Product & System Training
Technical training based on engineering protocols and design

REDUCE RISK, INCREASE PRODUCTIVITY
TRAIN YOUR IN HOUSE MAINTENANCE TEAMS
Enhance your productivity, reduce the risk of unplanned outages and safety incidents and enjoy lower operating costs by ensuring that your maintenance teams have the best understanding of the GE equipment they are responsible for. All equipment needs inspection and maintenance to keep it in the best operating condition. Knowing when to intervene, when to adjust, and when to call in expert help is critical for every successful maintenance team. Our training provides this essential knowledge.

EFFECTIVE TRAINING
DElIVERED BY OEM FIELD EXPERTS
Instead of self training or buying expensive 3rd party training, GE offers training which can be tailored to your specific needs, and is delivered by the equipment designers and the project engineers who build, install and commission the equipment you use. Nobody has a better understanding of the equipment.

TRAINED MAINTENANCE TEAMS
ENABLING OPERATIONAL COST SAVINGS
Unplanned outages can be very costly with costs ranging between $3,000 and $30,000 per hour and more. Knowledgeable well trained on-site maintenance teams are a key way of ensuring that problems are identified early and dealt with in-house quickly and effectively.

Training by GE enables you to leverage our long term service agreements incorporating remote support. This allows you to save lost revenues and unplanned downtime by allowing your maintenance personnel to be more productive and troubleshoot equipment issues rapidly with the help of remote GE support engineers.

We can tailor each course to meet the precise needs of your operating environment, industry or regulatory requirements.

Our training courses are delivered by the people who design the equipment with deep domain expertise.

We can train at one of our GE locations across the world, and we can also train at your site or at a location to suit your needs.
MERCHANT MARINE - CENTER OF EXCELLENCE (COE)

TRAINING CATALOGUE

ELECTRICAL PROPULSION SYSTEM (EPS)

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Your need for training your on-board engineering and maintenance personnel is the sole focus of our electrical propulsion system focused training catalogue.

The training courses allow you to strengthen the performance of your teams in the fields of studies, operation and maintenance, on equipment for which the use must be optimized.

We offer general or advanced training courses in the attached catalogue in our certified training centers. These training courses can be offered on-board your vessel with our certified mobile training center (MTC) on request.

Our training experts, recognized for their skills within GE POWER CONVERSION, can help you benefit from their know-how, which has been constantly improved by their experience on the ground. They offer you a grounded theoretical and practical training in the various fields of our activity, on our workstations in the secure environment of our center, or even on your own equipment on-board your vessel.

For any training requests: marine.training.belfort@ge.com
**GENERAL INFORMATION & CONDITIONS**

**Prerequisites:**
Fundamental knowledge of basic electrical engineering & electronics
Use of a personal computer

**Participants:**
From Junior to expert level

**Language:**
English or French

**Number of participants**
6 max at the Training Center or on-board

**Duration:** 3 to 5 days

**Location**
Training Center based in Belfort (France) Center of Excellence (COE),
On-board your vessel or at your offices using the Mobile Training Center (MTC)

**Daily Schedule:**
Every working day: from 9 a.m. to 4.30 p.m.

**Trainee’s documentation**
Trainee’s documentation relative to the course
Course convention
Certificate of attendance

**Course price include:**
A qualified instructor with up to date knowledge and teaching experience
Training room with infrastructure and training equipment (Notably MTC for on-board training)
Lunch, coffee and refreshments

**Training calendar**
Customer’s provisional dates need to be sent at: marine.training.belfort@ge.com to be confirmed by the training department.

**Travel and accommodation costs**
Airline tickets, travel time, accommodation, local transportation of the participants (or the trainer in case of on-board / customer offices training) and meals except lunch are not included in the price. GE Power Conversion can assist in handling accommodation and local transport. These expenses will be charged based on costs + 10% administration fee.

**Training benefit**
This is not a standard training, this is a tailored training to your Electrical Propulsion System.
**QUOTATION REQUEST FOR A TRAINING COURSE**

| Supplier: | GE POWER CONVERSION FRANCE SAS  
|           | Marine Services  
|           | 24, Avenue du Marechal Juin  
|           | 90008 – Belfort  
|           | France |
| Company: |  
| Billing address: |  
| Applicant's name: |  
| Position: |  
| Email address: |  
| Training code: |  
| Sessions number: | _______ x 6 trainees |
| Preferable location: | On-board / GE Training Center / Customer facilities  
| Preferable dates: |  
| This form to be sent to: | marine.training.belfort@ge.com |
| Specific(s) request(s): |  
| Customer confirmation: |  

---

**Customer Project Document File**

- MERCHANT MARINE - CENTER OF EXCELLENCE (COE)
- TRAINING CATALOGUE
- ELECTRICAL PROPULSION SYSTEM (EPS)
- Tender No / Marine Services - 2017 Training catalogue - Electrical Propulsion System - Rev C.docx

**Ref**: 793869  
**Revision**: C  
**Date**: 2017-03-20  
**Page**: 5/24
# MARINE THEORETICAL AND PRACTICAL TRAINING COURSES

## 1. SD7000 LCI DRIVE / PEC(E) CONTROL / SYNCHRONOUS INBOARD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
<th>M011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>3 days / session</td>
</tr>
</tbody>
</table>

**Objectives**
- Understand the architecture of your Electrical Propulsion System,
- Understand the technology used aboard,
- Understand the configuration changes and system setting-up

## 1. THEORETICAL REFRESHERS
- Synchronous machine refresher
- Thyristor and GRAETZ bridge refresher
- Transformers refresher

## 2. PRESENTATION OF SD7000 VSD OPERATING PRINCIPLE
- General presentation: Configuration, main components and options
- Converter structure
- Pulsed or synchronous running modes
- Torque control

## 3. PRESENTATION OF SD7000 PEC(E) CONTROL
- Architecture organisation
  - Hardware – Configuration
  - Software – System (P80i, etc)
  - Software – Application
    - Application structure (Version, module replacement
    - Main sequences and torque regulation
    - Test modes
    - Faults and alarms
    - Fast data recorder (Pertubography)

## 4. NETWORK ARCHITECTURE PRESENTATION
- Description of the network architecture (Wheelhouse, ECR, conv & mot rooms)
- Hardware description in the architecture (Switches, Ethernet ports, etc)
- Software description including (Addressing, Physical and IP addresses, etc)

## 5. REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION
- Remote I/O presentation
  - Characteristics
  - Topology
  - Connecting
  - Hardware and I/O visualization
- Remote I/O operation
  - RIO tool configuration
  - Exchanges configuration
  - Loading
  - P80i application
  - Diagnosis

## 6. HMI SUPERVISION
- General presentation (including views, alarms signification, etc)
- Configuration and restoration
- Data exchange and reading data
- Maintenance
# SD7000 LCI DRIVE / PEC(E) CONTROL / SYNCHRONOUS POD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
<th>MO12</th>
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<tbody>
<tr>
<td>Duration</td>
<td>4 days / session</td>
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</table>

## Course details

### Objectives
- Understand the architecture of your Electrical Propulsion System,
- Understand the technology used aboard,
- Understand the configuration changes and system setting-up
- Understand POD sub-equipment and operating system

### 1. THEORETICAL REFRESHERS
- Synchronous machine refresher
- Thyristor and GRAETZ' bridge refresher
- Transformers refresher

### 2. PRESENTATION OF SD7000 VSD OPERATING PRINCIPLE
- General presentation: Configuration, main components and options
- Converter structure
- Pulsed or synchronous running modes
- Torque control

### 3. PRESENTATION OF SD7000 PEC CONTROL
- Architecture organisation
  - Hardware – Configuration
  - Software – System (P80i, etc)
  - Software – Application
    - Application structure (Version, module replacement
    - Main sequences and torque regulation
    - Test modes
    - Faults and alarms
    - Fast data recorder (Pertubography)

### 4. NETWORK ARCHITECTURE PRESENTATION
- Description of the network architecture (Wheelhouse, ECR, conv & mot rooms)
- Hardware description in the architecture (Switches, Ethernet ports, etc)
- Software description including (Addressing, Physical and IP addresses, etc)

### 5. REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION
- Remote I/O presentation
  - Characteristics
  - Topology
  - Connecting
  - Hardware and I/O visualization
- Remote I/O operation
  - RIO tool configuration
  - Exchanges configuration
  - Loading
  - P80i application
  - Diagnosis

### 6. HMI SUPERVISION
- General presentation (including views, alarms signification, etc)
- Configuration and restoration
- Data exchange and reading data
- Maintenance

### 7. POD MOTOR FOCUS
- Auxiliary Slip Ring (ASR), Power Slip Ring (PSR), Auxiliaries
### MV7000 PWM DRIVE / PEC(E) CONTROL / ASYNCHRONOUS INBOARD MOTOR

<table>
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<tr>
<th>Training code</th>
<th>M013</th>
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<tr>
<td>Duration</td>
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**Objectives**
- Understand the architecture of your Electrical Propulsion System,
- Understand the technology used aboard,
- Understand the configuration changes and system setting-up

#### Course details

1. **THEORETICAL REFRESHERS**
   - Asynchronous motors refresher
   - Transformers refresher
   - P.W.M 2 and 3 levels NPC and NPP
   - P.W.M strategy of the MV7000
   - MV7000 flux vector control

2. **PRESENTATION OF MV7000 OPERATING PRINCIPLE**
   - Range of power for NPP, NPC and Unified
   - Configuration, main components and options

3. **PRESENTATION OF MV7000 PEC(E) CONTROL**
   - Architecture organisation
     - Hardware – Configuration (Main CPU, P1Be, EtherCAT network, etc)
     - Software – System (P80i libraries, etc)
     - Software – Application
       - Application structure (Version, module replacement, etc)
       - Main sequences and torque regulation
       - Test modes
       - Faults and alarms
       - Fast data recorder (Perubography)

4. **NETWORK ARCHITECTURE PRESENTATION**
   - Description of the network architecture (Wheelhouse, ECR, conv & mot rooms)
   - Hardware description in the architecture (Switches, Ethernet ports, etc)
   - Software description including (Addressing, Physical and IP addresses, etc)

5. **REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION**
   - Remote I/O presentation
     - Characteristics
     - Topology
     - Connecting
     - Hardware and I/O visualization
   - Remote I/O operation
     - RIO tool configuration
     - Exchanges configuration
     - Loading
     - P80i application
     - Diagnosis

6. **HMI SUPERVISION**
   - General presentation (including views, alarms signification, etc)
   - Configuration and restoration
   - Data exchange and reading data
   - Maintenance
# 1.4 MV7000 PWM DRIVE / PEC(E) CONTROL / ASYNCHRONOUS POD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
<th>M014</th>
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</thead>
<tbody>
<tr>
<td>Duration:</td>
<td>4 days / session</td>
</tr>
<tr>
<td>Objectives</td>
<td>Understand the architecture of your Electrical Propulsion System, Understand the technology used aboard, Understand the configuration changes and system setting-up, Understand POD sub-equipment and operating system</td>
</tr>
</tbody>
</table>

## Course details

### 1. THEORETICAL REFRESHERS
- Asynchronous motors refresher
- Transformers refresher
- P.W.M 2 and 3 levels NPC and NPP
- P.W.M strategy of the MV7000
- MV7000 flux vector control

### 2. PRESENTATION OF MV7000 OPERATING PRINCIPLE
- Range of power for NPP, NPC and Unified
- Configuration, main components and options

### 3. PRESENTATION OF MV7000 PEC(E) CONTROL
- Architecture organisation
  - Hardware – Configuration (Main CPU, PIBe, EtherCAT network, etc)
  - Software – System (P80i libraries, etc)
  - Software – Application
    - Application structure (Version, module replacement, etc)
    - Main sequences and torque regulation
    - Test modes
    - Faults and alarms
    - Fast data recorder (Pertubography)

### 4. NETWORK ARCHITECTURE PRESENTATION
- Description of the network architecture (Wheelhouse, ECR, conv & mot rooms)
- Hardware description in the architecture (Switches, Ethernet ports, etc)
- Software description including (Addressing, Physical and IP addresses, etc)

### 5. REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION
- Remote I/O presentation
  - Characteristics
  - Topology
  - Connecting
  - Hardware and I/O visualization
- Remote I/O operation
  - RIO tool configuration
  - Exchanges configuration
  - Loading
  - P80i application
  - Diagnosis

### 6. HMI SUPERVISION
- General presentation (including views, alarms signification, etc)
- Configuration and restoration
- Data exchange and reading data
- Maintenance

### 7. POD MOTOR FOCUS
- Auxiliary Slip Ring (ASR), Power Slip Ring (PSR), Auxiliaries
### 1.5 SD7000 LCI DRIVE / SYCONUM TECHNOLOGY / SYNCHRONOUS INBOARD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
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<tbody>
<tr>
<td>Duration:</td>
<td>3 days / session</td>
</tr>
<tr>
<td>Objectives</td>
<td>Understand architecture of your Electrical Propulsion System, understand technology used aboard, understand configuration changing and system setting-up</td>
</tr>
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</table>

#### Course details

<table>
<thead>
<tr>
<th>1. THEORETICAL REFRESHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Synchronous machine refresher</td>
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<tr>
<td>• Thyristor and GRAETZ' bridge refresher</td>
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<td>• Transformers refresher</td>
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<thead>
<tr>
<th>2. PRESENTATION OF SD7000 VSD OPERATING PRINCIPLE</th>
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<tbody>
<tr>
<td>• General presentation: Configuration, main components and options</td>
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<tr>
<td>• Converter structure</td>
</tr>
<tr>
<td>• Pulsed or synchronous running modes</td>
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<tr>
<td>• Torque control</td>
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<tr>
<th>3. PRESENTATION OF SD7000 PEC CONTROL</th>
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<tbody>
<tr>
<td>• Architecture organisation</td>
</tr>
<tr>
<td>- Hardware – Configuration (BEM340, BEM330, BEM742)</td>
</tr>
<tr>
<td>- Software – System (PNC Syconum, PLC Alspa, etc)</td>
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<tr>
<td>- Software – Application</td>
</tr>
<tr>
<td>▪ Application structure (Version, module replacement</td>
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<tr>
<td>▪ Main sequences and torque regulation</td>
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<tr>
<td>▪ Test modes</td>
</tr>
<tr>
<td>▪ Faults and alarms</td>
</tr>
<tr>
<td>▪ Fast data recorder (Pertubography)</td>
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</table>

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<thead>
<tr>
<th>4. FIPNETWORK ARCHITECTURE PRESENTATION</th>
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<tbody>
<tr>
<td>• Description of the network architecture (Wheelhouse, ECR, conv &amp; mot rooms)</td>
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<td>• Hardware description in the architecture (Switches, Ethernet ports, etc)</td>
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<tr>
<th>5. REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION</th>
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<tbody>
<tr>
<td>• Remote I/O presentation</td>
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<tr>
<td>▪ Characteristics</td>
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<tr>
<td>▪ Topology</td>
</tr>
<tr>
<td>▪ Connecting</td>
</tr>
<tr>
<td>▪ Hardware and I/O visualization</td>
</tr>
<tr>
<td>• Remote I/O operation</td>
</tr>
<tr>
<td>▪ RIO tool configuration</td>
</tr>
<tr>
<td>▪ Exchanges configuration</td>
</tr>
<tr>
<td>▪ Loading</td>
</tr>
<tr>
<td>▪ P80i application</td>
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<tr>
<td>▪ Diagnosis</td>
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<th>6. HMI SUPERVISION</th>
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<td>• General presentation (including views, alarms signification, etc)</td>
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<td>• Data exchange and reading data</td>
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<tr>
<td>• Maintenance</td>
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</tbody>
</table>
1.6 SD7000 LCI DRIVE / SYCONUM TECHNOLOGY / SYNCHRONOUS POD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
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<tbody>
<tr>
<td>Duration:</td>
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Objectives

- Understand the architecture of your Electrical Propulsion System,
- Understand the technology used aboard,
- Understand the configuration change and system setting-up
- Understand POD sub-equipment and operating system

### Course Details

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<th>2. PRESENTATION OF SD7000 VSD OPERATING PRINCIPLE</th>
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<tbody>
<tr>
<td>- General presentation: Configuration, main components and options</td>
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<td>- Pulsed or synchronous running modes</td>
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<tr>
<td>- Torque control</td>
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<tr>
<th>3. PRESENTATION OF SD7000 PEC CONTROL</th>
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<tr>
<td>- Architecture organisation</td>
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<tr>
<td>- Application structure (Version, module replacement)</td>
</tr>
<tr>
<td>- Main sequences and torque regulation</td>
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<td>- Test modes</td>
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<tr>
<td>- Faults and alarms</td>
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<tr>
<td>- Fast data recorder (Pertubography)</td>
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<tr>
<th>4. FIPNETWORK ARCHITECTURE PRESENTATION</th>
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<tr>
<th>5. REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION</th>
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<tbody>
<tr>
<td>- Remote I/O presentation</td>
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<td>- Characteristics</td>
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<tr>
<td>- Topology</td>
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<tr>
<td>- Connecting</td>
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<tr>
<td>- Hardware and I/O visualization</td>
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<tr>
<td>- Remote I/O operation</td>
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<td>- RIO tool configuration</td>
</tr>
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</tr>
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<td>- Loading</td>
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<td>- P80i application</td>
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<td>- Diagnosis</td>
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<table>
<thead>
<tr>
<th>6. HMI SUPERVISION</th>
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<tbody>
<tr>
<td>- General presentation (including views, alarms signification, etc)</td>
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<td>- Configuration and restoration</td>
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<table>
<thead>
<tr>
<th>7. POD MOTOR FOCUS</th>
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<tbody>
<tr>
<td>- Auxiliary Slip Ring (ASR), Power Slip Ring (PSR)</td>
</tr>
<tr>
<td>- Auxiliaries</td>
</tr>
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Customer : MERCHANT MARINE - CENTER OF EXCELLENCE (COE)

Project: TRAINING CATALOGUE
Document: ELECTRICAL PROPULSION SYSTEM (EPS)
File: Tender No / Marine Services - 2017 Training catalogue - Electrical Propulsion System - Rev C.docx

Ref : 793869
Revision : C
Date : 2017-03-20
Page : 11/24
## ONYX PWM DRIVE / OPSYS TECHNOLOGY / SYNCHRONOUS POD MOTOR

<table>
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<th>Training code</th>
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### Objectives
- Understand the architecture of your Electrical Propulsion System,
- Understand the technology used aboard,
- Understand the configuration changes and system setting-up
- Understand POD sub-equipment and operating system

### Course details

1. **THEORETICAL REFRESHERS**
   - Synchronous machine refresher
   - Thyristor and GRAETZ bridge refresher
   - Transformers refresher

2. **PRESENTATION OF SD7000 VSD OPERATING PRINCIPLE**
   - General presentation: Configuration, main components and options
   - Converter structure
   - Pulsed or synchronous running modes
   - Torque control

3. **PRESENTATION OF SD7000 PEC CONTROL**
   - Architecture organisation
     - Hardware – Configuration
     - Software – System
     - Software – Application
       - Application structure (Version, module replacement
       - Main sequences and torque regulation
       - Test modes
       - Faults and alarms
       - Fast data recorder (Pertubography)

4. **NETWORK ARCHITECTURE PRESENTATION**
   - Description of the network architecture (Wheelhouse, ECR, conv & mot rooms)
   - Hardware description in the architecture (Switches, Ethernet ports, etc)
   - Software description including (Addressing, Physical and IP addresses, etc)

5. **REMOTE INPUTS/OUTPUTS NETWORK ON AUTOMATION**
   - Remote I/O presentation
     - Characteristics
     - Topology
     - Connecting
     - Hardware and I/O visualization
   - Remote I/O operation
     - RIO tool configuration
     - Exchanges configuration
     - Loading
     - P80I application
     - Diagnosis

6. **HMI SUPERVISION**
   - General presentation (including views, alarms signification, etc)
   - Configuration and restoration
   - Data exchange and reading data
   - Maintenance

7. **POD MOTOR FOCUS**
   - Auxiliary Slip Ring (ASR), Power Slip Ring (PSR)
   - Auxiliaries

---

**Customer** : MERCHANT MARINE - CENTER OF EXCELLENCE (COE)  
**Project** : TRAINING CATALOGUE  
**Document** : ELECTRICAL PROPULSION SYSTEM (EPS)  
**File** : Tender No / Marine Services - 2017 Training catalogue - Electrical Propulsion System - Rev C .docx  
**Ref** : 793869  
**Revision** : C  
**Date** : 2017-03-20  
**Page** : 12/24
## 2. MARINE MAINTENANCE AND TROUBLESHOOTING TRAINING COURSES

### 2.1 SD7000 DRIVE / PEC(E) TECHNOLOGY / SYNCHRONOUS INBOARD & POD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
<th>M021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>3 days / session</td>
</tr>
<tr>
<td>Objectives</td>
<td>Understand how to maintain the equipment in an optimum way. Understand how to operate and potentially troubleshoot the equipment.</td>
</tr>
</tbody>
</table>

#### Course details

**1. MAINTENANCE ON STRATEGIC EQUIPMENT**
- Maintenance table review (Tasks description, sequence, etc) on:
  - Propulsion and distribution transformers maintenance
  - Control & monitoring cubicles maintenance
  - SD7000 converters cubicles maintenance
  - Remote I/O rack maintenance,
  - HMI and diagnostic PC maintenance
  - Spare parts maintenance and recommendation
- Safety rules and earthing procedures to carry out during a maintenance
  - Description of procedures (Lock-out, etc)
  - Specific tools needed.

**2. ISSUE IDENTIFICATION AND TROUBLESHOOTING**
- Equipment drawing and manuals
  - Familiarization and reading
  - Navigating through manuals and drawing
- Default matrix description
  - Categorization
  - Explanation of each default family,
  - Type of breakdowns, causes and remedies of the default.
- Events retrieving (alarms and trips) on a maintenance laptop
  - Pressure issue
  - Fluid issue,
  - Electrical issue,
  - Electro technical issue,
  - Mechanical issue
  - Communication issue

**3. MAINTENANCE AND TROUBLESHOOTING PRACTICE**
- Procedure to change I/O module
- Procedure to change switch RS20,
- Procedure to reload P80i software,
- Procedure to replace PIB(e),
- Electrical Propulsion Lock-out practice,
- Safety rules and earthing procedures.

**4. PROCEDURE TO DISMANTLE & REASSEMBLY THYRISTOR BLOCK**
- Work preparation / Explanation
- Start dismantling procedure by the trainees guide and by the trainer
- Reassembly by the trainees guided by the trainer
- Conclusion
### 2.2 MV7000 PWM DRIVE/PEC(E) TECHNOLOGY/ASYNCHRONOUS INBOARD&POD MOTOR

<table>
<thead>
<tr>
<th>Training code</th>
<th>M022</th>
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</thead>
<tbody>
<tr>
<td>Duration</td>
<td>3 days / session</td>
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</tbody>
</table>
| Objectives    | Understand how to maintain the equipment in an optimum way  
                  Understand how to operate and potentially troubleshoot the equipment |

<table>
<thead>
<tr>
<th>Course details</th>
</tr>
</thead>
</table>

#### 1. MAINTENANCE ON STRATEGIC EQUIPMENT
- Maintenance table review (Tasks description, sequence, etc) on:
  - Propulsion and distribution transformers maintenance
  - Control & monitoring cubicles maintenance
  - MW7000 converters cubicles maintenance
  - Remote I/O rack maintenance,
  - HMI and diagnostic PC maintenance
  - Spare parts maintenance and recommendation
- Safety rules and earthing procedures to carry out during a maintenance
  - Description of procedures (Lock-out, etc)
  - Specific tools needed.

#### 2. ISSUE IDENTIFICATION AND TROUBLESHOOTING
- Equipment drawing and manuals
  - Familiarization and reading
  - Navigating through manuals and drawing
- Default matrix description
  - Categorization
  - Explanation of each default family,
  - Type of breakdowns, causes and remedies of the default.
- Events retrieving (alarms and trips) on a maintenance laptop
  - Pressure issue,
  - Fluid issue,
  - Electrical issue,
  - Electro technical issue,
  - Mechanical issue
  - Communication issue

#### 3. MAINTENANCE AND TROUBLESHOOTING PRACTICE
- Procedure to change I/O module
- Procedure to change switch RS20,
- Procedure to reload P80i software,
- Procedure to replace PIB(le),
- Electrical Propulsion Lock-out practice,
- Safety rules and earthing procedures.

#### 4. PROCEDURE TO DISMANTLE & REASSEMBLY IGBT STACK
- Work preparation / Explanation
- Start dismantling procedure by the trainees guide and by the trainer
- IGBT stack reassembly by the trainees guided by the trainer
- Conclusion
## Course details

### 2.3 SD7000 LCI DRIVE/SYCONUM TECHNOLOGY/SYNCHRONOUS POD&INBOARD MOTOR

<table>
<thead>
<tr>
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<td>Objectives</td>
<td>Understand how to maintain the equipment in an optimum way</td>
</tr>
<tr>
<td></td>
<td>Understand how to operate and potentially troubleshoot the equipment</td>
</tr>
</tbody>
</table>

### 1. MAINTENANCE ON STRATEGIC EQUIPMENT

- Maintenance table review (Tasks description, sequence, etc) on:
-  Propulsion and distribution transformers maintenance
-  Control & monitoring cubicles maintenance
-  SD7000 converters cubicles maintenance
-  Remote I/O rack maintenance,
-  HMI and diagnostic PC maintenance
-  Spare parts maintenance and recommendation
- Safety rules and earthing procedures to carry out during a maintenance
  - Description of procedures (Lock-out, etc)
  - Specific tools needed.

### 2. ISSUE IDENTIFICATION AND TROUBLESHOOTING

- Equipment drawing and manuals
  - Familiarization and reading
  - Navigating through manuals and drawing
- Default matrix description
  - Categorization
  - Explanation of each default family,
  - Type of breakdowns, causes and remedies of the default.
- Events retrieving (alarms and trips) on a maintenance laptop
  - Pressure issue,
  - Fluid issue,
  - Electrical issue,
  - Electro technical issue,
  - Mechanical issue
  - Communication issue

### 3. MAINTENANCE AND TROUBLESHOOTING PRACTICE

- Procedure to change I/O module
- Procedure to change switch RS20,
- Procedure to reload control software,
- Procedure to replace Syconum cards,
- Electrical Propulsion Lock-out practice,
- Safety rules and earthing procedures.

### 4. PROCEDURE TO DISMANTLE & REASSEMBLY THYRISTOR BLOCK

- Work preparation / Explanation
- Start dismantling procedure by the trainees guide and by the trainer
- Reassembly by the trainees guided by the trainer
- Conclusion
## ONYX PWM DRIVE/OPSY SYS TECHNOLOGY/SYNCHRONOUS POD MOTOR

<table>
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<tr>
<th>Training code</th>
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<tr>
<td><strong>Duration:</strong></td>
<td>3 days / session</td>
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</tbody>
</table>
| **Objectives** | Understand how to maintain the equipment in an optimum way  
| | Understand how to operate and potentially troubleshoot the equipment |

### 1. MAINTENANCE ON STRATEGIC EQUIPMENT
- Maintenance table review (Tasks description, sequence, etc) on:
  - Propulsion and distribution transformers maintenance
  - Control & monitoring cubicles maintenance
  - ONYX converters cubicles maintenance
  - Remote I/O rack maintenance,
  - HMI and diagnostic PC maintenance
  - Spare parts maintenance and recommendation
- Safety rules and earthing procedures to carry out during a maintenance
  - Description of procedures (Lock-out, etc)
  - Specific tools needed.

### 2. ISSUE IDENTIFICATION AND TROUBLESHOOTING
- Equipment drawing and manuals
  - Familiarization and reading
  - Navigating through manuals and drawing
- Default matrix description
  - Categorization
  - Explanation of each default family,
  - Type of breakdowns, causes and remedies of the default.
- Events retrieving (alarms and trips) on a maintenance laptop
  - Pressure issue,
  - Fluid issue,
  - Electrical issue,
  - Electro technical issue,
  - Mechanical issue
  - Communication issue

### 3. MAINTENANCE AND TROUBLESHOOTING PRACTICE
- Procedure to change I/O module
- Procedure to change switch RS20,
- Procedure to reload control software,
- Procedure to replace Opsy cards,
- Electrical Propulsion Lock-out practice,
- Safety rules and earthing procedures.

### 4. PROCEDURE TO DISMANTLE & REASSEMBLY IGBT STACK
- Work preparation / Explanation
- Start dismantling procedure by the trainees guide and by the trainer
- IGBT stack reassembly by the trainees guided by the trainer
- Conclusion
3. MARINE ON-REQUEST TRAINING

3.1 ADVANCED TRAINING COURSES ON REALTIME SIMULATOR (RTLAB)

<table>
<thead>
<tr>
<th>Training code</th>
<th>M031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Objective is to simulate the actual power system on-board thanks to the real time simulator in Belfort and to carry out high level of simulation and troubleshooting</td>
</tr>
<tr>
<td>Customer benefits</td>
<td>Extensive hands on training of simulation and troubleshooting on control and power sides. Possibly adapting the same architecture as architecture existing onboard</td>
</tr>
</tbody>
</table>

**Details**

![Diagram showing the setup of the simulator](image)

Customer: MERCHANT MARINE - CENTER OF EXCELLENCE (COE)
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### 3.2 COMPLETE TRAINING COURSES ON ELECTRICAL PROPULSION TRAIN

<table>
<thead>
<tr>
<th>Training code</th>
<th>M032</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>Objective is to organize and carry out a training course on the complete electrical propulsion system train including all equipment supplied by GE PC thanks to GE PC Centers of Excellence (Drives, motors, generators, DP, switchboards, motors, etc).</td>
</tr>
<tr>
<td><strong>Customer benefits</strong></td>
<td>Take advantage of product knowledge from the designers of the equipment Complete view of the electrical propulsion system from GE PC Can be carried out in GE facilities or onboard</td>
</tr>
<tr>
<td><strong>Details</strong></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Details**

- **Electricity into motion**
  - Power generation
  - Electrical machines
  - Variable speed drives
  - Automation and control
  - Mechanical equipment

- **Electricity into electricity**
  - Power generation
  - Electrical machines
  - Variable speed drives
  - Automation and control
  - Mechanical equipment

- **Motion into electricity**
  - Power generation
  - Electrical machines
  - Variable speed drives
  - Automation and control
  - Mechanical equipment

---

**Customer**

: MERCHANT MARINE - CENTER OF EXCELLENCE (COE)

**Project**

: TRAINING CATALOGUE

**Document**

: ELECTRICAL PROPULSION SYSTEM (EPS)

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### 3.3 ELECTRICAL PROPULSION PRODUCTS

<table>
<thead>
<tr>
<th>Details</th>
<th>Power electronics: Fundamentals - Motors and Drive Systems in Theory &amp; Practice</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>101 – Fundamentals of variable-speed drives</td>
</tr>
<tr>
<td></td>
<td>102 – AC drive systems</td>
</tr>
<tr>
<td></td>
<td>103 – Power electronics</td>
</tr>
<tr>
<td></td>
<td>104 – Oscillation in drive systems</td>
</tr>
<tr>
<td></td>
<td>Power Electronics: Drive-Systems – Medium Voltage Drives</td>
</tr>
<tr>
<td></td>
<td>291 – MV7000 (Medium Voltage Converter)</td>
</tr>
<tr>
<td></td>
<td>292 – MV7000 (Medium Voltage Converter) with basics of HPCi/Control hardware</td>
</tr>
<tr>
<td></td>
<td>with VMIC + ICP</td>
</tr>
<tr>
<td></td>
<td>293 – MV7000 (Medium Voltage Converter) with basics of HPCi/Control with PEce</td>
</tr>
<tr>
<td></td>
<td>+ PIBe</td>
</tr>
<tr>
<td></td>
<td>Control &amp; Automation</td>
</tr>
<tr>
<td></td>
<td>560 Digital control and regulation system HPCi with P80i</td>
</tr>
<tr>
<td></td>
<td>564 Digital control and regulation system with P80i: maintenance</td>
</tr>
<tr>
<td></td>
<td>LV drives</td>
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<tr>
<td></td>
<td>261 LV7000 standard software – “All in one”</td>
</tr>
<tr>
<td></td>
<td>Rotating machines</td>
</tr>
<tr>
<td></td>
<td>710 Fundamental of Electrical Motors</td>
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<tr>
<td></td>
<td>511 Alignment</td>
</tr>
<tr>
<td></td>
<td>712 Installation &amp; Commissioning</td>
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<tr>
<td></td>
<td>720 Synchronous Motors</td>
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<td>721 Exciters and Excitation Panels</td>
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<td></td>
<td>730 Environment and Pressurization System</td>
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<td></td>
<td>740 Life Cycle Management</td>
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<tr>
<td></td>
<td>741 Troubleshooting</td>
</tr>
<tr>
<td></td>
<td>742 Vibrations</td>
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</tbody>
</table>

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3.5 MOBILE TRAINING CENTER (MTC)

<table>
<thead>
<tr>
<th>Training code</th>
<th>M034</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Objective is to supply a mobile training simulator to the customer including HMI supervision, control hardware, I/O station, switches, breakers, power supply, etc.</td>
</tr>
<tr>
<td>Customer benefits</td>
<td>Customer may carry out some hands on training onboard the vessel without any risk. Customer can dispense some training to the crew. Reduction of working man days and logistics for the trainees. Independent and dedicated system training. Can be easily dispatched on different vessels according to customer training needs.</td>
</tr>
</tbody>
</table>

Details
### 3.6 TRAINING SIMULATOR PLATFORM

<table>
<thead>
<tr>
<th><strong>Training code</strong></th>
<th>M035</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>Objective is to provide a standard container (size to be agreed depending on the equipment) fitted with a whole set of hardware (power and controls) relevant to a half motor propulsion system (except propulsion transformers and motor) including relevant auxiliaries that will allow the operators to carry out simulations and training sessions on the propulsion</td>
</tr>
<tr>
<td><strong>Customer benefits</strong></td>
<td>This simulator will feature a high level of autonomy and flexibility. This simulator allows having high level of simulation and troubleshooting. This hardware will be identical to the hardware actually installed on board</td>
</tr>
<tr>
<td><strong>Details</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Example on real case:**

The simulator will feature three main areas:

Converter area (power cabinet) including:
- Complete thyristors bridge unit (one half motor)
- Complete interfaces/measurement unit
- Simulation load / motor

Controls area (control cabinet) including:
- Excitation bridge
- Controller
- Pod remote control station

Consoles area (maneuvering simulation) including:
- Remote control (3 outstations)
- Navigation interfaces
- HMI

The following facilities will be provided to facilitate the simulation sessions:
- MCC / Mimic panel
- Cabinet including tools / measurement / testing equipment
- Office fitted with chair, armchair and PC (including keyboard and flatscreen)
- Bookshelves to accommodate project documentation
- Whiteboard

The container will also be fitted with following facilities:
- Lighting
- Air-conditioning
- Electrical distribution cables, inlets and outlets
- Two doors
- Fire extinguishers

![Diagram of the training simulator platform](image-url)
### 3.7 3D TRAINING COURSES

<table>
<thead>
<tr>
<th>Training code</th>
<th>M036</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>The aim of this tool is to passing through in virtual reality, the main equipment of the electrical propulsion system of your Vessel to discover the detail of their designation and functioning.</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>This real time 3D application will be use on a platform, accessible by username and password through all web browsers (Explorer, chrome and Firefox). Licenses with permanent validity will allow the user to learn and self-evaluated his knowledge.</td>
</tr>
<tr>
<td><strong>Scope of supply</strong></td>
<td>Generators / Motors / Drives / Remote Control / Pods</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>The users will have the overview of the Vessel, the real environment customized to be in immersive feeling to perform their training. The users will discover how the generators, drives and motors where composed with the electrical and mechanical characteristics. Then they will learn the maintenance operations animated in 3D real time to change and replace the parts of the generators, drives and motors in case of trouble. Finally, one example of the diagnostic procedure for one alarm to be follow in case of trouble on the propulsion system [for example Interface voltage measure card fault (Alarm n° xxx)].</td>
</tr>
</tbody>
</table>

### Illustration

![Diagram of a Vessel's electrical propulsion system](image_url)
4. TRAINING CODE RECAP CHART

4.1 MARINE THERORETICAL AND PRACTICAL TRAINING COURSES

<table>
<thead>
<tr>
<th>Training type</th>
<th>Training code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD7000 LCI DRIVE / PEC(E) CONTROL / SYNCHRONOUS INBOARD MOTOR</td>
<td>M011</td>
</tr>
<tr>
<td>SD7000 LCI DRIVE / PEC(E) CONTROL / SYNCHRONOUS POD MOTOR</td>
<td>M012</td>
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<tr>
<td>MV7000 PWM DRIVE / PEC(E) CONTROL / ASYNCHRONOUS INBOARD MOTOR</td>
<td>M013</td>
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<tr>
<td>MV7000 PWM DRIVE / PEC(E) CONTROL / ASYNCHRONOUS POD MOTOR</td>
<td>M014</td>
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<tr>
<td>SD7000 LCI DRIVE / SYCONUM / SYNCHRONOUS INBOARD MOTOR</td>
<td>M015</td>
</tr>
<tr>
<td>SD7000 LCI DRIVE / SYCONUM / SYNCHRONOUS POD MOTOR</td>
<td>M016</td>
</tr>
<tr>
<td>ONYX PWM DRIVE / OPSYS TECHNOLOGY / SYNCHRONOUS POD MOTOR</td>
<td>M017</td>
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4.2 MARINE MAINTENANCE AND TROUBLESHOOTING TRAINING COURSES

<table>
<thead>
<tr>
<th>Training type</th>
<th>Training code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD7000 LCI DRIVE / PEC(E) CONTROL / SYNCHRONOUS INBOARD&amp;POD MOTOR</td>
<td>M021</td>
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<tr>
<td>MV7000 PWM DRIVE / PEC(E) CONTROL / ASYNCHRONOUS INBOARD&amp;POD MOTOR</td>
<td>M022</td>
</tr>
<tr>
<td>SD7000 LCI DRIVE / SYCONUM / SYNCHRONOUS INBOARD&amp;POD MOTOR</td>
<td>M023</td>
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<tr>
<td>ONYX PWM DRIVE / OPSYS TECHNOLOGY / SYNCHRONOUS POD MOTOR</td>
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4.3 MARINE ON-REQUEST TRAINING

<table>
<thead>
<tr>
<th>Training type</th>
<th>Training code</th>
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<tbody>
<tr>
<td>ADVANCED TRAINING COURSES ON REAL TIME SIMULATOR (RTLAB)</td>
<td>M031</td>
</tr>
<tr>
<td>COMPLETE TRAINING COURSES ON ELECTRICAL PROPULSION TRAIN</td>
<td>M032</td>
</tr>
<tr>
<td>ELECTRICAL PROPULSION PRODUCTS</td>
<td>M033</td>
</tr>
<tr>
<td>MOBILE TRAINING CENTER (MTC)</td>
<td>M034</td>
</tr>
<tr>
<td>TRAINING SIMULATOR PLATFORM</td>
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</tr>
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<td>3D TRAINING COURSES</td>
<td>M036</td>
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<td>Version</td>
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