



**eekels**

**TBI techniek**

# High Voltage Shore Connection

Proposed IEC standard

IEC 60092-510 (draft)



High Voltage Shore Connection

# Background





**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent



**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*



**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*

SO<sub>x</sub> july 2010 1.5%=>2015 0.1%



**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*

SOx july 2010 1.5%=>2015 0.1%

NOx june 2011 –2016



**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*

SOx july 2010 1.5%=>2015 0.1%

NOx june 2011 –2016

Fuel Costs rise: shore power interesting



eekels

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*

SOx july 2010 1.5%=>2015 0.1%

NOx june 2011 –2016

Fuel Costs rise: shore power interesting

Legislation demand (USA)



**eekels**

TBI techniek

## Background



IMO air pollution rules  
generally more stringent

Northsea & Baltic Sea  
*Emission Controlled Area*

SOx july 2010 1.5%=>2015 0.1%

NOx june 2011 –2016

Fuel Costs rise: shore power interesting

Legislation demand (USA)

or will demand (Scandinavia) shore power.



**eekels**

TBI techniek

# Electrical Shore Power



**eekels**

TBI techniek

# Electrical Shore Power

- LV standard available
  - CEEFORM n x 125A



**eekels**

TBI techniek

## Electrical Shore Power

- LV standard available
  - CEEFORM n x 125A
- LV high power no standard available  
*(although de facto standards used –e.g. Maréchal )*



**eekels**

TBI techniek

## Electrical Shore Power

- LV standard available
  - CEEFORM n x 125A
- LV high power no standard available  
*(although de facto standards used –e.g. Maréchal )*
- HV port standards in USA
  - containerships (6,6 kV)
  - cruise ships (6,6&11kV)



**eekels**

TBI techniek

## Electrical Shore Power

- LV standard available
  - CEEFORM n x 125A
- LV high power no standard available  
(*although de facto standards used –e.g. Maréchal* )
- HV port standards in USA
  - containerships (6,6 kV)
  - cruise ships (6,6&11kV)
- ISO started standardisation for “cold ironing”  
(electrical, steam, water, waste connected to shore)
  - IEC continued standardisation electrical part  
(electrical work is done by IEC, mechanical ISO)



**eekels**

TBI techniek

## Electrical Shore Power

- LV standard available
  - CEEFORM n x 125A
- LV high power no standard available  
*(although de facto standards used –e.g. Maréchal )*
- HV port standards in USA
  - containerships (6,6 kV)
  - cruise ships (6,6&11kV)
- ISO started standardisation for “cold ironing”  
(electrical, steam, water, waste connected to shore)
  - IEC continued standardisation electrical part  
(electrical work is done by IEC, mechanical ISO)
- Work started 2007



**eekels**

TBI techniek

# Work Progress



**eekels**

TBI techniek

## Work Progress

2007

German draft for “one size fits all solution”, based on existing practice

6,6 or 11 kV 60 Hz



**eekels**

TBI techniek

## Work Progress

2007

German draft for “one size fits all solution”, based on existing practice

6,6 or 11 kV 60 Hz

2008

European delegates changed proposal to general draft with annexes for specific demands

USA & Europe => joint PT60092-510 IEC/ISO(IEEE)



**eekels**

TBI techniek

## Work Progress

2007

German draft for “one size fits all solution”, based on existing practice

6,6 or 11 kV 60 Hz

2008

European delegates changed proposal to general draft with annexes for specific demands

USA ó Europe => joint PT60092-510 IEC/ISO(IEEE)

2009 – 2 draft versions + P(ublic) A(vailable) S(pecification) accepted



**eekels**

**TBI techniek**

## Work Progress

2007

German draft for “one size fits all solution”, based on existing practice

6,6 or 11 kV 60 Hz

2008

European delegates changed proposal to general draft with annexes for specific demands

USA & Europe => joint PT60092-510 IEC/ISO(IEEE)

2009 – 2 draft versions + P(ublic) A(vailable) S(pecification) accepted

2010

IEC 60092-510 standard planned for september

*(delay expected appr 6 months:*

*– it is a worldwide new standard, 3rd draft needed)*



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content electrical



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –content electrical**

- Intended for 1 –20 MVA



**eekels**

TBI techniek

## IEC 60092-510 HVSC –content electrical

- Intended for 1 –20 MVA
- 6,6kV or 11kV, 50 or 60 Hz  
(IEC60038 supports ranges for 6-6.6 and 10-11kV!)



**eekels**

TBI techniek

## IEC 60092-510 HVSC –content electrical

- Intended for 1 –20 MVA
- 6,6kV or 11kV, 50 or 60 Hz  
(IEC60038 supports ranges for 6-6.6 and 10-11kV!)
- Power Quality based on shipboard rules



**eekels**

TBI techniek

## IEC 60092-510 HVSC –content electrical

- Intended for 1 –20 MVA
- 6,6kV or 11kV, 50 or 60 Hz  
(IEC60038 supports ranges for 6-6.6 and 10-11kV!)
- Power Quality based on shipboard rules
- Galvanic separation between shore grid and ship



**eekels**

**TBI techniek**

## **IEC 60092-510 HVSC –content electrical**

- Intended for 1 –20 MVA
- 6,6kV or 11kV, 50 or 60 Hz  
(IEC60038 supports ranges for 6-6.6 and 10-11kV!)
- Power Quality based on shipboard rules
- Galvanic separation between shore grid and ship
- Grounding still “to be discussed”

*USA national codes prefer low impedance grounding,  
ships may be high impedance (tankers!)*

## IEC 60092-510 HVSC –content electrical

- Intended for 1 –20 MVA
- 6,6kV or 11kV, 50 or 60 Hz  
(IEC60038 supports ranges for 6-6.6 and 10-11kV!)
- Power Quality based on shipboard rules
- Galvanic separation between shore grid and ship
- Grounding still “to be discussed”  
*USA national codes prefer low impedance grounding,  
ships may be high impedance (tankers!)*
- Standard plugs and sockets will be available for HV!



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

Engineering



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

### 1. Requirements for Shiplside facilities



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

## Verification and testing



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –content**

### Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

### Verification and testing

- Initial (certification of 1,2 and 3)



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

## Verification and testing

- Initial (certification of 1,2 and 3)
- Periodic and for maintenance



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

## Verification and testing

- Initial (certification of 1,2 and 3)
- Periodic and for maintenance

## Responsibilities



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

## Verification and testing

- Initial (certification of 1,2 and 3)
- Periodic and for maintenance

## Responsibilities

- Engineering: one party for shipshore connectivity



**eekels**

TBI techniek

# IEC 60092-510 HVSC –content

## Engineering

1. Requirements for Shiplside facilities
2. Requirements for Shoreside facilities
3. Requirements for a ship to connect to a shore facility

## Verification and testing

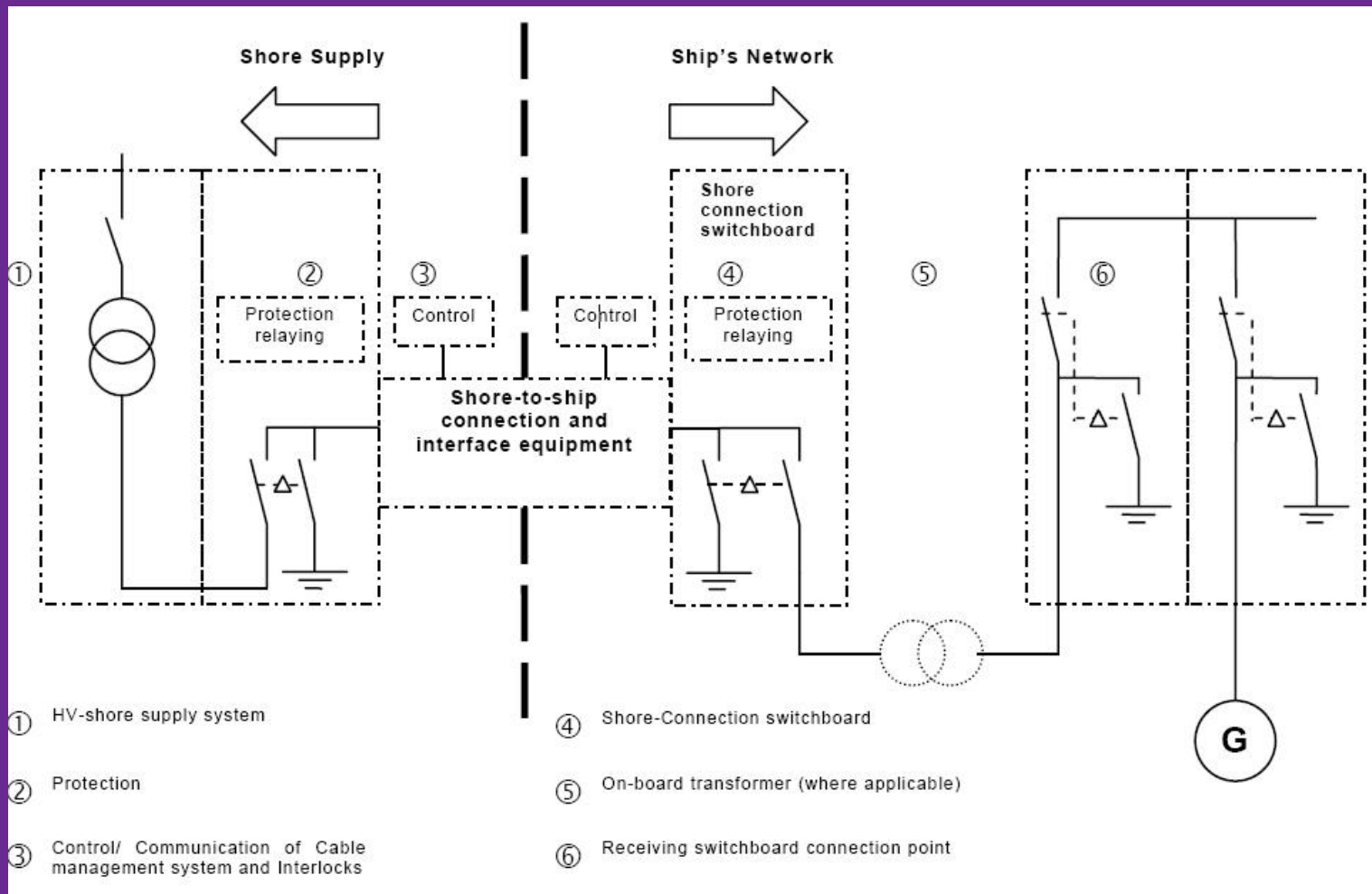
- Initial (certification of 1,2 and 3)
- Periodic and for maintenance

## Responsibilities

- Engineering: one party for shipshore connectivity
- HV-safety rules: PIC, education



# IEC 60092-510 HVSC –system





**eekels**

TBI techniek

# IEC 60092-510 HVSC –ship annexes



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –ship annexes**

### Cruise ships

Multiple cables 6,6 and 11kV /60Hz (4x 500 A, 11kV)



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –ship annexes**

### **Cruise ships**

Multiple cables 6,6 and 11kV /60Hz (4x 500 A, 11kV)

### **Tankers (large LNG)**

Multiple cables, connection boom, IEC60079,  
6,6kV/60Hz



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –ship annexes**

### **Cruise ships**

Multiple cables 6,6 and 11kV /60Hz (4x 500 A, 11kV)

### **Tankers (large LNG)**

Multiple cables, connection boom, IEC60079,  
6,6kV/60Hz

### **Large Container vessels**

Double cable, plugs, cable and reel defined 6,6kV /60Hz



**eekels**

TBI techniek

## **IEC 60092-510 HVSC –ship annexes**

### **Cruise ships**

Multiple cables 6,6 and 11kV /60Hz (4x 500 A, 11kV)

### **Tankers (large LNG)**

Multiple cables, connection boom, IEC60079,  
6,6kV/60Hz

### **Large Container vessels**

Double cable, plugs, cable and reel defined 6,6kV /60Hz

### **RoRo (including ferries)**

Based on European situation with LV-ship, 11 kV  
(discussed)



**eekels**

TBI techniek

# IEC 60092-510 HVSC – 2010 issues to be solved



**eekels**

TBI techniek

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy  
earth fault current



**eekels**

TBI techniek

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy  
earth fault current
- Standard HV plug and socket



**eekels**

TBI techniek

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy

  - earth fault current

- Standard HV plug and socket

  - Standardisation is started, but will not be finished when standard is ready



**eekels**

TBI techniek

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy  
earth fault current
- Standard HV plug and socket  
Standardisation is started, but will not be finished when standard is ready
- Power range and SCC

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy  
earth fault current
- Standard HV plug and socket  
Standardisation is started, but will not be finished when standard is ready
- Power range and SCC  
SCC is set at 16 kA, this will lead to large cable size

## IEC 60092-510 HVSC – 2010 issues to be solved

- Grounding philosophy  
earth fault current
- Standard HV plug and socket  
Standardisation is started, but will not be finished when standard is ready
- Power range and SCC  
SCC is set at 16 kA, this will lead to large cable size
- Communication system for safety systems

## **IEC 60092-510 HVSC – 2010 issues to be solved**

- Grounding philosophy  
earth fault current
- Standard HV plug and socket  
Standardisation is started, but will not be finished when standard is ready
- Power range and SCC  
SCC is set at 16 kA, this will lead to large cable size
- Communication system for safety systems  
Only ESD system defined. Expertise missing in PT



**eekels**

TBI techniek

## High Voltage Shore Connection

