systems 3 + 1 in backup control station</td>
<td>Controller Space A0 between redundant groups.</td>
</tr>
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Documentation (EHS)

- Description of protection design philosophy and protection systems the redundancy concept of DP system depends on
- Analysis of effects of severe voltage transients on power system stability
- Short circuit analysis
- Simulation of severe over/under voltage and over/under frequency
- Protection coordination analysis
- Protection settings
- Description of automatic blackout recovery
Section 9: Stationkeeping Performance

- New notations
  - **SKP**: verification for given design environmental conditions through analysis
  - **SKP(a,b,c,d,e,f)**: determine limiting environments for a given environment site through analysis

- Supplement for DPS-series notations

- Objective
  - Recognition of DP capability
  - Encourage robust design and consistent assessment
SKP Notation

- Owner specify design environment conditions
  - Design wind speed and directions
  - Design wave height, related period and directions
  - Design current speed and directions

- Station keeping performance assessment
  - Environmental load calculation
  - Available thrust calculation including effect due to thruster interference with others

- Analysis results demonstrate the capability of stationkeeping for the specified environment conditions
Environmental Load

- **Wind and current**
  - 1-minute mean wind speed at 10-meter above water surface
  - Model test data to be used whenever possible
  - For non-ship shape unit, wind and current forces according to ABS Rules for MODU, FPI or API 2SK
  - For a ship shape unit, wind and forces according to ABS Rules for MODU, FPI, API RP 2SK or OCIMF publication

- **Wave**
  - Significant wave heights and characteristic periods (frequencies)
  - JONSWAP for North Sea and locations with limited fetch
  - Bretschneider for open seas
  - Model test data for wave drift force if available
  - Drift force calculation using appropriate hydrodynamic analysis computer program
Available Thrust

- Manufacturer’s test data of full scale or suitable model test for the thrust output of thrusters to be used
- This Guide provides method for determining available thrust
- Thruster-Thruster Interaction
- Thruster-Hull Interaction
- Thruster-Current Interaction
SKP(a,b,c,d,e,f) Notation

- **a**: the probability that the vessel can remain on station with all thrusters operating for location f and current speed e
- **b**: the probability that the vessel can remain on station with the failure of minimum effect of single thruster for location f and current speed e
- **c**: the probability that the vessel can remain on station with the failure of maximum effect single thruster for location f and current speed e
- **d**: the probability that the vessel can remain on station with the worst case failure condition for location f and current speed e
- **e**: current speed in knot (owner specify or typical 1.5 kt)
- **f**: environment location (owner specify or typical North Sea)
SKP(a,b,c,d,e,f) Notation

- Same analysis procedures for load and thrust calculation
- May cover SKP if design environments are given and are within the limit
- Require for the relationship between wind speeds and wave heights
- Require probability of non-exceedance of wind speed
Where the DP system is to be supplemented with a stationkeeping performance notation, the following information is to be submitted for review:

- General arrangement and lines plan
- Thruster arrangement
- Thruster power and thrust
- Thruster interactions
- Analysis procedures
- Capability plots
- Documentation on the environment conditions long term distribution (any area for intended service)
- Owner specified limiting environments