
INSTRUCTION

Code of Practice

Marine & Ports



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Revision History

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Introduction

This Code of Practice (CoP) is public operational process document for ABB Marine & Ports personnel and contractors giving practical advice on how to achieve ABB's health and safety standards. The main focus is on site operations, but the set requirements are also applicable to other activities as a baseline. This material is used for training and its requirements must be implemented.

Sales and project managers reference this CoP when tendering for work and when making contracts.

This document represents ABB's minimum standards in connection to ABB Marine & Ports business scope. It is based on ABB Group HSE/SA management system called "The ABB Way", as well as on the code of practice "Safety and Health in Construction" by the International Labor Office (ILO) and on the best practice from the Marine and Cranes industry. When national legislation or customer requirements set a higher standard, then the higher standard is used. The underlying business scope (risk-based) ABB Way applicability assessment is documented in document called BL IAMP ABB Way Navigator (internal ABB document).

As this CoP is prepared against most common ABB Marine & Ports business scope risks, some local and/or project specific health and safety risks may not be covered by this CoP, in which case reference must be made directly to ABB Way standards and the ILO code of practice, IMO standard or local instructions.

Abbreviations

Abbreviation	Description
CPR	Cardiopulmonary Resuscitation
HSE/SA	Health, Safety and Environment / Sustainability Affairs
JESA	Job Environmental and Safety Analysis
JHA	Job Hazard Analysis
JOR	Job Observation Report
JRA	Job Risk Assessment
JSA	Job Safety Analysis
LOTO	Lock Out, Tag Out
NMI	Near Miss Incident
PICW	Person in Charge of Work
PPE	Personal Protective Equipment
PTW	Permit to Work
SOT	Sustainability Observation Tour

Focus groups of codes of practice

Table 1: Focus groups of codes of practice

No.	Code of Practice	Site personnel or service engineers (Marine)	Site personnel or service engineers (Ports)	Site visitors
1	Safety planning	✓	✓	✓
2	Training and competence	✓	✓	
3	Business Travel	✓	✓	✓
4	Working in foreign countries or locations	✓	✓	✓
5	Driving and transportation safety	✓	✓	✓
6	Site conditions	✓	✓	✓**)
7	Safety signs and signals	✓	✓	✓**)
8	First aid and emergency medical treatment	✓	✓	
9	Emergencies on site	✓	✓	✓
10	Personal protective equipment	✓	✓	✓
11	Lone working	✓	✓	
12	Electrical safety	✓	✓	
13	Testing and commissioning equipment	✓	✓	
14	Safe use of ladders	✓	✓	
15	Working at height	✓*)	✓	
16	Airborne hazards	✓	✓	✓
17	Noise hazards	✓	✓	✓
18	Asbestos	✓		
19	Chemical safety	✓	✓	
20	Compressed gases in a ship	✓		
21	Hydraulic pressure	✓		
22	Entry into Azipod	✓*)		
23	Falling objects	✓*)		
24	Azipod hauling and lifting operations	✓*)		
25	Permanent magnets	✓		
26	Microwave radar safety		✓	
27	Sea trials	✓		
28	Pneumatic tools	✓		
29	Respiratory protective equipment	✓	✓	
30	Hygiene when travelling	✓	✓	✓
31	Rigging and slinging	✓*)		
32	Boarding and leaving ships	✓	✓	
33	Working hours on site	✓	✓	
34	Batteries of an Energy Storage System	✓	✓	

*) - Mainly when project scope includes Azipod units.

**) - Site manager or site host organizes a safety briefing that covers site-specific practices and risks.

ABB Way references table

Table 2: ABB Way references table

IAMP HSE/SA Operations Instruction (Code of Practice #)	ABB Way Main Reference
CoP #1	SA-S-002
CoP #2	SA-M-06
CoP #3	SA-S-006
CoP #4	SA-S-000 Emergency preparedness and response attachments
CoP #5	SA-S-110
CoP #6	SA-S-002
CoP #7	SA-S-109-02
CoP #8	SA-S-000-01, SA-S-000-01-01
CoP #9	SA-S-002, SA-S-000 Emergency preparedness and response attach.
CoP #10	SA-S-101, SA-S-102-02
CoP #11	SA-S-106
CoP #12	SA-S-107, SA-S-107-02, SA-S-107-02-01, SA-S-107-03, SA-S-109-03
CoP #13	SA-S-107-04, SA-S-107-05, SA-S-109
CoP #14	SA-S-102, SA-S-102-01, SA-S-109, SA-S-109-04
CoP #15	SA-S-001, SA-S-102, SA-S-102-03, SA-S-102-05, SA-S-109, SA-S-109-04
CoP #16	SA-S-301
CoP #17	SA-S-101-02, SA-S-104
CoP #18	SA-S-105-05
CoP #19	SA-S-305, SA-S-105-01
CoP #20	SA-S-105-02
CoP #21	
CoP #22	SA-S-001-01, SA-S-001-02, SA-S-001-03
CoP #23	
CoP #24	
CoP #25	
CoP #26	
CoP #27	
CoP #28	SA-S-109, SA-S-109-03, SA-S-109-04
CoP #29	SA-S-101-03
CoP #30	
CoP #31	SA-S-103, SA-S-103-02, SA-S-109-04
CoP #32	
CoP #33	
CoP #34	SA-S-107-07

CoP 1: Safety planning

Introduction

This Code of Practice (CoP) provides guidelines on safety planning for site operations. Most of this information can also be found in the Project HSE Plan, but this CoP is written from the site personnel's point of view. It covers new-build projects, large service projects, crane projects and service trips. The Project HSE Plan covers only new-build projects.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors when working on site.

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks, roles and responsibilities

Hazards and risks

Environment, health and safety (HSE) aspects for site works are identified and evaluated, and correct controls are put into place in accordance with the hierarchy of controls. This must be done by all ABB personnel and contractors. To be able to do this properly, persons in different roles need suitable HSE competence. For more information, see CoP 2.

The roles listed in Section Roles and responsibilities are important for securing proper HSE of site operations.

Roles and responsibilities

HBU or LBU Manager

The HBU or LBU Manager is the senior Responsible Manager for HSE/SA and they make sure that:

- Visible management leadership and involvement is provided.
- A formal HSE/SA management system in compliance with ABB's requirements is implemented, maintained and subject to effective monitoring.
- Resources are provided to minimize or eliminate identified risks.
- If there are several ABB entities (LPGs, LBUs or BUs) at the same customer site, the involved ABB entities agree on who is the "Lead Manager" at the site.
- Conduct SOTs.

HBU or LBU HSE/SA Manager

The HSE/SA Manager is accountable to the Responsible (LBL) Manager and shall:

- Make sure that safe working practices and programs are maintained throughout the organization.
- Monitor compliance with HSE/SA requirements and assist line managers in non-conformance issue handling.
- Develop and implement HSE/SA management strategy, plans and objectives.
- Conduct HSE/SA assessments and SOTs.

Sales Manager

The Sales Manager makes sure that:

- Pre-tender HSE checklist is used to identify any major health and safety risks in the sales phase.

- Customer's safety requirements are known.
- The customer is informed about ABB's safety standard.
- If a project is done at a new site, HSE/SA Manager or HSE/SA advisor is consulted before tendering to consider if special safety or security risks related to the geographical area or customer site require addressing.
- HSE costs are included in the full cost calculation.

Project Management Manager or Service Manager (Head of Project or Service organization)

The Project Management Manager or Service Manager makes sure that:

- Processes are in place to identify, eliminate or minimize all significant risks (e.g. risk assessment). Such process shall include preparation of project HSE plan.
- Processes are in place to select competent employees and subcontractors with respect to health and safety (e.g. Contractor qualification process and PCS2).
- Processes are in place to appoint Person in charge of work (PICW) for electrical works.
- Permit to work (PTW) processes are in place for high risk activities, mainly electrical works, but also for confined space work and hot works (if offerings include e.g. Azipod entry or welding). Need for Work at Height PTW to be assessed case by case.
- HSE training requirements for the role are maintained and the personnel are trained on HSE.
- Compliance with project reviews and SOTs is monitored.
- Incidents are reported.

Project Manager

The Project Manager is overall responsible for HSE in their project and they make sure that:

- The Project HSE plan, including risk assessment, is established and implemented at project start-up, and updated throughout the project. Ensure that Safety Binder is delivered to site and the content is up-to-date
- Site condition assessment (before site entry) has been conducted (consult HSE/SA advisor). Primary rule is that totally new project sites or project sites where ABB Marine and Ports has not had a project site personnel working during last 24 months must always be assessed.
- Person in charge of work (PICW) is appointed for electrical works.
- Establish project emergency contact plan & response plan.
- Ensure to provide adequate resources for site staff, e.g. PPE and testing equipment
- Permit to work (PTW) is applied for electrical works, but also for confined space work and hot works (if offerings include e.g. Azipod entry or welding). Need for Work at Height PTW to be assessed case by case.
- If project scope includes "turn key" type deliveries from suppliers/contractors e.g. battery delivery including commissioning, the contractor must deliver risk assessment prior any work commences on site. Such risk assessment shall be reviewed with consultation from HSE/SA. "turn key" in this context means work scope where the supervision of the work scope is executed by the contractor, not ABB.
- Make sure that site personnel (including contractors) are trained and have received the required safety courses.
- During commissioning kick-off meeting, roles and responsibilities at the site are assigned and recorded in the minutes of meeting (such as Site manager, Lead Engineers, PICW).
- Identify customer HSE rules, instructions and required trainings on site. Person providing site familiarization (HSE briefing) to persons arriving at the site is named.
- Primary Customer contact is named.
- Project HSE/SA performance is monitored and reported.
- SOTs are performed periodically.
- Timely response safety concerns from the project team, proactively communicate safety issues with project stake holders and promote the rectification.

At project sites without appointed ABB Site Manager, the Project Manager is also responsible for the tasks listed under Section Site Manager .

Project Lead Engineer and Design Engineers

- The project design engineers are responsible for identifying and eliminating/minimizing health and safety risks during the design stage
- Only approved chemicals are used in technical solutions

Purchasing Engineer

- Check, when ordering the contractor for the job, that the contractor is qualified

- HSE training and site briefing requirements are defined in the purchase order for the contractors
- ABB's Reach/ ROHS list is included in the equipment orders.

Site Manager

Site Manager, when applicable, is responsible for HSE on site related to ABB personnel and contractors and is accountable to PM. Site Manager makes sure that:

- Check that the site engineers have sufficient and valid trainings.
- Follow up that correct PPE is used.
- Check that there is suitable testing equipment on site
- Provide site HSE briefing on site for ABB personnel and contractors. Inform about the customer mandatory HSE training
- All significant risks and controls are communicated to all site personnel, including customer specific requirements (ref. safety briefing at the site).
- HSE routines, such as CoP and Project HSE plan, are implemented, and all personnel work accordingly.
- Person in charge of work (PICW) is appointed for electrical works and PICW process is followed.
- Permit to work system is applied when required (mainly el. works, inside Azipod works and hot works). As default, the site manager provide permits to ABB works e.g. working inside Azipod unit
- If project scope includes "turn key" type deliveries from suppliers/contractors e.g. battery delivery including commissioning, the contractor has risk assessment for the own scope of work.
- Site activities are coordinated with yard and contractors, e.g. schedule tasks in safe order, including toolbox or pre-start meetings, weekly review meetings.
- Effectiveness of risk assessments are evaluated, and control actions are taken.
- Safety records are maintained.
- Subcontractors are working in accordance with ABB safety standards.
- Perform safety tours on site to assess site conditions, hazards and risks. Take immediate actions if possible or/and report findings to the customer and copy to the project manager
- Incidents and near misses are reported to the project manager, the line manager of the site manager and HSE organization.

Commissioning Manager or Service Line Manager (manager who assigns site or service resources)

The Commissioning Manager or Service Line Manager makes sure that:

- Site or service personnel (employees and contractors) are trained, competent and formally authorized to work safely at site.
- Site or service resources are provided according to the needs.
- Site or service personnel are given access to the correct PPE, work tools and equipment.
- HSE Risk Assessment is established and implemented and is updated as relevant (e.g. for service jobs).
- Person in charge of work is appointed (PICW) when not handled by project manager (e.g. for service jobs).
- When contractors are engaged, the BU IAMP Contractor Management Process is followed strictly.
- If Contractor scope includes "turn key" type deliveries i.e. contractor does not just provide labor, but also supervise the work at site, the contractor must provide risk assessment for the own scope of work prior work commences on site.
- HSE routines (e.g. CoP) are implemented, and all personnel work accordingly.

Commissioning, Site or Service Engineer (including contractors)

The Commissioning or Site Engineer is responsible for:

- Working according to ABB safety standards (CoP) and other set requirements (e.g. customer requirements or project HSE plan).
- Checking regularly that PPE and tools are functional, in good order and applied suitably at all time.
- Ensuring competency certifications are followed, permits are obtained and valid.
- "Walking" the PTW before starting work.
- Reporting hazards and NMIs.
- Performing SJA, JOR and toolbox talks as required.

Person in Charge of Work (PICW)

The person who is responsible for overall supervision, safety of work, work crew and to be nominated in written.

The PICW is responsible for ensuring that safety procedures and guidelines are followed by the work team and must carry out all necessary steps to create a safe work environment.

The PICW working on site is responsible for (within the appointed scope of work):

- Overall supervision and safety of work and work crew.
- Completing the Job observation report prior to any work activities at the site.
- Ensuring correct LOTO procedures.
- Issuing and receiving work permits.
- "Walking the permit" with all affected workers in the work party.
- Briefing everyone in the work crew and any other affected working parties.
- Re-briefing the crew if any work conditions change.
- Making sure that the work area is clear of all plant, tools, equipment and personnel once the work is complete.
- Reviewing the risk assessment, JOR, SJA, PTW (if prepared by the customer), and project HSE plan. If a PTW is not prepared by the customer, the PICW shall prepare an ABB PTW (template: SA-S-107-01).
- Making sure that emergency preparedness measures are appropriate, in place and communicated.
- Making sure that provisions for first aid or CPR are appropriate and readily available.
- Making sure that the work crew uses correct PPE and tools for the job.
- Requesting customer's safety instructions, including safety briefing on site, to understand customer's safety requirements, and other applicable legal requirement.
- Identifying hazards on site proactively, resolving the hazard if possible, and reporting to the manager.

Operational controls

Safety must be part of preparation and execution of all site works including site surveys performed by sales personnel.

Safety must be on the agenda of project meetings, start-up meetings for the whole project (internal and with customer), commissioning meetings (internal and with customer). Safety must be part of the execution.

Suitable level of corrective action must be taken on reported near misses, unsafe conditions and behaviors based on risk assessment.

All site personnel are responsible for:

- Familiarizing themselves with ABB Project Safety Plan, including participation in customer safety orientation (if applicable).
- Following the prevailing instructions, safety rules and regulations, including the ABB Marine & Ports Code of Practice.
- Checking regularly that PPE and tools are functional and in good order. Reporting malfunctioning PPE and tools to the supervisor. For more information, see CoP 10.
- Reporting near miss incidents and accidents, unsafe conditions and unsafe behaviors to the site or project manager and line manager. Reporting cases to the hazard reporting system.
- Performing JOR, SJA / JSA / JRA, SOT and tool box meeting when required. For more information, see the sections below.
- Following ABB Stop Take Five philosophy.

Sustainability Observation Tours (SOT)

SOT must be performed periodically by Project Manager or Site Manager. SOT is required for all projects with an ABB Site Manager. For projects without an ABB Site Manager, the Project Manager performs SOT during site visits.

Job Observation Report (applicable for NO)

Before on-site work can start, the Commissioning or Service Engineer must make sure that the work site is ready. The Commissioning or Service Engineer must fill out a job observation report (JOR) before the work is started, and again if they have been away from the site for more than one week. This ensures that the required level of HSE is in place before the work is done.

A completed JOR is sent to ABB Project Manager or Site Manager for archiving in a project file. If there are any deviations or actions required, ABB Project Manager or Site Manager (or client site responsible) is notified immediately. If any hazardous conditions are found, the work must not be started before SJA is performed and/or necessary actions are carried out.

Job Safety Plan, Safe Job Analysis, Job Safe Analysis or Job Risk Analysis (abbreviated here SJA)

A safe job analysis (SJA) must be performed if an unfamiliar task is identified. That is, the task is not covered by existing controls (such as procedures or instructions) or existing controls are not adequate (a residual risk in Risk Assessment remains too high). In the SJA, all conditions and activities in the specific work area must be considered. The procedure that describes in detail how the safety of personnel, material and environment is secured, is done together with the involved personnel.

A completed SJA is signed by the persons who did it, sent to ABB Project Manager or Site Manager, and client site responsible (if applicable), and stored in the project files by ABB Project Manager. All relevant personnel must be informed.

Toolbox meeting on site, including JESA (Applicable for CN)

Toolbox meeting is for exchanging information and ideas on health, safety and environmental matters. The project Site Manager or Site Leader is responsible for conducting Toolbox meetings for all employees in their respective work areas including contractors.

The project Site Manager or nominee makes sure that a record of toolbox meetings is completed for each done safety talk. The record includes topics and names of attended employees. A copy of the toolbox talk and relevant open actions is forwarded to the Project Manager on completion for review and follow up.

Stop and Take Five philosophy

Before starting work, each ABB employee or contractor uses 'five minutes' to consider if risks related to the works are properly controlled. If not, necessary controls regarding an identified risk must be implemented. If controls for the risk are not known, a SJA must be performed.

Flow chart for safety risk management

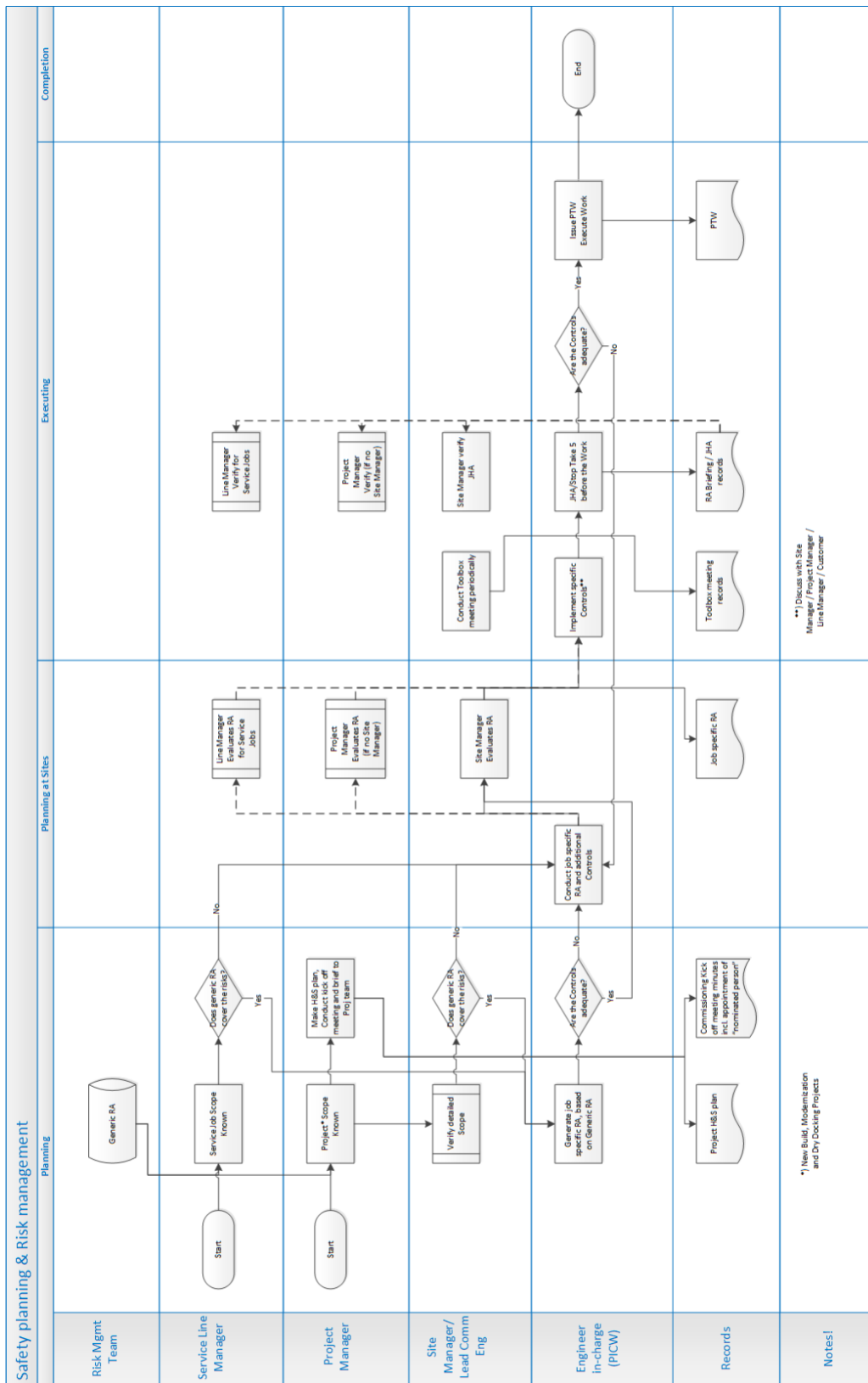


Figure 2.1: Safety Risk Management – Flow Chart

Training and competence

All ABB employees and contractors must fulfill the EHS requirements for their work activities. For more information, see CoP 2.

They must be familiar with the contents of this CoP.

Monitoring and checking

Active monitoring

The LBL Manager and applicable accountable managers in line are responsible for the following issues.

- Making sure that persons working on site are briefed on this Code of Practice.
- Making sure that individuals working on site follow the requirements of this Code of Practice.
- Making sure that this Code of Practice is part of HSE/SA audits and reviews conducted by the LBLs.

Reactive monitoring

All personnel involved in the project must report all accidents, near miss incidents, damages to the environment or material, and unsafe conditions and behaviors to the Site Manager and/or Project Manager. The gained experience is used to prevent similar situations from occurring again.

Documentation and records

The following records must be kept by the LBL (to the extent applicable):

- Project HSE Plan
- Safety Risk Assessment
- Records of personnel training
- Records of performed Safety Tours
- Records of performed SOTs
- Records of reported near miss incidents, accidents and unsafe conditions or behaviors
- Records of SJA, JSA, JRA or JHA
- Records of JOR
- Records of Toolbox Talk
- Records of PTW.

References

The following references are not all-inclusive. If a local reference is missing, please contact your HSE Advisor for further assistance.

- Project HSE Plan
- HSE Risk Assessment
- SOT template:
 - CN: SOT Report EN
 - FI: Safety check list 3AFV000352
 - NO: 3AJM000230-014
 - SG: SOT form Marine & Ports
- Reporting of Near Miss Incidents: GISA 01.05A22
- NO: SJA/JSA/JRA template: 3AJM000230-007
- NO: JOR template 3AJM000230-006
- CN: Project Site Toolbox Meeting

CoP 2: Training and competence

Introduction

Health and safety of ABB personnel when they work on site is determined to a large extent on their competence to undertake the work. This Code of Practice (CoP) describes the minimum training and competence requirements for ABB Marine & Ports personnel who work on site.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work at customer sites.

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Without suitable health and safety competence persons working on site cannot identify the hazards correctly. Therefore, they cannot evaluate the risk and put the correct control in place according to the hierarchy of controls.

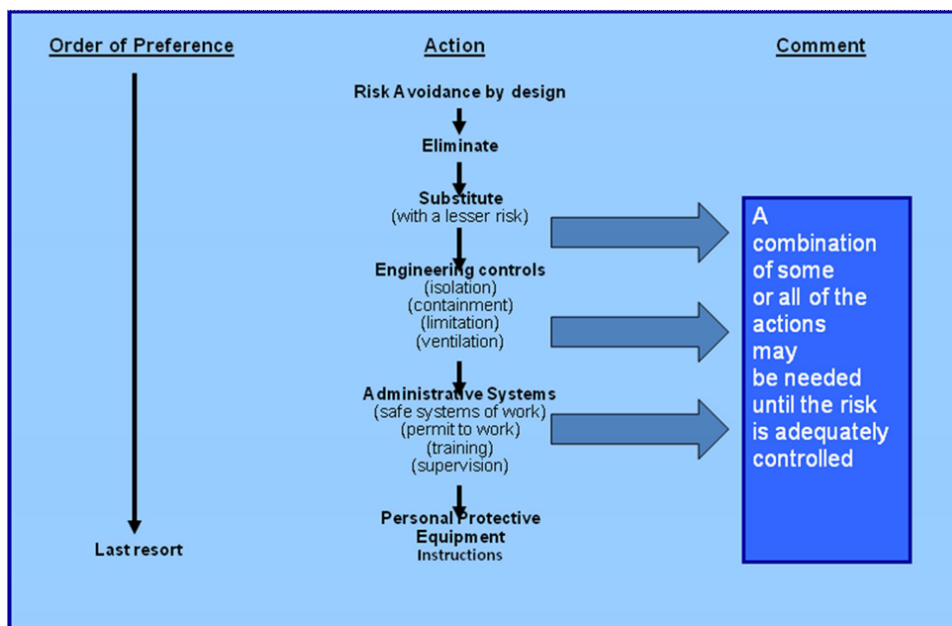


Figure 3.1: Hierarchy of Controls

Risk is the product of hazard severity and the probability of the occurrence of harm. The latter is determined by a number of factors. A fundamental factor that has a significant effect on the risk of injury from a particular task or activity is the degree of training and competence. If ABB personnel are not trained or competent, the risk of injury increases.

Operational controls

This code of practice defines the minimum occupational health and safety training or competence requirements for all site personnel. Additional training or competence is required in some specific work tasks and these shall be defined locally.

All personnel working at a customer site must be skilled in the work they do. They must also be instructed on the health and safety contents and requirements in the ABB Marine & Ports codes of practice.

All persons must receive suitable training or instruction or both on the personal protective equipment (PPE):

- Correct use of their PPE and what not to do.
- How to fit respiratory protective equipment (RPE) correctly.
- How to obtain replacements.
- Emergency arrangements where PPE may be needed.

All persons who are at the site must receive a suitable site induction briefing (accountable: Site Manager, Project Manager or Customer). The briefing makes sure that the persons are fully familiar with:

1. General site layout
2. Access points to the site
3. Safe walking routes
4. Location of welfare facilities including toilets, washing, canteen, drinking water facilities
5. Location/arrangements regarding medical help
6. Site first aid arrangements
7. Emergency evacuation arrangements and assembly points
8. Site HSE rules including PPE requirements
9. Emergency contact phone numbers (including customer's representative on site).

The following valid safety trainings are required for persons involved in mechanical work:

1. BL IAMP Code of Practice training
2. First aid (recommended for all, in minimum as defined in CoP 8)
3. Basics fire training, such as basic knowledge on fire risks and action to take on discovery of fire. Fire and fire extinguisher types. Use of fire extinguisher.
4. Basics of electrical works permit to work practice, seven steps approach and electrical safety distances. Special focus on lock out tag out importance also in connection to mechanical works.
5. Azipod Confined Space (if working inside the Azipod propulsor)
6. Inspection of scaffolding (recommended min. one person at the site, if work involves working on scaffoldings).
7. Hot works training (if conducting and/or managing hot works).

The following valid safety training courses are required for electrical work:

1. The courses listed above
2. Electrical safety training (electricians' level, this replaces the basic training, point 3 above)
3. If person acts as PICW, then PICW001 course or equivalent verified (in writing) by ABB Group Electrical Safety Authority (ESA).

Project and site managers must have role-specific valid health and safety training.

Training and competence

Every project team member must be familiar with these requirements before starting any work on site.

Monitoring and checking

The Responsible (LBL) manager is accountable for making sure that managers who select persons for the sites follow these requirements.

Managers who select persons for on-site works are responsible for making sure that all persons who work on site have the required trainings and competence.

Documentation and records

Managers who select persons for the site must have records that prove that the minimum occupational health and safety requirements for the selected persons are met.

Site managers must have records that proper site briefing has taken place.

CoP 3: Business travel

Introduction

International travel is an essential part of ABB Marine & Ports business. Following the travel requirements is very important. Planning travel well in advance saves time and money. It can also reduce any personal stress from organizing things in a hurry. This Code of Practice (CoP) summarizes the key requirements for travelling.

The ABB travel risk management process can be found in the intranet:

<https://go.insideplus.abb.com/tools-and-services/business-travel-portal/health-safety-security/security>

In addition, there are 5 documents in the ABB way:

<https://go.insideplus.abb.com/tools-and-services/business-travel-portal/health-safety-security/before-travel>

Scope

These requirements apply to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Hazards and risks vary and depend on travel arrangements and the destination country. Consider and evaluate the following topics.

- Destination country risks
- Travel and medical insurance
- Passport which is valid for at least six months
- Visa, entry and exit permits (when required)
- Work permits (when required)
- Driving license (when required)
- International certificate of vaccination or prophylaxis (yellow booklet) with the required vaccinations and prophylaxes
- Transportation and tickets
- Immigration and customs documentation
- Accommodation
- Local contacts including ABB host country organization
- Possible diseases you have, medication and medical treatment
- Unusual blood type, transportation in country of destination
- Invitation letter from the customer
- Working conditions, including working hours
- Job-specific planning and required controls, such as personal protective equipment (PPE).

As part of your travel preparations, research your destination for awareness of its security situation.

Operational controls

As a minimum, cover the following topics:

1. Check the travel risk.

The [guidance](#) on the business travel portal, which explains in detail how to check the travel risk. You can also go directly to the [travel risk procedure overview](#) to check for risk ratings and security approval requirements

and levels. Or check the [International SOS website](#). Login with the ABB membership number 22ACMA000037 to access the ABB membership area.



There are five categories of travel risk: insignificant, low, medium, high and extreme risk. For higher risk destinations (i.e. medium, high and extreme), special preparedness requirements and approval procedures are applicable. For details, please refer to the rest of the preparedness steps.

NOTE

- How to research your destination and [check the travel risk](#)
 - How to verify [applicable travel risk procedures](#), depending on the travel risk rating
 - [Video tutorial - how to access your travel security risk on the international SOS portal](#)
2. Read the International SOS travel advice and complete the e-Learning.
Link to the International SOS portal:
<https://www.internationalsos.com/MasterPortal/default.aspx?membnum=22ACMA000037>



In absolute minimum: Read the Important message, the security summary as well as the Before You Go section of the medical tab.

NOTE

Complete the medical and security travel risk awareness e-learning:

Intranet link:

<https://go.insideplusabb.com/tools-and-services/business-travel-portal/health-safety-security/international-sos/international-sos-training-hub>

Direct link: <https://traininghub.internationalsos.com/abb/>

3. Consult the Security Point of Contact (PoC).

This is mandatory for HIGH and EXTREME travel risk destinations.

There are 2 options:

- a. The ABB Security PoC
- b. iSOS

<https://abb.sharepoint.com/sites/GroupFunctionSustainabilityAffairs/corporatesecurity/CS-inside/SitePages/Travel%20Risk%20Procedures.aspx>



Even if a third party takes care of the local travel and security arrangements. You are responsible for initiating the contact.

NOTE

4. Book and register your travel.

Book the trip via a designated ABB travel agency or travel booking system. It records your itinerary in the TravelTracker tool and a pre-trip advisory email with a link to the TravelReady form is sent (depending on the risk rating).

In case travel is not booked via a designated ABB travel agency – this is especially important for contractors.

The two options are MyTrips: <https://mytrips.travelsecurity.com/Login.aspx?ci=R8wlfQHcyNw%3d>

Or forward itinerary to ABBTravel@itinerary.internationalsos.com

More info can be found here:

<https://go.insideplusabb.com/tools-and-services/business-travel-portal/health-safety-security/security/travel-registration>

5. Make appropriate travel and security arrangements.

Make your local travel and security arrangements with a trusted third party, such as an approved car rental company, ABB travel agency or travel booking system, or with the ABB host country organization.

6. Register your emergency details.

Make sure that your International SOS Emergency Record is up to date and has your passport copy, emergency contact details, email address, mobile phone numbers and so on.

Link to the Emergency record page:

<https://emergencyrecord.internationalsos.com/emergencyrecord/secure/main.cfm?lang=en&CustNo=LChQNipHXz5d1JXXT16WCik>

7. Complete the TravelReady form and submit it for approval.

If you travel to a destination with a higher risk rating and you book the trip via a designated ABB travel agency or travel booking system, you receive a pre-trip advisory (PTA) email with important travel advice and a link to the Travel ready form. PTA is sent from ABB-Travel-Security@internationalsos.com.

If you do not receive a PTA within 24 hours after the booking, contact travel-security@ch.abb.com. Include the booking reference number (PNR) in the email.

8. Make sure that you receive the travel risk approval from your line manager before traveling.

Make sure that you receive all necessary travel risk approvals prior to travel.

Travel without an approved TravelReady Form is not allowed.



Each TravelReady Form needs to be approved by your line manager. Whether additional security approval is required, can be seen

NOTE

<https://abb.sharepoint.com/sites/GroupFunctionSustainabilityAffairs/corporatesecurity/CS-inside/SitePages/Travel%20Risk%20Procedures.aspx>

9. Be prepared for an emergency.

Know how to get support in case of an emergency.

You can call an International SOS assistance center at any time (24/7).

- Americas: +1 215 942 8226
- Europe, CIS: +44 20 8762 8008
- Africa or the Middle East: +971 4 601 8777
- Asia, Australia or the Pacific Rim: +65 6338 7800

You can also call directly with the International SOS app. Download it at [International SOS webpage](https://www.internationalsos.com/assistance-app)

(<https://www.internationalsos.com/assistance-app>) and use the ABB membership number 22ACMA000037.

In case of an emergency, if possible, inform your line manager and your contact person of the receiving (ABB) organization.

Training and competence

ABB travel policy, ABB general advice for travelling and working internationally, and emergency procedures must be communicated to ABB Marine & Ports employees and contractors before travelling.

Monitoring and checking

Communication arrangements and travel plans must be available to the Responsible (LBL) manager or unit.

Documentation and records

Travel documents and plans, management approvals, hotel bookings and contact persons must be made available by the LBL responsible unit.

CoP 4: Working in foreign countries and locations

Introduction

As a global company, ABB works in almost 100 countries. The political, economic, environmental, medical and natural disaster conditions are different in each country and also in certain international waters where ABB could operate. These circumstances can represent increased risks to employees who work there. ABB has well-established travel security procedures to identify the high-threat countries. ABB also has systems to monitor the status of travelers and to receive updated advice (see CoP 3).

This Code of Practice helps ABB Marine & Ports personnel to manage such risks when they work mainly in projects in foreign countries or locations.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Hazards and risks depend on the destination country. Typical risks that can be encountered:

- Medical, such as diseases, quality of healthcare, and ethical rules
- Environmental, such as high or low temperatures
- Social unrest
- Kidnapping and extortion
- Theft
- Armed robbery
- Piracy
- Terrorism
- Transportation and traffic conditions
- Risk of war
- Natural disasters, such as hurricanes, tsunamis and earthquakes.

Click on the following link to be redirected to a map view where you can review the sub-country areas and respective risk ratings. This will allow you to identify the risk levels of different (sub-)country destinations and in particular the highest risk level. Please use the ABB membership number (22ACMA000037) as login as well as for the password.

[Travel Security Online](#)

When logged in, choose the 'maps' button on the left side menu. Make sure to get to the correct map layer by selecting the 'travel' view in the 'risk rating' dropdown menu at the top right of the map.

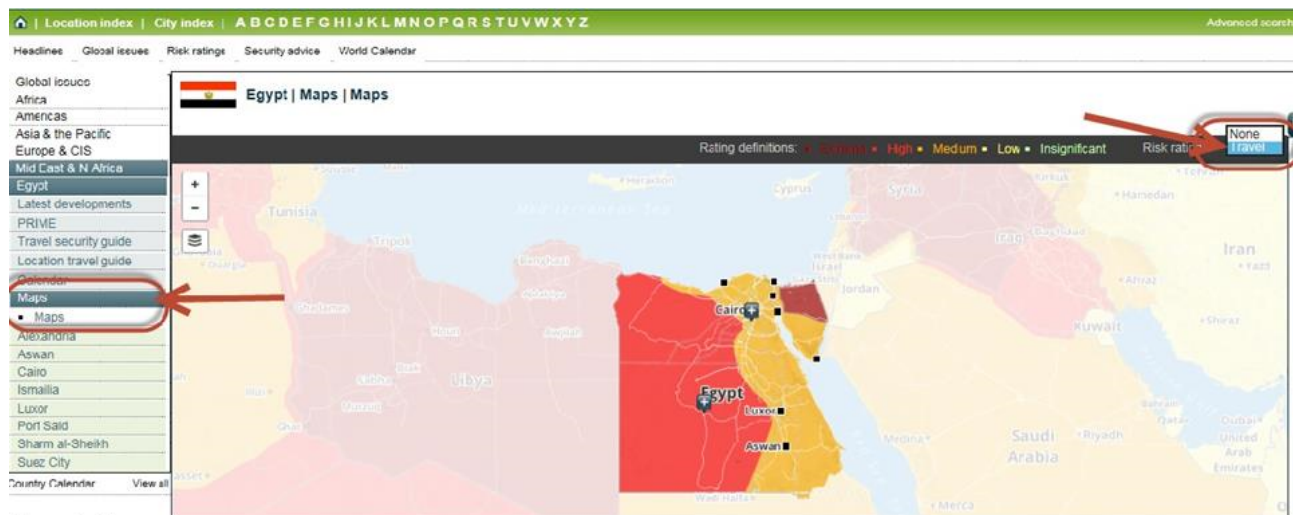


Figure 5.1: Travel Security Online - Maps

Check more details via the [International SOS website](#) International SOS website (risk description and background).

Operational controls

The following control measures must be applied as a minimum when preparing a project abroad:

- Making sure that the BL or LBL Manager, BL or LBL Marketing Sales Manager, Project Manager, Line Managers and employees are aware of business travel related processes and their responsibilities.
- Making sure that security is considered and budgeted for already in the tendering stage.
- Covering the destination country risks during safety planning in addition to HSE risks (see CoP 1). To do so, do at least the following steps:
 - Review the travel risk, road traffic and medical risk rating
 - Review the destination country security documentation
 - Consult the destination country security [point of contact](#) for country-specific risks. This is mandatory for High and Extreme risk locations.
 - Include the risks in the project risk assessment and apply the required controls, as in safety planning in general.
 - Ensure that a contingency plan is prepared and implemented as necessary, for example, an evacuation plan in case of natural disaster.
- Making sure that the site team members know the identified risks and needed controls before departure and checking that they are willing and ready to go.
- Making sure that the persons are fit for the identified conditions. For example, that their medical screening is done and vaccinations are given. Requirements depend on the overall risk assessment or outcome of safety planning.

Training and competence

ABB business travel policy (see CoP 3), ABB general advice for travelling and working internationally, destination country specific instructions, project controls or rules, and emergency procedures are communicated to ABB Marine & Ports employees or contractors or both before travelling.

Monitoring and checking

- Responsible (LBL) Manager or Project Manager must make sure that the project HSE plan covers country-specific risks.
- Responsible (LBL) Manager or Project Manager must make sure that defined controls are applied.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

ABB uses a travel tracking system that lets you identify who is in a particular affected area in case of a crisis or incident. It is therefore a record.

CoP 5: Driving and transportation safety

Introduction

Road travel is one of the major reasons for accidents and incidents.

This Code of Practice (CoP) provides practical guidance on best practices for driving and road safety. Its purpose is to promote travel safety and security, to ensure proper planning, to achieve efficiency and reasonable costs, and to harmonize travel-related practices.

Scope

These requirements apply to all vehicles that are used for business by ABB Marine & Ports employees and to vehicles used by contractors to transport their workers to and from the site.

In some countries it is not advisable to drive on your own. In such cases the vehicles must be leased, rented or hired with a driver, or if the vehicle is an ABB car, it should be driven by a local. Countries with high-risk road traffic are listed below as an example. See also Road Safety Standard, GI/SA-O.1.05A17.

If national legislation, ABB requirements or customer requirements differ, then the higher standard must be followed.

HIGH ROAD SAFETY RISK				
Afghanistan	Comoros	Honduras	Mozambique	South Africa
Algeria	Congo	India	Myanmar	Sri Lanka
Angola	Côte d'Ivoire	Indonesia	Namibia	Sudan
Armenia	Congo (DRC)	Iraq	Nepal	Swaziland
Azerbaijan	Djibouti	Kenya	Nicaragua	Tajikistan
Bangladesh	Ecuador	Kiribati	Niger	Tanzania (UR)
Benin	Egypt	Korea (DPR)	Nigeria	Togo
Bolivia	Equatorial Guinea	Kyrgyzstan	Pakistan	Uganda
Bosnia and Herzegovina	Eritrea	Lao (PDR)	Papua New Guinea	Ukraine
Botswana	Ethiopia	Lesotho	Peru	Uzbekistan
Burkina Faso	Gabon	Liberia	Philippines	Vietnam
Burundi	Gambia	Madagascar	Republic of Moldova	Yemen
Cambodia	Georgia	Malawi	Rwanda	Former Yugoslavian states
Cameroon	Ghana	Maldives	Sao Tome and Principe	Zambia
Cape Verde	Guatemala	Mali	Senegal	Zimbabwe
Central African Republic	Guinea	Mauritania	Seychelles	
Chad	Guinea-Bissau	Mauritius	Sierra Leone	
China	Guyana	Mongolia	Solomon Islands	
	Haiti	Morocco	Somalia	

Hazards and risks

Road incidents often cause more deaths and serious injuries to employees and contractors than incidents on site.

Unsafe vehicles, violations of regulations and speed limits, and fatigue are examples of hazards and risks.

Travel is an important part of work undertaken by ABB Marine & Ports, and within ABB Group, driving is identified as one of the high-risk tasks of our personnel.

Operational controls

Risk avoidance and risk reduction

- Minimize travel by use of videoconferencing, Sametime meetings and teleconferences instead of traveling whenever practical.
- Always assess your capability to drive at destination. Do not drive during your first visit to the destination country because you do not have personal understanding of the local road traffic conditions. If in any doubt, use alternatives, such as host pick-up, appropriate taxi or public transportation.
 - What is the destination country road safety risk level?
 - Does CoP allow driving in that country?
 - Am I familiar to drive in the destination country?
 - Are there circumstances, like a long-haul flight, influencing your capability to drive?
 - What kind of work activities you will conduct e.g. influence on fatigue?
- Plan early, if possible. Advance planning reduces risks and makes it also possible to find the lowest prices.
- Pre-book transportation via our travel agency partners or local ABB colleagues before travel.
- If you book a vehicle at the destination, ask local ABB colleagues for assistance. Consider the language barrier because the leasing companies often have only very few English-speaking persons and they can usually speak only some simple words.
- Use ABB preferred rental companies (agreement between ABB Group and the rental company) if you lease, rent or hire vehicles. This should ensure that a vehicle meets safety standards.
- Do not drive vehicles rented by colleagues, unless you are registered as a co-driver on rental agreement.
- Inspect the vehicle before acceptance. The vehicle should not be older than 3 years. Particularly check the following matters:
 - Existence of seat belts
 - Condition of tires: wearing surface, air pressure, and winter tires in snowy conditions
 - At least two airbags (driver and passenger)
 - Head rests in the front and back seats
 - ABS and power steering
 - First aid kit
 - Air conditioning in hot environment.
- When booking a vehicle with a driver, clearly emphasize the requirement of seat belts in the back seat and the need for safe driving practices. Do this each time to raise awareness.
- Avoid 'spot' or hire direct taxis in high road risk countries.

Risk control

- Whenever possible, travel in the back seat.
- Use seatbelts every time and travel only in vehicles specifically designed for passenger use.
- If the vehicle is also transporting goods, make sure that the load is secured properly.
- Comply with all national road laws, and speed limits on site. Remember: Violation can be serious criminal act, especially in case of incident
- Do not use hand-held mobile phones, or similar devices when driving.
- Do not under any circumstances drive under the influence of alcohol or drugs, or when suffering from fatigue.
- Report all motor vehicle incidents and near misses, so that others can learn as well
- Make sure that the manufacturer's passenger limit and load to be carried are not exceeded. Follow procedures for safe operation and maintenance of the vehicle.
- Report all motor vehicle incidents and near misses. Take photos if possible and include details of those involved.
- Do not use motorcycles for business travel.
- One common root cause of road incidents is fatigue. It is recommended to rest adequately on long journey, to take a short break of at least 15 minutes after about 2 hours of driving, and a longer break of about 60 minutes after 4 hours.
- Since so many factors affect fatigue, it is not possible to set firm limits in terms of mileage or time, except perhaps for very specific situations. Examples of recommended maximum distances set for some specific situations are 400 km (250 miles) for driving on generally good roads and 600 km (375 miles) for mainly driving on motorways. However, any such recommendations should be regarded as exceptional journeys, not the norm. Mileage limits should be regarded as indicative and not rigid, otherwise unreasonable situations could arise, such as an overnight stop a short distance from the destination or the use of cross-country or town-center routes instead of an easier but longer motorway journey.

Training and competence

- Make sure that you are suitably trained and licensed to operate the class of vehicle to be used.
- Employees who drive more than 30,000 km for business per year, or who are required to work in an area with a high-risk level status must attend a suitable advanced driving course.

Monitoring and checking

- Supervisor is responsible for ensuring that persons who are required to travel are aware of this Code of Practice.
- Individuals who are traveling are responsible for following the requirements of this Code of Practice.
- Driving and road safety practices must be part of HSE/SA audits and reviews conducted by the LBL.
- All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

CoP 6: Site conditions

Introduction

A lack of hazard awareness or working in unfamiliar environments can increase the risk of injury. The risk of injury can increase simply because persons who work on site do not know about its hazards and risks nor about the control measures and procedures in place to deal with the risks.

This Code of Practice (CoP) sets out some basic requirements to follow when planning any visit to a shipyard or port to ensure that all ABB staff and any contractors are aware of the location, the site-specific hazards and the general arrangements on site for controlling those risks.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors, or work sites which have a nominated ABB Site manager or responsible person (and partially to personnel working for small or short-term site works, such as service visits).

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Working in any unfamiliar environment increases health and safety risks because of the lack of knowledge about any site-specific hazards, rules, practices or procedures, or any applicable prohibitions.

Operational controls

Planning

- Before arriving at the site and before agreeing on any contract, make sure that you obtain information about the site details by asking the customer. Such details can include site layout, details of site-specific hazards, applicable site safety rules.
- Obtained information is incorporated into the HSE plan for the project or contract which is prepared during the tender or contract phase.

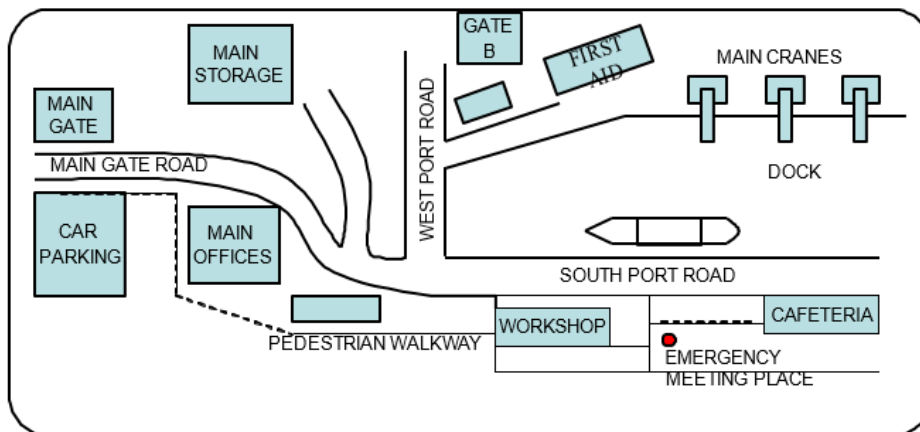


Figure 7.1: Illustration of site layout

The information that must be obtained includes:

- Site map and details of safe walking routes, prohibited areas, and location of the facilities, such as welfare, first aid and so on
- Details of the customer's on-site organization and contact person or a contact for the shipyard or port
- Details of the site HSE rules. They should include any or all of the following information:
 - Prohibitions, for example, alcohol and drugs
 - Requirements for personal protective equipment on site
 - Radio practices, for example, frequencies
 - Announcement practices
 - Lockout/Tagout practices
 - Requirements for work permits, for example, hot work and electrical isolation
 - Fire and emergency procedures with emergency telephone numbers for fire, police, ambulance and emergency contact for the shipyard or part facility
 - Waste treatment arrangements
 - Site security requirements
 - Vehicle parking requirements
 - Storage and laydown areas
 - Incident reporting requirements with near miss and hazard reporting requirements
 - Disciplinary matters on site.

On arrival at the site

- On arrival at the site, all ABB employees and contractors report to the security gate. They sign in and obtain their site ID if required.
- ABB Supervisor or Site Manager ensures that ABB employees and contractors are given a site briefing or induction about the HSE/SA rules and emergency arrangements on site.
- If the site briefing or induction is not provided, ABB Supervisor or Site Manager contacts the customer's representative on site to obtain this information.
- Site briefing or induction covers the following topics if possible:
 - Site layout details with safe walking routes
 - Important locations, such as parking, gates, lunchroom, emergency meeting places, offices, welfare facilities and first aid station
 - Emergency contact information including telephone numbers for ambulance, police, fire service and also the port, shipyard or vessel contacts
 - Vessel or port details, such as evacuation routes and fire extinguishers.
- For small or short-term works, such as service visits shorter than 2 - 3 days, the ABB employee doing the work requests the Customer for a site escort. The site escort is a person who is familiar with the site and who can brief the ABB employee about the site, its facilities and any HSE/SA requirements.

Internal ABB HSE requirements, such as emergency protocols and PPE are not covered in this CoP.

Before starting work

Before starting work, ABB Supervisor or Site Manager holds a briefing on:

- Scope of works, associated risks and their controls
- Principal hazards and risks on site and their controls
- Mandatory PPE
- Local emergency practices
- Customer ABB main contact
- Possible site specific HSE requirements e.g. a customer HSE induction, PPE, working hours practices, permit to work practices, daily meeting practices and coordination of electrical works
- Name and phone number of the responsible person for HSE on site or on board the vessel
- ABB responsible person(s) e.g. PICW, Site Manager, Project Manager, HSE/SA advisor
- Name of responsible person on board the vessel for connection or switching
- Details of any other contractors who may be working within the same work area as ABB and any risks that may affect ABB.
- Location of general welfare arrangements including:
 - Supply of drinking water
 - Lunchroom and messing facilities
 - Toilets and washing facilities
 - Changing facilities and storage of clothing
 - Storage of personal protective equipment
 - First aid and medical facilities.

Extreme weather conditions

Every task has some risk but when the task is carried out in severe weather conditions (cold, hot, windy), the level of risk can increase either directly or indirectly. Site workers who work in countries with extreme weather conditions may be exposed to hypothermia, frost bite, heat stroke, heat edema, heat syncope, heat rash, heat cramps, and heat exhaustion.

All ABB employees have a right to stop work that is considered unsafe. If this occurs, the employee must immediately report the situation to their ABB lead on site. The ABB lead considers the situation and if it is possible to conduct mitigating actions and continue the work.

If not, the ABB lead must tell the Client responsible at the site and discuss the situation.

The information below guides you on weather conditions and recommended actions during the conditions.

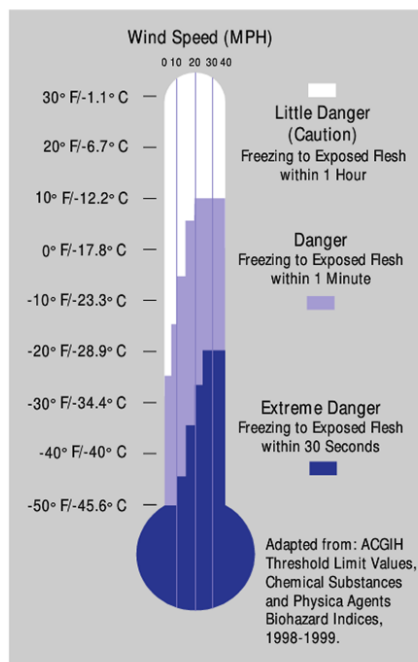
			RELATIVE HUMIDITY								
			10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %
TEMPERATURE °Celsius	40°C	104°F	37	40	43	49	> 54	> 54	> 54	> 54	> 54
	39°C	102°F	36	38	42	47	52	> 54	> 54	> 54	> 54
	38 °C	100°F	35	37	41	43	49	> 54	> 54	> 54	> 54
	37 °C	98°F	34	36	38	41	43	52	> 54	> 54	> 54
	36 °C	96°F	33	35	37	40	42	49	53	> 54	> 54
	34 °C	94°F	32	34	35	38	41	44	50	53	> 54
	33 °C	92°F	31	32	33	36	38	41	46	50	53
	32 °C	90°F	29	31	32	33	36	38	41	46	50
	31 °C	88°F	28	30	31	32	34	35	38	41	46
	30 °C	86°F	27	29	29	31	32	32	36	38	43
	29 °C	84°F	26	27	28	29	30	32	33	35	37
	28 °C	82°F	25	26	27	27	29	30	32	33	35
	27 °C	80°F	24	25	26	26	27	28	29	30	32
	26 °C	78°F	22	24	25	25	26	27	27	28	29
24 °C	76°F	21	22	24	24	25	25	25	26	26	
23 °C	74°F	20	21	23	23	24	24	24	24	25	
Directions: Locate the current temperature on the left column and then locate the relative humidity on the top row. Follow the temperature across and the humidity down until they meet, this measurement is heat index. The heat index will increase 10 °C in direct sunlight.											
Danger Category		Apparent Temperature	Heat Syndrome				Recommended				
Extreme Danger		> 54 °C	Heatstroke imminent				Stop work immediately				
Danger		41 - 54 °C	Heat cramps, or heat exhaustion likely. Heat-stroke possible with prolonged exposure and activity.				Make a documented assessment of whether it is safe to continue or not. Individual consideration must be taken.				
Extreme Caution		32 - 40 °C	Heat cramps, or heat exhaustion possible with prolonged exposure and activity.				Ensure that you have salty drinks throughout all day, and take frequently breaks.				
Caution		27 - 32 °C	Fatigue possible				Drink water. Evaluate the situation through the day. .				
Note: Degree of heat stress may vary with age and health											

THE COLD STRESS EQUATION

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result.

Hypothermia can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/ 37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.



Recommended actions on persons with hypothermia (land temperature)

- Call for emergency help.
- Move the person to a warm, dry area.
- Replace wet clothing with dry and warm clothing or wrap the person in blankets.
- Give warm sweet drinks, not drinks with caffeine.
- Have the person to move arms and legs.
If the person is unable to do this, place warm bottles or hot packs in the arm pits, groin, neck and head areas.

Recommended actions on persons with hypothermia (water temperature)

- Call for emergency help.
- Do not remove clothes.
- Get out of water as quickly as possible, do not swim.
- If getting out of the water is not possible, wait and conserve body heat by holding arms across the chest, keeping thighs together.
- Huddle together with another person if possible.

Recommended actions on persons with frost bite (land temperature)

- Move the person to a warm and dry area.
- Remove wet clothes.
- Do not rub the affected area.
- Place the affected area in warm water 40°C (104°F).
Monitor the water temperature to slowly warm the tissue.
- Do not pour warm water directly on the affected area.
- Wrap the affected area and keep it warm.
- Seek medical attention as soon as possible.

Recommended actions on persons with heat attack

- Call for emergency help.
- Move the person to a cool and shady area.
- Remove unnecessary clothes.
- Wet the skin with sponge or garden hose.
- Apply ice packs to armpit, groin, neck and back.
- Immerse the patient in a shower or tub of cool water.

Training and competence

This CoP must be communicated to every project team member before starting any work on site.

Monitoring and checking

ABB Supervisor or Site Manager is responsible for making sure that all project team members are familiarized with the site before starting any work. This must include contract personnel working on behalf of ABB.

Site conditions must be part of HSE audits and reviews conducted by the LBLs.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

Site conditions must be included as part of the Project HSE Plan during the project start-up phase and documented during the commissioning phase.

CoP 7: Safety signs and signals

Introduction

Safety signs and signals are not always understood by employees and others.

This Code of Practice informs ABB employees on international signage for communicating information clearly.

Scope

These requirements apply to all ABB Marine & Ports employees or contractors when working on site. If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

It is important for safety that all ABB personnel and contractors on site understand the safety signs easily. ABB employees who do not understand safety signs and signals can fail to recognize a known hazard or another danger, such as a prohibited area or an action, which in turn could lead to serious injuries or even death. The same applies to contractors or in some cases to the public, for example, visitors on site.

Operational controls

General

All persons on site can identify the following four basic categories of safety signs:

1. Safe condition signs
These typically indicate the means of escape (for example, in case of fire), first aid station or safety shower. They are rectangular or square in shape and the pictogram is on a green background.
2. Prohibition signs
These prohibit an activity or behavior that is likely to increase danger. They are circular in shape with a black pictogram on a white background, red edging and diagonal line.
3. Hazard warning signs
These warn of a particular hazard or danger. The signs are triangular in shape with a black pictogram on a yellow background with black edges.
4. Mandatory signs
These indicate a requirement that must be complied with. The signs are round in shape and have a white pictogram on a blue background.

















Signage Category	Examples			
 Safe condition	 Means of escape	 Emergency shower	 First aid	
 Prohibition	 No forklift trucks	 No smoking	 No entry	
 Hazard and warning or caution	 Danger of electrocution	 Danger fire risk	 Danger of death	
 Mandatory (Must do)	 Eye protection must be worn	 Hand protection must be worn	 Wear respirator	

Figure 8.1: Basic safety sign categories

Sign boards on many sites display a set of signs that tell about present hazards and applicable prohibitions. They will also instruct on the required personal protective equipment. Combinations of safety signs are also possible.

Fire safety

Signage for fire safety has a red sign with a white pictogram.



Figure 8.2: Examples of fire signage

Acoustic signals

Acoustic signals are also used on site. The most common one is the fire alarm signal.

It is important to inform ABB employees about the fire signals and in particular the evacuation signal when they arrive at the site. This is very important when working on board a vessel.

Other acoustic safety signals are alarms that warn of impending or actual movement of machinery, such as cranes. The cranes normally give an acoustic signal that warns persons of the movement of the load, the crane or both.

Site personnel must contact the Site Manager for advice in case they notice a safety sign that they do not understand.

Training and competence

This CoP must be communicated to every project team member before they start any work on site.

Monitoring and checking

Site Manager is responsible for ensuring that all project team members are familiarized with the signage before starting any work on site. This includes contract personnel working on behalf of ABB.

Signage recognition must be part of HSE/SA audits and reviews conducted by the LBLs.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

None required.

CoP 8: First aid and emergency medical treatment

Introduction

It is essential that all ABB Marine & Ports personnel or contractors know how to act when emergency medical treatment is required, or first aid assistance is needed on site.

This Code of Practice (CoP) sets out basic requirements to follow when working on customer sites.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors, or work sites which have a nominated ABB Site manager or responsible person.

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

ABB Marine & Ports work sites often have poor accessibility for medical teams. This combined with imprecise location information of the injured person can increase the risks further (see CoP 6). Lack of adequate first aid services or emergency medical support is likely to increase the severity of outcome of any injury.

Operational controls

General

- All tendered contracts or projects must include suitable provision on the reasonable availability of emergency medical services. It is impossible to state what is reasonable, but at least the provisions must be such that a seriously injured person is treated by a medical professional within one hour of any incident. This will normally be in the hospital or suitable trauma center.

To achieve the response time for seriously injured persons at remote sites or locations, it may be necessary to make or secure additional medical provisions at the site, such as:

- Ambulance or vehicle capable of taking a full-length stretcher
- Availability of medical professional, and trauma facilities
- Helicopter evacuation.

Confirm this with the customer during the tender phase of the contract.

- As an absolute minimum, every work location must have first aid available within 5 minutes of an incident. As an exception, confined spaces have own protocols (see CoP 22).
- All projects and work areas must have a first aid kit readily accessible for starting first aid within 5 minutes of an incident.
 - As a best practice or if you cannot tell if an adequate first aid kit is readily available on site, ABB provides their own first aid kit to every project.
 - First aid kits must be made of impervious material, be dustproof and of sufficient size to store the required contents. They must be sealable and have a handle for emergency transport.
 - The outside of the first aid kit must clearly tell its purpose, for example, "First Aid".
 - Contents of the kits must be suitable and sufficient for the site (see Table 3). The contents must be based on the involved hazards and risks. For example, if welding is done, treatment for burns must be available.
 - Every first aid kit must be kept fully stocked and maintained in a clean and hygienic condition.

- Emergency contact information must be posted in visible locations at the site and communicated to all workers (see also CoP 6: Site Familiarization). The information must include telephone or radio contact name and numbers of:
 - Medical professional
 - Ambulance
 - Hospital.

Emergency medical care

Emergency medical care is the provision of skilled medical help at the scene of an accident, medical emergency, or during transport to hospital. It consists of recognition, resuscitation and stabilization of the seriously injured and it extends beyond the preservation of life to the prevention of complications and the relief of suffering.

First aid treatment

First aid treatment includes:

- Treatment for the purpose of preserving life and minimizing the consequences of injury or illness until help from a doctor, nurse or medical professional is obtained.
- Treatment of minor injuries which do not need treatment by a doctor, nurse or medical professional.

First aid kit minimum contents for projects and work sites



This is not a personal first aid travel kit.

NOTE



Local requirements may differ. Check if they do and make local agreement on the contents.

NOTE

Table 3: First aid kit minimum contents for projects and work sites

Item	Group A Kit Over 25 persons on site	Group B Kit 1 - 25 persons on site
Absorbent compress	4	4
Antiseptic swabs	20	10
Alcohol swabs	20	20
Bandage conforming 5 cm	2	1
Burn treatment kit	6	6
Cold compresses, heat stress	5	5
Contaminated waste bag	1	1
Dressing strip, plastic (50)	2	1
Dressing tape (hypoallergenic) 25 mm	1	1
Dressing, wound, no. 14P	2	1
Dressing, wound, no. 13P	2	1
Emergency blanket	1	1
Eye pad, sterile, single	3	1
Eye flush kit	1	1
First Aid Manual	1	1
First Aid Pamphlet	1	1
Large latex gloves (pair)	3	2

Item	Group A Kit Over 25 persons on site	Group B Kit 1 - 25 persons on site
Non-adherent dressing, 7.5 x 7.5 cm	2	2
Protective eyewear	1	1
Resuscitation face shield or Mask	1	1
Safety pins, 12-pack	1	1
Scissors, Sharp/Blunt, 125 mm	1	1
Sodium chloride, 30 ml	6	3
Splinters forceps	1	1
Triangular bandage	6	2
Tongue blades, use for finger splints	5	5

Training and competence

Valid first aid training is a recommendation for all ABB Marine & Ports employees and contractors who work on sites. The training must fulfil at least the International SOS standard. The training must be refreshed at suitable intervals, for example, every 3 years.

As an absolute minimum there must be at least one trained first aid person for every team and shift working on site.

Monitoring and checking

Managers responsible for selecting site personnel must have a system in place to ensure validity of first aid training of personnel travelling to the site. First aid and emergency medical provision must be part of HSE/SA audits and reviews conducted by the LBLs.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

Validity of first aid training must form part of personnel information records and certificates of training must be retained.

CoP 9: Emergencies on site

Introduction

Ports, shipyards and vessels are high risk environments, especially during construction or large maintenance works. Factors that contribute to high risks are the number of parallel work activities and the nature of works, such as welding and painting, which can introduce high risks, for example, fire on board. Some ports also have an increased risk level due to the goods being transported, for example, chemicals.

This Code of Practice (CoP) helps ABB employees and subcontractors to prepare themselves for emergencies on site.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors working on site or visiting the site without a guide. All personnel must have essential contact information with them and follow the site's or customer's protocols in case of emergency.

Hazards and risks

Working on board a ship or a crane (only one way of exit and no light) presents an increased risk in respect of evacuation if, for example, a fire breaks out or there is a chemical threat. By knowing how to act in such incidents, you can handle the situation better.

Operational controls

All ABB personnel who are going to work on site or visit it must know the Emergency Contact Plan and the Escape Plan for the site. Personnel working on site must also know the Risk Assessment and Project HSE Plan of the project and the Emergency Preparedness Plan of the site or customer.

Emergency Contact Plan



Figure 10.1: Example of emergency contact plan (text is illustrative only)

Project Manager must provide customer a customer emergency contact plan or prepare this document and give it to the personnel before they are sent to the site.

- If an injury happens, first call the site's medic team if the site has one.
- Then call the site's HSE responsible (or other nominated contact) for help to contact the national ambulance if you are in a country where people do not speak English. You can also call an ambulance directly.
- Report all relevant incidents to Project Manager and your line manager.

Escape Plan

Escape plan is a map of the area showing the locations of evacuation points/ muster stations, firefighting equipment, first aid stations and escape routes. The escape plan should also tell how the site warns people if an emergency occurs, like bells ringing when there is a fire.

The map can also show other useful locations on site, such as toilets and canteen.

Emergency Preparedness Plan

The site or the customer should provide ABB personnel an Emergency Preparedness Plan before starting work. Alternatively, its content can be covered during site-specific safety introduction. If this is not provided, ABB Project Manager must get the information and inform the personnel who work on site about what to do in case of critical situations.

The Emergency Preparedness Plan informs about what to do and who to alert in case of emergencies on site such as:

- Fatal or serious injuries
- Fire evacuation on board a vessel or crane

- Evacuation at sea
- Chemical spillage in the environment or on board
- Forces of nature, such as hurricanes, tornadoes and earthquakes
- Emergencies related to work in confined space
- Emergencies when travelling in high risk countries (see CoP 4 for a list of high-risk countries).

A good emergency plan also includes key procedures, such as:

- Stop all the work if an emergency occurs.
- Shut off the valves and switches near you if you can.
- Walk to the nearest designated evacuation point/ muster station. Do not run.
- Stay at the evacuation point/ muster station for a head count.
- Only go back to work when an ALL CLEAR SIGNAL is given.
- Always bring a flashlight with you when on board for safe evacuation.

Risk Assessment

The Emergency Preparedness Plan should cover operations or activities that have high scores in the project HSE Risk Assessment.

Project Safety Plan

The Project HSE Plan is the main safety document for the project. Therefore, this document should refer to all the above-mentioned documents and link to them.

Communication

All ABB personnel who are likely to travel to customer sites must be briefed on the contents of this CoP.

Monitoring and checking

The project's site emergency preparedness must be part of HSE/SA audits and reviews conducted by the LBLs. The LBLs must also check that the planning of the projects includes the requirement to obtain the site emergency information from the customer and the ship operator, whichever party is in control of the work on board the vessel or at the site. This information must be obtained before arriving on site preferably at the tender or contract stage.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

CoP 10: Personal protective equipment

Introduction

This Code of Practice on the selection, provision and maintenance of personal protective equipment (PPE) is for ABB Marine & Ports activities during operations within ports and shipyards but also while at sea during commissioning.

Scope

These requirements on PPE apply to all ABB Marine & Ports employees or contractors working on customer sites. For the requirements on respiratory protection equipment (RPE), see CoP 29.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Work instructions instruct in safe working methods and requirements for PPE. PPE is considered as the last resort of protection measures, that is, other safety measures should always be considered prior to PPE.

In most projects ABB is not fully in control of the work site because the shipyard, vessel owner or vessel operator carry the main responsibility. There may also be several contractors working in the same area as ABB employees. Therefore, the use of PPE should always be considered based on the actual situation at the site.

Operational controls

Selection and provision of general PPE

All PPE that is provided for ABB Marine & Ports personnel including any possible subcontractors must be fit for purpose and comply with the relevant EN or ANSI standard or their equivalent.

The following is an indicative list of PPE or other safety equipment that must be provided for all persons who visit and work at customer sites.

Personally issued PPE:

- Safety helmet or safety helmet equipped with a visor
- Ear protection (personal or disposable)
- Respiratory protection, disposable dust mask or reusable half mask with P3 filters
- Eye protection (glasses, goggles or face shields)
- Overall or cover suit, flame resistant
- Protective footwear, boots
- Protective gloves
- Flashlight with spare batteries
- ABB lockout/tagout equipment

Additional safety equipment to be available at the site:

- Danger signs and hazard tape
- Portable earthing devices
- Insulating mats
- HV indicator rods
- Walkie-talkie



The risk assessment and working instruction should specify which PPE is worn for the work activity.

NOTE

Specifications		A	B	C	D	E	F
Voltage: valid for AC and DC		<30V and	30V ...415V and	30V ... 415V and	>415V ... <1000V or	≥1 kV ... ≤7 kV or	≥7 kV ≤ 40 kV
Upstream overcurrent breaker (device)		≤16 A and	≤16 A and	>16 A ... ≤63 A or	>63 A or	>200 A or	n / a
Short circuit current		Ics ≤ 1 KA	Ics ≤ 1 KA	Ics > 1 KA	Ics > 7 KA	Ics > 15 KA	n / a
HAZARD LEVEL	ACTIVITIES						
LIVE WORKING	Connecting, installing, assembling & dismantling, maintaining, greasing, covering & cleaning	These works may not be executed unless they are technically necessary. When required, additional training and level of competence, a specific operating instruction and special equipment (not covered by this standard) are necessary. Needs pre-approval and authorization by the LBU Manager					
PROCEDURES TO ACHIEVE SAFE WORKING	<ul style="list-style-type: none"> Switch off switchgear / distribution one; Identify equipment to be worked on; Isolate and lock off & tag test circuits are dead apply earthing and short circuiting. protect against other live parts 	Outerwear: Long-Sleeved Shirt; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Outerwear: Long-Sleeved Shirt; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Outerwear: Long-Sleeved Shirt or Jacket; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Underwear: Long-Sleeved Shirt; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC) Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Underwear: Long-Sleeved Shirt; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC) Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Underwear: Long-Sleeved Shirt; ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC) Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)
	<ul style="list-style-type: none"> switch on switchgear / distribution Removing or inserting these cartridges which are not protected against direct contact. Examination works Diagnostic measurements 	Outerwear: Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Outerwear: Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Outerwear: Trousers: ATPV rating of ≥8cal/cm² PPE Category 2 (NFPA 70E) or Class 1 (IEC)	Outerwear: Overall: ATPV rating of ≥25cal/cm² PPE Category 3 (NFPA 70E) or Class 2 (IEC)	Outerwear: Overall: ATPV rating of ≥25cal/cm² PPE Category 3 (NFPA 70E) or Class 2 (IEC)	Switching Suit: ATPV rating of ≥40cal/cm² PPE Category 4 (NFPA 70E) or Class 2 (IEC)
	e.g. Work on equipment where other parts are "LIVE" in the working area	PPE: Safety Glasses, Arc-Rated or Leather Gloves where required	PPE: Safety Glasses, [Voltage-Rated Helmet and Visor minimum (8cal/cm²) and Balacava or Neck Protector: ARC/FR minimum where required], Electrical Gloves Class 00 = 500v and Leather Over-glove	Balacava or Neck Protector: ATPV rating of ≥8cal/cm²	Neck Protector or Flash Hood: ATPV rating of ≥25cal/cm²	Neck Protector or Flash Hood: ATPV rating of ≥25cal/cm²	Neck Protector or Flash Hood: ATPV rating of ≥40cal/cm²
WORKING IN "DEAD" CONDITION OR WITHOUT ARC FLASH HAZARD	e.g. work on equipment where there is no electrical risk, where the electrical supply has been physically isolated and where there will be no intervention on the electrical installation	Outerwear - ABB's Minimum Standard: Long-Sleeved Shirt and Trousers or Coveralls, ATPV rating of ≥8cal/cm² (PPE Category 2 NFPA 70E) or (Class 1 (IEC))					

Figure 11.1: PPE requirements for ABB Marine & Ports, quick reference

TASK OR ACTIVITY 	Protective Helmets	Hearing Protection	Safety Glasses or goggles	Welding Helmet with goggles or face shield	Face Shield	Dust mask (disposable)	Half mask with P3 filter	Respirator with air supply	Gloves	Welding jacket and chaps	Coverall suit with HIVIZ	Safety footwear	Safety Harness
	EN 397	EN 352-3, EN 458	EN 166 & 168	EN 169-171	EN 166	EN 140, 149	EN 140 & 149	EN 136-139, 269-271			EN 531	ISO 20345, EN 345	ISO 10333
General work in shipyard			to be carried						EN 388				
Welding						With P3 Filter	With P3 Filter		EN 12477				
Grinding			Face shield is preferred			With P3 Filter			EN 388				
Working in noisy environment									EN 388				
Work with exposure to airborne chemicals							With P3 Filter*		EN 388				
Work in confined spaces								Special rescue situations	EN 288				
Working at height									EN 388				
General Working with chemicals									EN 374				
Working with exposure to airborne particles						With P3 Filter	With P3 Filter		EN 388				

Note: overalls has to comply with ABB arc flash requirements

* Not suitable against all chemicals, check suitability against chemical in question from your local safety advisor.

Care and maintenance

Each employee must maintain all non-disposable PPE in good condition for use. Hearing protectors must be checked periodically to keep the seals in good condition. Eye protection, safety footwear and head protection must also be checked periodically.

Supervisor on site makes sure that there are sufficient supplies of disposable PPE, such as ear plugs, available.

Storage

All ABB staff that is required to travel to the site must be provided with a suitable bag in which to store all the required PPE. The PPE is kept in good order and damage-free in the bag during transit to the site.

Summary of PPE requirements

Don'ts:

- Never use PPE if it is dirty or damaged or if it is incomplete.
- Never leave PPE lying around where it can get contaminated or damaged.
- If there is large amount of contamination. do not work in the area.

Dos:

- Always ensure that the PPE is in good working order before going to the site and before first use.
- Always clean and store PPE properly. If it gets damaged, obtain a replacement.

Training and competence

All ABB employees must receive suitable training and instruction on HSE requirements for their work activities.

Employees must be instructed about:

- Correct use of the PPE that they have been issued with and what not to do.
- How to fit RPE (Respiratory Protective Equipment) correctly.
- How to obtain replacements.
- Emergency arrangements where PPE may be needed.

Monitoring and checking

Active monitoring

- All ABB staff must be issued with suitable PPE based upon the risk assessment carried out in respect of the work activity to be undertaken. It is important that all staff understand that they are responsible for checking their equipment before they go to the site to ensure that it is in good order and that they have the necessary replacement supplies with them, particularly in respect of disposable equipment.
- When back at the home location, each person has their equipment checked periodically by their supervisor. The check makes sure that the equipment is maintained in a reasonable state.
- PPE compliance forms an essential part of any SOT carried out on site.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses related to PPE, incorrect use of PPE, neglect to use PPE and so on must be reported to the applicable database.

Documentation and records

The following records must be kept by the LBL:

- Risk assessment or Job Safety Analysis (JSA) which specifies the requirement for PPE.
- Record on training and instruction.

CoP 11: Lone working

Introduction

There is no general prohibition of lone working but wherever it is practical lone working should be avoided. This Code of Practice guides on the occasions when lone working is necessary.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors, or work sites which have a nominated ABB Site manager or responsible person.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.




Hazards and risks

No additional hazard emerges from lone working but the risk of serious injury or illness emerges because a worker is on his own and cannot call for assistance and as a consequence, the outcome from any incident is more severe. This can include a work-related incident or a medical condition.

Operational controls

As in all cases, a risk assessment is done before starting any work and preferably during the planning stage when the possible lone working situation is identified. The assessment identifies the hazards associated with the proposed work activity and specifies the control measures required in the normal way as per the hierarchy of control.

When lone working cannot be avoided, proper consideration must be given to risk reduction measures. They include consideration of the following:

- Avoid the need for lone working if at all possible. If necessary, postpone the work.
- Lone working is prohibited for high risk activities, such as live electrical work, work in confined spaces and work at height. Live electrical work means working either on or in close proximity to energized conductors.
-  On no account is lone working permitted when working on or near electrical installations where there is a foreseeable risk of electrocution or in confined spaces, as there must be suitable arrangements in place to provide emergency support and first aid, or to arrange for its provision.
WARNING
- Ensure that the lone worker is competent and understands the limits of the work activities.
- Ensure that the ABB employee registers his presence on site with the security office on site and that he informs them about his work location.
- Reduce the risk by limiting the activities to low risk ones, such as monitoring duties only, and by not allowing operation of plant, equipment, machinery or vehicles, or working at height and so on.
-  When an engineer is required to work on electrical equipment, such as a drive for a large crane, the engineer must be accompanied until the seven steps are properly applied and the equipment is proved dead and the isolator is locked off.
WARNING
-  Similarly, the equipment must not be re-energized until a second person is present.
WARNING

- Provide the lone worker with a suitable means of communication to alert a contact person or someone else on site when there is something of concern or in case of an emergency. The person need not necessarily be an ABB employee.
- Provide the lone worker with some type of manual or automatic alarm which operates when there is a lack of activity.
- Actively contact the lone worker to check on his status throughout the shift or ensure that there is a regular call in schedule.
- When a lone working situation emerges unplanned, the lone worker must contact his supervisor to agree on the precautionary measures that must be applied. He should also contact customer's representative on site.
- Ensure that the lone worker has a travel first aid kit available.

Training and competence

This content must be communicated to ABB Marine & Ports employees or contractors before starting any work on site.

Monitoring and checking

Project Manager or Service Manager is responsible for ensuring that ABB Marine & Ports employees, contractors or both do not generally get involved in lone working.

If lone working is absolutely necessary, the Project Manager or Service Manager checks that the precautionary measures are adequate based on the risk assessment and that the lone worker is informed of the requirements before starting any work on site. The lone worker must also be informed of any other work proceeding on site that may interface with the lone worker's activity.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

Lone working is to be identified as a part of the Health and Safety planning during project start-up phase or as part of the risk assessment on site.

CoP 12: Electrical safety

Introduction

Working on electrical systems at voltages above 50 V presents serious hazards to persons in terms of electrocution and effects of arc flash which can occur on systems below 1000 V and above 1000 V.

This Code of Practice describes the basic minimum requirements for electricians or engineers of ABB Marine & Ports who work on electrical systems on site.

For detailed information on the required electrical safety trainings, see ABB Way control standard SA-S-107-06 and sub-documents.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Work on electrical equipment presents a number of basic hazards. The hazards include electric shock which, if the person is subject to a voltage across his body, can result in a serious injury and often in death depending on the voltage, current and time involved. This can occur at currents of 30 mA.


The hazards also include arc flash which occurs if an accidental short circuit occurs when a conductive object gets too close to a high amp (power) current source, or when equipment failure happens. It can often result in the release of very high energy levels over a very short time period releasing large amounts of heat with the conductors becoming molten, which are then vaporized. This can result in severe burns to the uncovered parts of body. It is particularly relevant at voltages below 1 kV owing to the compact nature of the equipment and therefore the small clearances, but it can also occur at voltages above 1 kV.

Other hazardous effects include exposure to ultraviolet radiation, effects of arc blast (pressure wave), and possible fire.

Operational controls

As in all cases when managing risks, risk avoidance and elimination is the first and preferred option. Thereafter it is about risk reduction followed by risk control measures. These are summarized as follows.

Table 4: Application of the hierarchy of control to electrical risks



Risk avoidance or elimination	•	Make sure that work is well planned and organized to enable all equipment to be worked on so that it is free from electrical danger i.e. dead.
Risk reduction	•	Only allow skilled, authorized and competent persons including contractors to be within the vicinity zone and the general work area.
	•	Use voltage rated tools to reduce the probability of any accidental short circuit and therefore the incidence of an arc flash.
Risk isolation	•	Where there are other live parts exposed, make sure that adequate physical separation, insulated screens or both are applied to prevent electrical danger during the work activity.
Risk controls	•	Permit to work is issued to confirm that the correct precautions (Seven Steps) are applied.
	•	Make sure that the equipment to be worked on is suitably identified and where practicable, segregated to prevent unauthorized or unskilled persons from entering the work area.
	•	Isolators are locked out and tagged.
	•	Earths or grounds are applied where appropriate.
	•	Conductors to be worked on are tested to make sure that they are dead before the work starts.
	•	Competent and skilled persons including contractors who work within the vicinity zone and the general work area are briefed on the work and the control measures.
	•	Personal protective equipment is specified, issued and worn to protect against electrocution and arc flash.

Application of the Seven Steps

The Seven Steps must be applied to all electrical work done on ABB Marine & Ports work sites.

The Seven Steps that Save Lives

step /1/

Prepare for the work

Do an on-site Risk Assessment or Job Hazard Analysis.



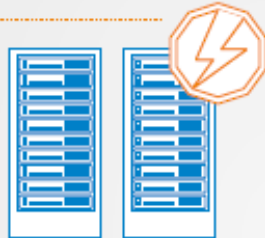
- Be in possession of a clear work order to execute the work
- Where required, the access or work permit to be obtained by a person who is authorized for the specific electrical system
- Ensure the competence of workers
- Check for proper tools for the Job
- Determine and select the proper arc-rated Personal Protective Equipment (PPE) and associated PPE as defined in the arc-flash risk assessment or ABB matrix
- Engage the person responsible for electrical equipment or system, review single-line, schematics, switching plans, etc.
- Decide on the appropriate work methods and Initiate the Permit To Work (PTW) process



step /2/

Clearly identify the work location and equipment

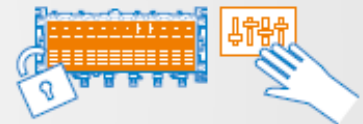
Use your senses to identify problem areas. Define the work area via barriers and barricading and label equipment. Avoid distractions such as talking or texting on the phone.



step /3/

Disconnect all sources and Secure against reconnection

Perform switching, when required and only while wearing the proper PPE identified in step 1, or observe switching from a safe distance and implement Lockout/Tagout.

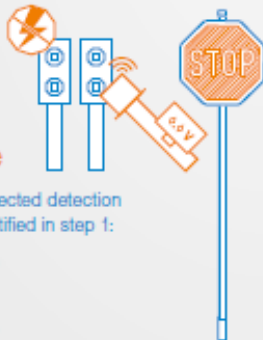


step /4/

Verify the absence of operating voltage

Utilize only properly rated and inspected detection devices and wear proper PPE identified in step 1:

- Test voltage detection device
- Test for voltage
- Test voltage detection device



step /5/

Carry out earthing and short circuiting

Close and lock earthing switch or apply portable equipment for earthing and short-circuiting while wearing the proper PPE identified in step 1.



step /6/

Determine minimum approach distances, apply screening, and when applicable, padlock both cable and buss bar shutters, utilize proper insulated gloves and tools for inadvertent contact potential.

Protect against adjacent live parts and take special precautions when close to bare conductors



step /7/

Complete the permit to work and "Walk the Permit"



- Check Isolation points
- Verify all circuits are isolated and secured
- Ensure all parties are Integrated with the Lockout/Tagout
- Check the earths are properly applied
- Answer specific questions from the working group
- Ensure the work can proceed without danger
- Validate the PTW

Minimum distances

EN 50110 sets out the main requirements for safety when operating electrical installations. It describes the minimum distances that must be maintained when working in areas where adjacent conductors may be energized. Table 5 summarizes the distances.

Table 5: EN 50110 - Guidance on minimum distances for live working and vicinity zones

Nominal system voltage kV	Distance in air defining the outer limit of the live working zone (DL) mm, see Figure 13-1	Distance in air defining the outer limit of the vicinity zone (DV) mm, see Figure 13-1
<1	No contact	300 mm
3	120	1120
6	120	1120
10	150	1150
15	160	1160
20	220	1220
30	320	1320

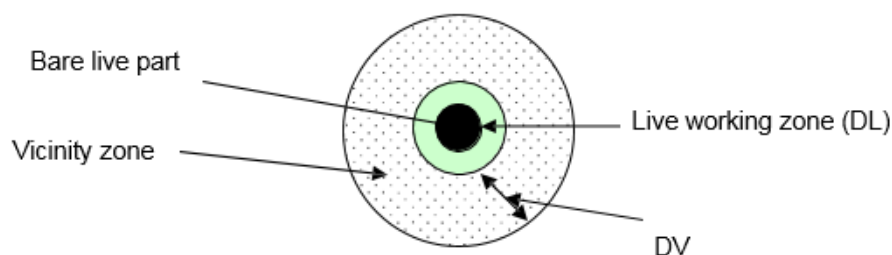


Figure 13.1: Definition of live working and vicinity zones

Arc flash protection

All electricians in ABB Marine & Ports must be provided and wear the personal protective equipment specified by ABB where there is a potential for arc flash. This includes the provision of any or all of the following:

- Suitable head protection, EN 50365
- Eye, face or neck protection, EN 166
- Suitable voltage rated gloves, EN 60903 or ASTM equivalent
- Whole body clothing, EN ISO 11612 (flame proof)
- Safety footwear, EN531
- Hearing protection
- Voltage rated tools, VDE EN 60900.



Do not wear any uncovered metal pieces, such as earrings or necklaces.

WARNING

See also EN 50110 and ABB Way SA-S-101-07/SA-S-101-07-01 for guidance on Arc Flash protection.

In case of electrical shock

Act according to the given emergency instructions and the emergency contact plan.



If a person suffers an electrical shock, they must go or be taken to a hospital even if they seem to be fine afterward.

WARNING

Training and competence

Person who work with electrical systems must be skilled on the voltages that are involved in their work. In particular they must have adequate experience and training for the works they perform. They must be familiar with the Seven Steps and the ABB Way SA-S-107 (including sub-documents) on electrical safety. They must have valid electrical safety training and live works safety training.

Monitoring and checking

The Responsible (LBL) Manager must have adequate arrangements in place to ensure that all persons who attend a customer site are competent for the work to be undertaken. The Responsible (LBL) Manager must also ensure that SOTs and audits are carried out periodically to check that the requirements of this and any other CoP are being complied with.

Active monitoring

- All ABB personnel and contractors who work on electrical systems must have valid electrical safety trainings (covering also safety aspects of live works).
- Once a year, each person, when back at the home location, gives their equipment to their supervisor for functional check and calibration.
- Use of testing and commissioning equipment can be subject for discussion during SOTs.
- Supervisors must make sure that persons working for them are skilled and are taking the required trainings.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses related to electrical safety must be reported to the applicable database.

Documentation and records

Every Local Business Unit is responsible for keeping up-to-date documentation of electrical and other relevant safety training undertaken by the staff. This documentation must be available on site when needed.

Each LBL must also have in place an effective system for the inspection, testing and maintenance of portable electric and other tools and devices.

CoP 13: Testing and commissioning equipment

Introduction

Incorrect use of defective or inadequate testing and commissioning equipment can lead to serious injuries. This Code of Practice guides on the safe use of devices that are used in testing and commissioning of LV equipment.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors when working on site.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

An insulation tester, also known as megometer and megger, is a portable device used to test wire insulation. Wrong use of an insulation tester can lead to electrocution. The shock should not be fatal for people unless they have heart issues, but it can lead to dangerous situations such as losing consciousness while standing on scaffolds.

A multimeter, also known as multitester and VOM (Volt-Ohm meter), is used to measure voltage, current and resistance. Incorrect use of an unsafe multimeter can cause it to explode in the worst case. Multimeters are rated into categories based on their intended application. The four categories are:

- Category I: Used where equipment is not directly connected to the mains.
- Category II: Used on single phase mains final sub-circuits.
- Category III: Used on permanently installed loads such as distribution panels, motors and 3-phase appliance outlets.
- Category IV: Used on locations where fault current levels can be very high, such as supply service entrances, main panels, supply meters and primary over-voltage protection equipment.

Operational controls

Insulation tester

- Completely discharge, drain the circuit and check it is dead before connecting an insulation tester to it.
- Disconnect the device to be tested from other electrical circuitry before testing.
- Cables and capacitors can store charge for some time after test, and they can be charged with dangerous amounts of energy from a low output insulation tester. After testing, discharge the equipment or the measured circuit by using a cord between the circuit and ground, while wearing voltage rated gloves.
- Never touch the test leads.
- Ensure that the calibration of the insulation tester is valid.
- To avoid damage on equipment, do not use an insulation tester to test a low voltage-resistant device, unless the insulator has low resistance range. Insulators should mainly be used to test insulation measurements or conductor capability.

Multimeter

Before travelling to the site:

- Test the multimeter at regular intervals and check that the calibration is valid.

- If possible, choose a multimeter that has protection against overload on the ohm function and with protected entry connections.
- Only use test cords with 90-degree connections to the multimeter, protection against physical contact and different colors.
- Use a multimeter with fused leads (500 mA) and probes with minimum exposed metal on the tip to avoid short circuit across terminals or to earth during testing.
- If possible, ensure that the multimeter complies with accepted safety standards (UL 3111, EN 61010, IEC 1010 (replaces IEC 348)).

Before using the multimeter:

- Make sure that the multimeter is fully functional, test the functions before use.
- Check the test cords for physical damages.
- Choose the right setting and range for the specific measurement.

When measuring:

- Use the three-point test method, especially when checking to see if a circuit is dead. First, test a known live circuit. Second, test the target circuit. Third, test the known circuit again. This verifies that your meter works properly before and after the measurement. If possible, use a dedicated instrument (preferably with an attached “safe” proving device) to test for dead circuits because a lot of things can go wrong with a multimeter.
- Hook on the ground clip first, and then make contact with the hot lead. Remove the hot lead first, the ground lead last.
- Hang or rest the meter if possible. Try to avoid holding it in your hands, to minimize personal exposure to the effects of transients.
- Keep one hand in your pocket when possible. This reduces the chance of a closed circuit across your chest area and through your heart.

Tools

- Use tools intended for electricians, such as fully insulated screwdrivers except for the tip. The maximum voltage limit should be stated on the tool.

Training and competence

All ABB employees must receive suitable training and instruction on environmental, health and safety (HSE) requirements for their work activities.

For testing and commissioning equipment, the employees must be instructed on safe work with electrical equipment and correct use of insulator and multimeter.

Equipment user manuals should be read, at least the parts regarding safety.

Monitoring and checking

Active monitoring

- All ABB personnel must be issued with the testing and commissioning equipment necessary for their work.
- Once a year, each person, when back at the home location, gives their equipment to their supervisor for functional check and calibration.
- Use of testing and commissioning equipment can be subject for discussion during SOT.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses related to testing and commissioning equipment must be reported to the applicable database.

Documentation and records

The following records must be kept by the LBL:

- Record of calibration of instruments
- Record on training for safe work with electrical equipment.

CoP 14: Safe use of ladders

Introduction

Work at height that involves the use of ladders is one of the major areas for accidents and incidents. This Code of Practice guides on the safe use of ladders and stepladders on work sites.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

The main hazard in working on a ladder is falling as a result of a number of possible causes. Typical causes of incidents involving ladders include:

- Ladders are defective because they are not inspected nor maintained.
- “Homemade” or makeshift equipment is used.
- Ladders are placed on uneven surfaces or where they could slip easily.
- Ladders are in use near exposed live electrical conductors including overhead lines.
- Persons working on ladders overreach causing them to fall.
- Tools that require a high degree of leverage are used causing a person to overbalance and then fall.

Operational controls

Risk avoidance or elimination

As with all health and safety requirements, hierarchy of control must be applied, and risk avoidance must be the first consideration. A significant number of serious incidents occur each year involving ladders. Generally, do not use ladders as a working place except for simple works of short duration, for example 30 minutes.

Significant work of longer duration requires other measures. Consider other methods for working at height, such as fixed platforms, mobile scaffolds or mobile elevated working platforms (MEWP).

Risk reduction and control

Ladder pre-use inspection

- Always check a ladder before using it.

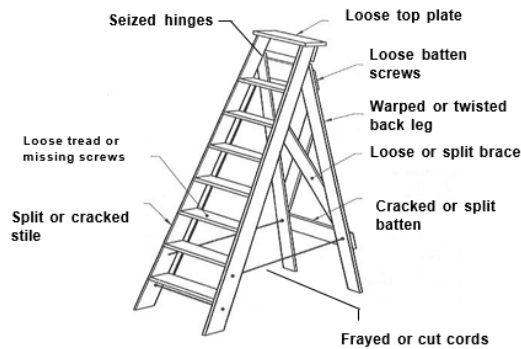


Figure 15.1: Inspection points of ladders

- If the ladder is fitted with metal spreader arms, check that they lock into place when fully spread.
- Check that the steps or rungs of all ladders are tight and secure.
- Make sure that all hardware and fittings are properly and securely attached.
- Test that the movable parts operate without binding or without too much free play.
- Inspect metal and fiberglass ladders for bends and breaks.
- Never use a damaged ladder. Tag it "Defective" and report it to your supervisor (to be removed).
- Ladders should also have an ID.

Ladder set-up

- Place a ladder firmly and evenly on the ground with a slope of 4:1. Make sure that the ladder is in a straight and secure position before climbing it. If one foot is in a low spot, build up the surface with firm material.



Figure 15.2: Correct set-up of ladder

- Do not make a ladder reach further by setting it on boxes, barrels, bricks or other unstable bases.
- Do not let ladders lean sideways. Level them before use.
- Brace the foot of a ladder with stakes or place stout boards against the feet if there is any danger of slipping or get another person to foot it.
- Never set up or use a ladder in a high wind, especially a lightweight metal or fiberglass ladder. Wait until the air is calm enough to ensure safety.
- Never set up a ladder in front of a door unless the door is locked or a guard is posted.
- Do not use ladders on ice or snow unless absolutely necessary. If you must use ladders on ice or snow, attach spike or spur-type safety shoes on the ladder feet and be sure they are gripping properly before climbing.
- Wear safety shoes on ladder feet whenever there is any possibility of slipping.

Key points on climbing and standing on ladders

- Keep the steps and rungs of ladders free of grease, oil, wet paint, mud, snow, ice, paper and other slippery materials. Before climbing a ladder, remove any such debris from your shoes also.

- Always face the ladder when you climb up or down. Use both hands and maintain a secure grip on the rails or rungs, always with three points of contact.
- Never carry heavy or bulky loads up the ladder.
- Climb and stand on the ladder with your feet in the middle of the steps or rungs.
- Do not overreach from the ladder nor lean too far to one side.
Overreaching is a common cause of falling from the ladders. A good rule is to always keep your belt buckle inside the rails of the ladder. Work as far as you can reach comfortably and safely, and then move the ladder to a new position.
- Never climb onto the ladder from the side, from above the top or from one ladder to another.
- Do not use the rungs as hand grabs.

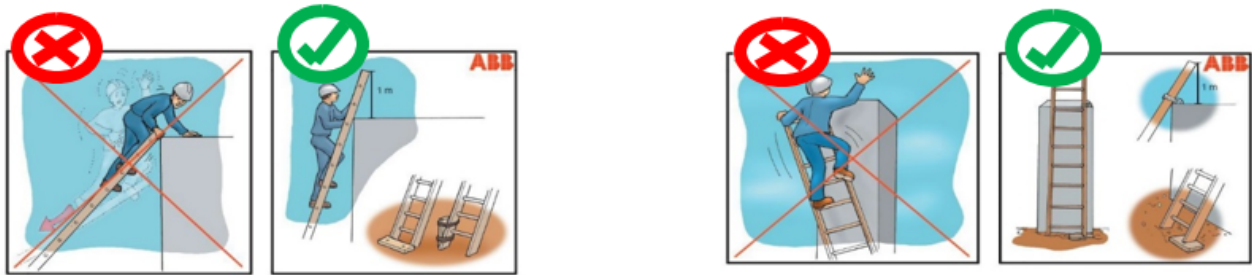


Figure 15.3: Examples of use of ladders

Correct use of ladders

- Never use metal ladders near exposed electrical wiring.
Metal ladders should be marked with tags or stickers reading **CAUTION - Do not use near electrical equipment** or similar wording.
- When using ladders in areas with traffic, erect warning signs or barricades to guide traffic away from the foot of the ladder. If this is not possible, have someone hold and guard the bottom of the ladder.
- Do not move the ladder while you are on it by rocking, jogging or pushing it away from a supporting wall.
- Do not leave tools or materials on top of ladders.
- Never push or pull anything sideways while on a ladder. This puts a side load on the ladder and can cause it to tip out from under you.
- Allow only one person at a time on a ladder unless the ladder is specifically designed for two people.
- Never use a ladder as a horizontal platform, plank, scaffold or material hoist.
- Never use a ladder on a scaffold platform. If you need to reach higher, the scaffold should be higher.

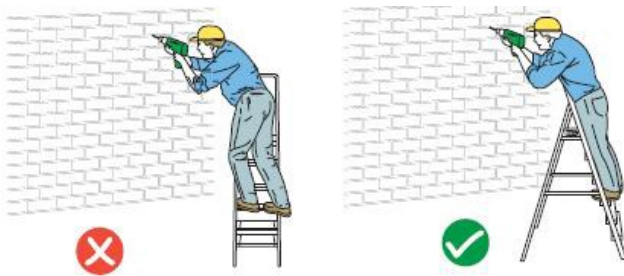


Figure 15.4: Correct use of step ladders

Training and competence

Persons who use ladders at customer sites must be briefed on the contents of this Code of Practice.

Monitoring and checking

- The supervisor is responsible for ensuring that persons who use ladders are aware of this Code of Practice.

- Use of ladders must be part of OHS audits and reviews conducted by the LBLs.
- Ladders that are ABB equipment must be given an ID number and be subject to a routine inspection once every 3 months and a simple record kept in a register. Alternatively, the ladder itself can be marked as inspected.
- Non-ABB equipment should not be used. However, if it is used to complete a job then it should be fully checked visually to ensure that it is fit for purpose.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

None required.

CoP 15: Working at height

Introduction

This Code of Practice (CoP) tells ABB Marine & Ports personnel and contractors about the hazards and risks of working at height. Works that are performed under a ship are emphasized. The same principles also apply to environments that involve working at height.

Work at height is defined as work that is done at heights higher than 1.8 m (6 ft).

Scope

This CoP applies to all ABB Marine & Ports employees or contractors working on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

The hazards and risks of working at height under a ship are the same as in other environments where working at height is involved. The main difference is that the equipment providing a safe working platform is usually owned by the shipyard and can very often be in a poor state of repair. This is particularly the case in countries which do not traditionally have a high HSE standard.

Hazards include:

- Falling from height
- Falling objects

Operational controls

Risk avoidance

As with health and safety risks, the hierarchy of control must be properly applied, and risk avoidance is the best and most preferred option. Consider during the planning phase what work (if any) can be done without working at height. If risk avoidance is not practicable, consider the possibilities of risk reduction and risk control.

Risk reduction and control

As options for working at height, you can use:

1. Custom-made equipment
2. Fixed scaffolding
3. Mobile scaffolding
4. Mobile elevated working platforms
5. Fall arrest equipment.

Custom-made equipment

A specific, custom-made work platform providing a safe means of access to the Azipod propulsors is the preferred option. With this option, it is not necessary to erect the work platform each time it is required.



Figure 16.1: Custom-made equipment

Custom-made work platforms require maintenance to ensure that they stay in good working condition and are safe to use.

Fixed scaffolding

The main purpose is to provide a safe place for persons to work at and to prevent them from falling from height while they do their work. A fixed platform or scaffolding can provide an effective means for achieving this, but the scaffolding must be built by competent persons, be in a good state of repair and be complete.

The properties of a correctly erected fixed scaffolding are shown in the following table. Any fixed platform at a shipyard should have these properties.

Table 6: Correct erection of scaffolding



Sound footing



Vertical uprights and bracing



Secured by ties



Platform, toe board, rails

Table 7: Incorrect erection of scaffolding



Fixed scaffolding in dangerous state

Key requirements for a fixed platform:

1. Scaffolding is erected by a competent person.
2. Components are in good condition, particularly the ones bearing loads.
3. Apply a safe method of erecting/dismantling which prevents the worker from falling.
4. Lift and lower equipment by rope or hoist.
5. Lock each level in place before installing the next level.
6. Vertical members are upright and have a secure footplate.
7. Lateral bracings are provided.
8. Scaffolding is tied or otherwise secured to a structure, such as a ship.
9. Guard rails are provided at 950 mm (37.40in) and 470 mm (18.50in).
10. Install toe boards, inner ladders/stairways with handrails, and fully decked platforms.
11. If for any reason a scaffolding is considered unsafe, it should be tagged as unsafe.



12. The scaffolding is inspected before first use and then every time it is modified.



WARNING

Always check the scaffolding safety card before the use of scaffolding.

13. Do not move scaffolding with workers aboard

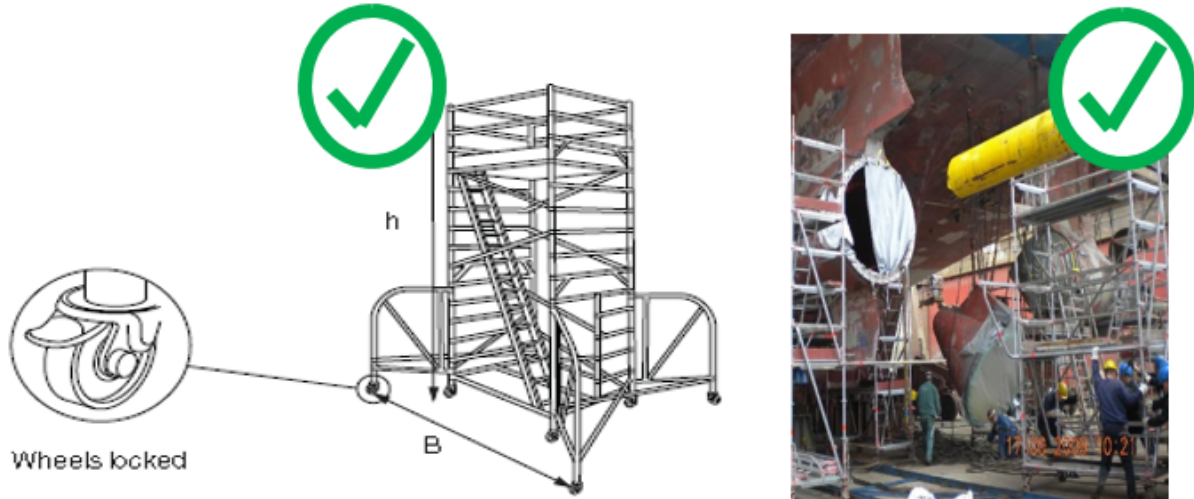
Mobile scaffolding

Flaws in mobile scaffolding are often the same as those of other types of scaffolding. These include:

- Component parts are damaged but are still used.
- Scaffolding is poorly erected with no adequate means of access.
- Platforms have a limited number of boards in place or the boards are of poor quality.
- There are no toe boards nor guard rails, or the guard rails are of poor quality.
- Wheels are not locked.
- If sheeted, the wind load is not considered adequately.
- When the mobile tower is moved or modified, it is not inspected nor maintained.



Figure 16.2: Damaged and dangerous mobile scaffolding



Max ratio $h:b = 3:1$

Figure 16.3: Correct set-up of mobile or modular scaffolding

Mobile elevated working platforms

Mobile elevated working platforms (MEWP) provide a safe means of access to difficult areas below a ship. They vary in size from small scissor lifts to larger self-propelled ones.

Basic precautions for MEWPs:

1. Make sure that the surface is even (flat), stable and can withstand the weight of the machine. Steel plates may be required if the bottom of the dry dock is uneven or unstable.
2. In areas where other persons are working or where the work is in contact with the customer's employees, block the area to keep unauthorized persons out.

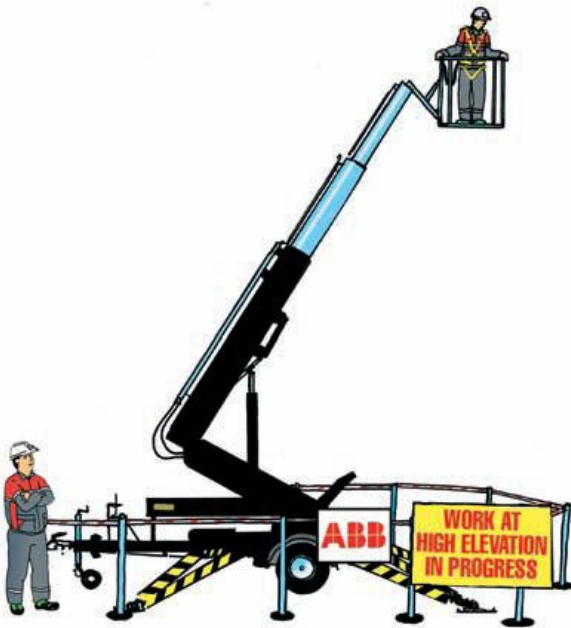


Figure 16.4: Ensuring use of outriggers and fencing off the area

3. Check the safe working load.
4. All operators of MEWP equipment must wear the following suitable PPE:
 - Fall arrest harness attached to a lanyard with a shock absorber (ISO 10333/ANSI Z359.13) must be worn at all times when in the basket of the elevated work platform. The lanyard must be attached to the designated anchor point in the basket and to the personal harness at all times.
 - Safety helmet
 - High visibility vest or equivalent
 - Safety boots.

Whenever a person wears a harness, an elevated work rescue plan must be in use. There must be a person in place who knows how to use the ground controls and lower the elevated work platform to the ground.



Figure 16.5: Checking safe working load (SWL)

See also ABB Way SA-S-102-03 on mobile elevated working platforms.

Fall arrest

Fall arrest equipment should not normally be required if there is a safe working platform (fixed, mobile or modular platform).

If the fall arrest equipment (fall arrest harness attached to a lanyard with a shock absorber) is needed, it must comply with ISO 10333 and persons must be instructed to use it. When the fall arrest equipment is used, the safe method of working must also consider how to do rescuing in case it becomes necessary.

Lighting

A dry dock does not generally have lighting installed and therefore it is important that projects consider the need for adequate lighting. In poor lighting persons cannot see the working platform nor the safe means of access. There are also shadows in poor lighting.

It is important that lighting is provided both for the workplace and its means of access. Lighting supplies should be protected with ground fault circuit interrupters or made safe against cable damages otherwise.

Training and competence

All persons who are required to work at height below a ship must be instructed and trained in:

- Hazards associated with working at height
- Recognition of faulty scaffolding equipment
- Correct use of PPE including the use of fall arrest equipment.

Communication

All ABB Marine & Ports personnel and contractors must be briefed on the requirements of this CoP.

Monitoring and checking

The LBL must ensure that, where site work involves working at height, SOT and any scheduled safety inspections include checking the compliance with the requirements of this CoP. Include the following checks:

- Employees are trained and instructed on these requirements.
- Employees follow the requirements when working on site.
- Scaffolding or other arrangement is checked before its first use and then whenever it is altered or modified, or every 7 days.
- If the scaffolding is damaged or otherwise inadequate, it is tagged as such and taken out of use until it is repaired.
- All fall arrest equipment is inspected before use by the user and formally every 12 months and a record is kept.

Documentation and records

The following records must be kept:

- Personnel qualification and training records are maintained for a minimum of five years.
- Records pertaining to an incident are maintained for the duration of the employment of the involved individuals.
- Records of inspection of safety harnesses and lanyards are retained for 12 months.
- Records of inspection of the scaffolding are retained for the duration of the project.

CoP 16: Airborne hazards

Introduction

Working on board a ship is working within an enclosed space. Onboard work done by ABB or other contractors can generate airborne contaminants within the enclosed space during the construction, service, repair or refit of the ship at a dry dock.

This Code of Practice (COP) guides ABB Marine & Ports staff to recognize potential situations where they can be exposed to airborne contaminants and to take suitable precautions.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Activities of ABB Marine & Ports do not generally cause significant exposure to airborne contaminants. If they do, suitable control measures are identified in the risk assessment and safe working instructions. However, work on board a ship can mean that ABB works next to other contractors who could do work which is outside the control of ABB and can include activities that generate airborne contaminants.

General

Materials can become airborne in a number of different ways and forms. For classification of airborne contaminants, see the table below.

Table 8: Examples of airborne contaminants

Solids	Liquids	Gases or vapors
<ul style="list-style-type: none"> Asbestos fibers Engine exhaust particulates Lead dust and fume Silica dust Welding fume Shot blasting dust Wood dust Smoke Fungal spores Bacteria Virus Parasites 	<ul style="list-style-type: none"> Sprayed droplets Paints Pesticides Powder coatings Liquid jetting Sewage water <hr/> <p>Mists</p> <ul style="list-style-type: none"> Chrome acid Cutting fluids Oil mist 	<ul style="list-style-type: none"> Ammonia Carbon monoxide Carbon dioxide Freons Helium Nitrogen and oxides Mercury vapor Solvent vapors Exhaust gases



This CoP does not cover guidance on asbestos, it is covered in CoP 18.

NOTE

Some contaminants can become airborne as a result of a natural process, for example, evaporation of flammable liquids or use of compressed gases. Some contaminants become airborne as a result of the process itself. For example, electrical arc welding applies electricity to generate high temperatures to make welding of steel or aluminum possible. However, materials used in welding include fluxes which are vaporized and add to the general cocktail of substances that can be present.

To determine the potential hazard of airborne substances, consider the following factors:

- The hazardous nature of the contaminant, for example, toxic, harmful and irritant.
- The form of the substances including the particle size in case of dusts.
- The process by which the substance becomes airborne, hot, cold or spraying.
- Environmental conditions including the presence or absence of exhaust ventilation.

Table 9: General properties of airborne contaminants

Form	Description	Visibility	Example
Dust	Solid particles which can be supplied as part of a process, such as powder handling, or generated by the process, such as crushing, grinding or blasting.	In diffuse light inhalable dust clouds are partially visible. Respirable dust (< 5 µm) is practically invisible.	Metal dust
Fume	Vaporized solid that has condensed. Particle size: 0.001 µm - 1 µm.	Fume clouds tend to be dense. They are partially visible. Fume and smoke are generally more visible than similar concentrations of dust.	Solder fume, welding fume
Mist	Liquid particles are generally process generated, such as spraying. Particle size: 0.01 µm - 100 µm. Size distribution can change as volatile liquids evaporate.	Same as dust.	Paint spraying, jet washing
Fibers	Solid particles where the length is several times the diameter. Particle size is as for dust. Anything < 5 µm is respirable.	Same as dust.	Asbestos, fiber, fiberglass, refractory ceramic materials
Vapor	The gaseous phase of a liquid or solid at room temperature. Behaves as a gas.	Generally invisible. At very high concentrations vapor laden cloud may just be visible.	Volatile organic compounds
Gas	A gas at room temperature.	Usually invisible.	Chlorine, nitrogen, carbon dioxide.

Welding

On board a ship, welding is one of more common activities that is done during construction, repair or re-fitting. Every time an arc is struck in electric arc welding between the electrode and the work piece, particles and gases are emitted into the working environment. The particles and gases are the unavoidable by-products of the welding process and appear as smoke made up of larger particles (up to 50 µm) and eventually results in a dust fall. The smaller particles, smaller than 1 µm, usually result in a fume that can be a risk to the health through inhalation. Any particle which is smaller than 5 µm enters the lungs and stays there.

The dust produced can contain a range of different metals including iron, lead, manganese, copper and chromium. Fluorides can also be present. Gases can also be present in many cases as shield gases or as oxides of nitrogen created by the intense heat of welding. Ozone can also be present. Shield gases include carbon dioxide, argon and helium.

Grinding

Grinding is a common activity on board a ship and can create airborne concentrations of dust. While the welding fume is created by a hot process, grinding is a cold process that generates large amounts of fine dust. The fine dust can be respirable and enter the lungs and remain there in the same way particles do.

The composition of dust depends on the grinded material including any paint or other surface coating that are present. Particles are generated but the hazardous nature depends on the composition. Exhaust ventilation should be provided, and persons exposed should use a respirator.

Painting

Painting is also a very common onboard activity during construction and maintenance. Paint is applied by brush or roller or by spaying. Spray painting makes the paint airborne and will result in vaporized solvent, paint particles and any uncombined chemicals that can be present. This can cause both an occupational health hazard and a fire hazard.

Painting by using a brush or roller is unlikely to result in airborne particles but there will still be natural evaporation of the solvent vapor. The amount will depend on the flash point of the solvent and the ambient temperature on board the vessel. The lower the flash point of the paint the more likely it will be for the solvent to evaporate. It is also true that solvents with low flash points will also present a serious fire hazard, particularly if there is inadequate ventilation.

Asbestos

Although asbestos has been banned in the construction of new ships under the IMO rules from 1 Jan 2011, there are ships with asbestos in many different forms and locations.

For more information, see CoP 18.

Confined space working

A ship is in effect a confined space. Many activities done in the open air are normally not a significant health risk. If the activities are done in a confined space with no forced ventilation, they can become a risk to the health. The severity of the risk depends on:

- Hazardous nature of the contaminant
- Duration of exposure
- Concentration of the contaminant in air
- Effectiveness of any control measure in place, such as exhaust ventilation.

When working in confined spaces, ABB staff must make sure that a suitable risk assessment is done, and other work done in the same work area by other contractors is noticed because it can impact ABB directly. This can include exposure to dust, fume, vapors and gases.

Gases can present a particular hazard because in addition to accumulation in absence of exhaust ventilation they can also, through the process in some cases, use up the oxygen and cause reduced oxygen levels in the atmosphere. This can occur with welding.

The use of oxy acetylene gases can present an added hazard. If oxygen is not controlled after use, then it is possible for oxygen levels to increase and this can cause a very serious fire hazard.

Volatile organic compounds (VOC) or solvents generate vapor which in most cases is heavier than air. Gases are generally heavier than air so they tend to accumulate in low-lying areas of any enclosed space and are particularly hazardous in confined spaces. To prevent such accumulation, adequate exhaust ventilation is important.

Operational controls

General

Working on board a ship includes many hazards which can be created by other contractors working in the same area as ABB. It is also the case that ABB's activities, if not properly controlled, can also adversely affect other persons in the same area. As with all risks, there is a preferred hierarchy for applying suitable controls measures. They are summarized in the following sections.

Control of airborne contaminants

Avoidance and elimination

The most effective control is to avoid being exposed to airborne contaminants. To do so, ABB staff on board the vessel must find out if any other work is done within ABB's proposed work area and if so, whether it is likely to present a risk to the health or safety of ABB staff. If other contractors work in the same area and create airborne contaminants, the proposed work should start after the other contractors have finished their work or when effective control measures, such as exhaust ventilation, are in place to remove the airborne contaminants. If you have any doubts, contact your ABB supervisor or HSE advisor.



Figure 17.1: Hierarchy of control

Risk reduction and control

When it is not practical to postpone the work and there is a likelihood of airborne contaminants within the proposed work area, then use exhaust ventilation to remove the contaminants to the atmosphere. It is important that the emission point is to the atmosphere, otherwise the contaminants can just move from one work area to another. In some cases, it can also be necessary to have both local exhaust ventilation and air input.

Respiratory protective equipment (RPE)

If ABB staff or contractors are potentially exposed to airborne contaminants, they should immediately wear suitable RPE. The use of a disposable mask or a half mask with a P3 filter provides adequate protection. The half masks are not generally suitable for persons with facial hair. They should wear a full-face respirator. See also CoP 29.



Figure 17.2: Half masks used for particulates, with P3 filter

Training and competence

All ABB Marine & Ports staff who work on board a ship must be instructed on the content of this CoP.

Monitoring and checking

Incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

A record of the safety briefing must be kept in respect of both ABB engineers and contractors.

CoP 17: Noise hazards

Introduction

This Code of Practice (CoP) provides ABB Marine & Ports staff with practical information on the hazards and risks involved in exposure to high noise levels while working on board a ship or generally within a shipyard. It tells what precautionary measures to take to reduce or preferably eliminate the risk and to protect their hearing in any event.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Noise induced hearing loss can occur over a relatively short period of exposure and at noise levels that at first do not appear to be that high. Noise (sound pressure) is transmitted through vibrating air and causes damage to the fine hair cells located in the inner ear. These hair cells convert sound vibrations into electrical signals which are transmitted via the auditory nerve to the auditory center of the brain. When these cells become so damaged that they can no longer convert the sound into electrical signals that portion of hearing is lost. The process is irreversible and is therefore permanent. Higher frequencies which are part of the speech band are affected first and this directly affects the ability to hear.



There is no medical cure for noise induced deafness.

WARNING

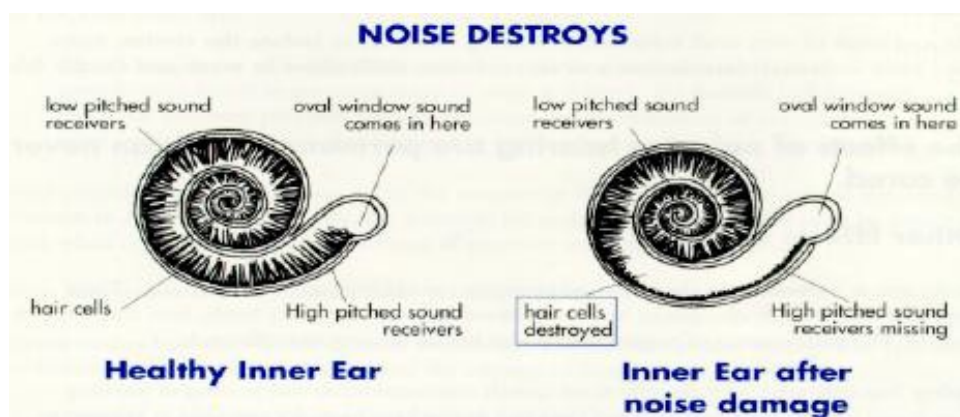


Figure 18.1: Illustration of hair cell damage

Damage to hearing is caused by exposure to high noise levels measured in decibels, dB(A), and by the duration of exposure measured in hours and minutes.

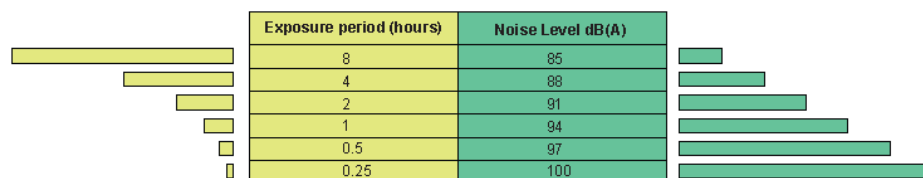


Figure 18.2: Equivalent noise exposures

A person exposed to 100 dB(A) for 15 mins receives the same noise dose as a person exposed to 85 dB(A) for 8 hours. Because the decibel scale is logarithmic, an increase of 3 dB(A) in noise doubles the noise energy and therefore the potential damage or risk of hearing loss.

It is necessary to wear hearing protection for the whole period of exposure. If the noise exposure is less than 85 dB(A), preferably 80 dB(A), the risk of noise induced hearing loss is eliminated for most people. However, a small number of people could still suffer some damage.

Operational controls

Pre-employment

All new employees who will work in high noise level environments at customer sites must take an audiometric test to ensure that any pre-existing hearing defects are known, and that ABB has a record of the hearing performance. It is important for both the employee and ABB to ensure that persons with existing hearing impairment are not placed in areas with a significant risk of hearing loss. It is also important to have a benchmark of any existing hearing impairment.

Hazard identification and risk assessment

It is not possible to identify every noise hazard zone at a shipyard or on board a ship. It is assumed that everyone who works for ABB Marine & Ports in such an environment is exposed to noise levels exceeding 80 dB(A) at some point. A ship or a shipyard is a noise hazard zone particularly when working inside the ship. Traveling by helicopter also involves high noise levels.

Hearing protection equipment must be available when entering a ship or a shipyard. It must always be worn when working or moving around in the areas of high noise level (for example, running engines, operating hand tools, grinding, machining, use of compressed air). This applies even if the area is not marked with noise hazard signs showing mandatory requirement.



If you cannot have a normal conversation with someone close to you without shouting, then the noise level is likely to be above 85 dB(A) and hearing protection should be worn.

NOTE



Figure 18.3: Noise hazard signs



Figure 18.4: Types of hearing protection

Training and competence

The content of this CoP must be communicated to every project team member before starting any work on site. Training includes instruction on the following topics:

- Effects of noise on hearing ability and general well-being.
- Noise induced hearing loss is irreversible and therefore permanent.
- Noise induced hearing loss can occur with relatively short exposures.
- Measurement or recognition of noise levels and typical levels at a shipyard.
- Types of personal protective equipment available.
- Process for obtaining the correct equipment at ABB Marine & Ports.
- Care and maintenance of equipment including need for cleanliness.

Monitoring and checking

Site Manager or nominated person is responsible for ensuring that all project team members are aware of noise hazards before starting any work on site. They also periodically check that proper hearing protection is in use. Contract personnel working on behalf of ABB are also included.

HSE/SA audits and reviews conducted by the LBLs must include checks that suitable hearing protection is both available and worn in high noise areas.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

The following records must be kept:

- Briefing of this CoP
- Issue of any personal hearing protection (non-disposable)
- Any noise surveys carried out at site.

CoP 18: Asbestos

Introduction

As a general principle the ABB Marine & Ports business does not include the use of asbestos products. While asbestos as a material is not involved in the manufacture and installation of ABB Marine & Ports products and services, there is the potential of exposure to asbestos when working on customer premises and in particular on ships.

This Code of Practice (CoP) guides ABB employees who work in the marine and crane environment and where they can be exposed to asbestos materials by accident if the asbestos material is damaged or disturbed by other persons working in the same area.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working at customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Types of asbestos

Asbestos is a fibrous mineral that occurs naturally in many parts of the world. It exists in two basic forms, serpentine and amphibole. The serpentine form produces fibers that are curled whereas the amphibole forms produce fibers that are straight and needle-like.

The most dangerous are small fibers whose length is greater or equal than 5 μ . Once inhaled they can get into the lung and potentially cause a number of respiratory diseases such as asbestosis (a fibrosis of the lung), lung cancer and mesothelioma (a cancer of the inner lining of the chest).

The main types of asbestos that you are likely to encounter are chrysotile (white), amosite (brown) and crocidolite (blue).

Hazard identification

Asbestos is a versatile material that has variety of different uses or applications which are summarized below.

HIGH POTENTIAL



LOW POTENTIAL

- Sprayed coatings and laggings particularly for insulation
- Loose fill and in blankets and mattresses
- Insulating boards, blocks and composite products
- Ropes, yarns and cloth
- Millboard, paper and paper products
- Asbestos cement products
- Bitumen roofing felts, damp proof courses
- Asbestos paper backed vinyl flooring
- Un-backed vinyl flooring and floor tiles
- Mastics, sealants, putties and adhesives
- Textured coatings and paints containing asbestos
- Asbestos reinforced PVC and plastics.

Banning of different forms of asbestos has gradually taken place since the 1970s. In 1976 the marketing and use of most forms of asbestos including chrysotile was banned throughout the EU. Amphiboles have been banned since

1985 and chrysotile was finally banned in the 1990s. However, there is still a significant amount of the material remaining in existing buildings, plants and equipment.

Under the International Maritime Organization SOLAS convention (chapter 11-1 reg 3-5) asbestos materials have been banned in new installations on ships from 1st January 2011. However, ships built before 2011 still contain asbestos materials in many cases. The following table represents an indicative list taken from the IMO guidelines.

Table 10: Indicative list of likely location of asbestos on board ship

LOCATION	COMPONENT
Propeller shafting	Packing with low pressure hydraulic piping flange Packing with casing Clutch Brake lining Synthetic stern tubes
Diesel engine	Packing with piping flange Lagging material for fuel and exhaust pipe Lagging material for turbocharger
Turbine engine	Lagging material for casing Packing with flange of piping and valve for steam line, exhaust line and drain line Lagging material for piping and valve of steam line, exhaust line and drain line
Boiler	Insulation in combustion chamber Packing for casing door Lagging for exhaust pipe Gasket for manhole and hand hole Gas shield packing for soot blower Packing with flange of piping and valve for steam line, exhaust line, fuel and drain line Lagging material for piping and valve for steam line, exhaust line, fuel and drain line
Incinerator	Packing for casing door, manhole and hand hole Lagging material for exhaust pipe
Auxiliary (machinery) pumps, compressors, oil purifier, crane	Packing for casing door and valve Gland packing Brake lining
Heat exchanger	Packing with casing Gland packing for valve Lagging material and insulation
Valves	Gland packing with valve, sheet packing with piping flange
Pipes and ducts	Lagging material and insulation
Tanks (fuel, hot water, condenser) and other equipment	Lagging material & insulation
Electric equipment	Insulation material
Ceiling, floor and wall in accommodation areas	Tiles, partition boards including fire doors
Air conditioning system	Sheet packing, lagging material for piping and flexible joint
Miscellaneous	Ropes Adhesives, mastics, fillers and sealing putty Sound damping and molded plastic products Electrical bulkhead penetration packing Circuit breaker arc chutes Pipe hanger inserts Weld shop protectors or burn covers Fire-fighting blankets, clothing and equipment

(Extract from IMO guidelines for the development of the inventory of hazardous materials)

Maintenance workers are the most likely persons to be most at risk. Also, others can be at risk when they do similar work involving working on plants, equipment or structures. They could disturb the material and generate airborne concentrations of fibers. This is most likely with asbestos insulation or sprayed coatings which contain high concentrations of asbestos and therefore are more likely to generate airborne fibers, particularly if the coatings are not sealed or have suffered mechanical damage. This is potentially the most likely source of exposure within an engine room where insulating coatings would have been used to insulate items of a plant to prevent heat loss, such as boilers and calorifiers.

Typical exposures that are likely to be encountered where there is poor control are listed in the following table.

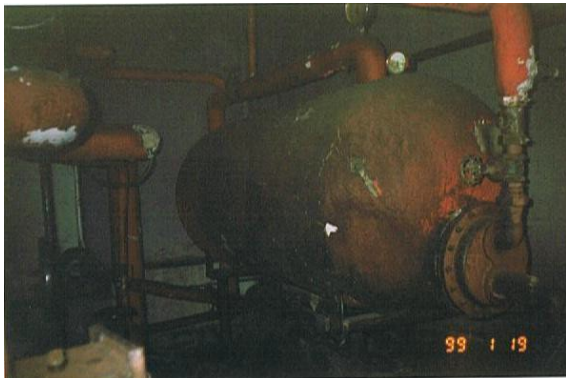
Table 11: Typical Exposures of Asbestos where Control is Poor

Task	Typical exposure (fibers / ml)
Dry removal of sprayed coating	Up to 1000
Dry removal of lagging	Up to 100
Drilling of asbestos insulation board (AIB)	Up to 10
Use of jigsaw on AIB	Up to 20
Hand sawing AIB	Up to 10
Sweeping AIB debris	Up to 100
Drilling asbestos cement	Up to 1
Hand sawing asbestos cement	Up to 1
Use of circular saw on asbestos cement	Up to 20
(Source: HSE - Asbestos Essentials)	

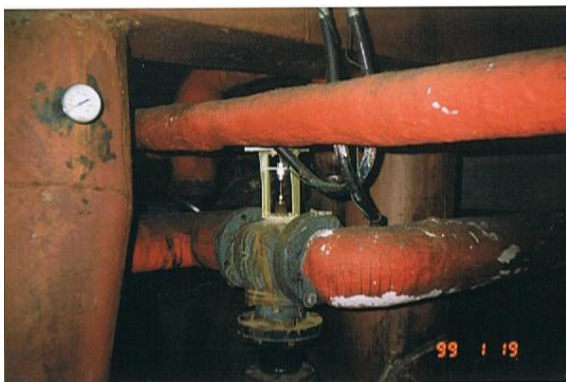
Where asbestos is bound in to form a composite material that has been formed into a specific product or component (e.g. a gasket or an insulating board) then it is not likely to generate airborne fibers unless it is mechanically worn down or damaged in some way. The exposure limit for asbestos within the EU is 0.1 fibers / cm³ for an 8-hour time weighted average (TWA).

Identifying asbestos

Asbestos is used in many ways and can be found in many different locations within a building structure including a ship. The following pictures give a general overview of likely locations of asbestos material on board a ship.



Damaged asbestos thermal insulation



Damaged asbestos thermal insulation on pipework



Asbestos Fire Blanket



Remains of Asbestos (of flange gasket)



Asbestos Fire Blanket In Use



Asbestos blanket

Operational controls

General

Working on board a ship has many hazards. Some are caused by the many interfaces between ABB's activities and those of other parties working on the vessel while it is in a dry dock for repairs. Hazards can arise as a result of other persons working in the same area as ABB and because their work could adversely affect ABB engineers and those who are immediately involved with the work.

If ABB's activities are not properly controlled, they could also adversely affect other persons in the same area. As with all risks, there is a preferred hierarchy for applying suitable controls measures. First, consider risk avoidance and elimination and then apply risk reduction, isolation and control measures and as a last resort, use personal protective equipment.

Possible accidental exposure

If ABB engineers work on board a ship and it becomes apparent that there is asbestos or potentially asbestos containing material in the work area or within the access to it, follow the general advice and guidance:



Do not put yourself at risk from breathing in asbestos fibers.

If in doubt, leave the area and contact your supervisor and LBL HSE/SA advisor.

WARNING

1. When contracting with the dockyard or ship owner, ask them whether there is asbestos present on board a ship and its location. The type of asbestos is also useful. There may already be an inventory that provides useful information about the location of the material. This information should be in the health and safety plan.
2. If you suspect that there is asbestos and airborne fibers in the work area, do not start the work. Report your concerns immediately to your ABB supervisor at the site.

3. If you have started the work and think that the air has asbestos fibers as a result of work being done by other contractors on the ship, wear a suitable respirator, such as a disposable or reusable half mask respirator with a P3 filter. Once protected, leave the area and report the matter.
4. If possible, attach a sign or notice to indicate that the materials may contain asbestos and should not be disturbed.
5. If the asbestos material has been damaged then it may be necessary to report the matter to the Chief Engineer or his representative on board.
6. If you have dust or debris on your clothing, carefully remove the clothing and put it in a plastic bag and label it suitably. If possible, take a shower before wearing a new set of clothes.
7. ABB Supervisor contacts the ABB HSE/SA advisor and Responsible (LBL) Manager for advice on what actions to take. Send possible samples of the dust or suspect material and photographs.
8. Follow any subsequent advice from the ABB HSE/SA advisor and Responsible (LBL) Manager.
9. Any additional sampling must be carried out by an ABB appointed or approved specialist.

Respiratory protective equipment (RPE)

If ABB staff or contractors are potentially exposed to asbestos by accident, they should immediately wear suitable RPE as described in CoP 29.

Training and competence

All ABB employees working on customer sites must receive training on the content of this code of practice.

Monitoring and checking

Active monitoring

Do regular checks to ensure that:

- In new build projects ABB shall stipulate with the customer that no asbestos materials shall be present on board the vessel or used.
- In respect of each contract, the LBL asks the ship owner or shipyard on the likely presence of asbestos and its location.
- All ABB engineers and any contract staff are briefed on what to look for in terms of possible asbestos materials and what action to take if they suspect that they are at risk.
- ABB engineers and contractors have the correct PPE in case they need to use it.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

A record of the safety briefing must be kept in respect of both ABB engineers and contractors.

CoP 19: Chemical safety

Introduction

This Code of Practice (CoP) for ABB Marine & Ports guides on the safe use of chemical substances within ships. There is a separate CoP for compressed gases.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working on customer sites.








If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.




Hazards and risks

General

All chemical substances are currently classified according to their harmful effects.

Table 12: Classification of hazardous substances

SYMBOL	HAZARDOUS EFFECTS	SYMBOL	HAZARDOUS EFFECTS
	EXPLOSIVE (E) Solid liquid, pasty or gelatinous substances and preparations which may react exothermically (give out heat) without atmospheric oxygen thereby evolving gases which under certain conditions may detonate etc. when partially confined.		EXTREMELY FLAMMABLE (F+) Liquid substances and preparations having an extremely low flash point, (typically < 0°C), and a low boiling point. Includes gaseous substances which are flammable when in contact with the air.
	VERY TOXIC (T+) Substances and preparations which in very low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via the skin.		HIGHLY FLAMMABLE (F) Liquid substances and preparations having a very low flash point, typically 0°C - 32°C.
	TOXIC (T) Substances and preparations which in low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via the skin.	No symbol	FLAMMABLE Liquid substances and preparations having a low flash point, typically > 32°C.
	HARMFUL (Xn) Substances and preparations which may cause death or acute or chronic damage to health when inhaled, swallowed or absorbed by the skin.		OXIDISING AGENT (O) Substances are preparations which give rise to a highly exothermic reaction in contact with other substances particularly flammable substances.

SYMBOL	HAZARDOUS EFFECTS	SYMBOL	HAZARDOUS EFFECTS
	IRRITANT (Xi) Noncorrosive substances and preparations which through immediate, prolonged or repeated contact with the skin or mucous membrane may cause inflammation.		DANGEROUS FOR THE ENVIRONMENT(N) Substances and preparations which, were they to enter into the environment, would present or might present an immediate or delayed danger for one or more components of the environment.
	CORROSIVE (C) Substances and preparations which may, on contact with living tissues, destroy them.		

There is no international system for classifying hazardous substances for supply. In the EU there has been a long-established system for classifying hazardous substances according to their harmful effects as mentioned in Table 12.

There is a move towards harmonization with the UN's Globally Harmonized System of Classification and Labelling of Chemicals (GHS), see the following table. There will be a gradual migration across.

Table 13: Change to UN globally harmonized system for hazard labels

From

To GHS



In some special cases, carcinogens, mutagens etc. will be classified as toxic with additional information to describe the type of carcinogen and its class (1, 2 or 3).

Using or being exposed to hazardous substances when working on a ship increases the hazard level. The hazard level increases particularly when working in enclosed areas or in certain confined spaces such as an Azipod, where fumes, gases or vapors can collect because of the lack of natural ventilation.

Labeling

All substances must be labelled. Dangerous substances or preparations must currently have information labels as shown below. The information will be replaced with the UN symbols in due course.

NAME OF SUBSTANCE	
	Risk phrases e.g. toxic by inhalation
	Safety phrases e.g. wear suitable personal protection gloves, eye protection
EC number	
Name and address of supplier	
Emergency telephone number	

Figure 20.1: Example of a typical label under current system

- **Name of substance**
Identification of substance or preparation
- **Risk phrases**
Risk phrases summarizing the main hazards or harmful effects
- **Safety phrases**
Safety phrases summarizing the main precautionary measures
- **Hazard symbols**
Pictograms for the hazard
- **Contact details for supplier**
Name and address of supplier



WARNING

If a substance or a preparation has no label on the container, do not use it.

Material Safety Data Sheets (MSDS or SDS)

No hazardous substances or other proprietary materials should be on the ship unless they are all in labelled containers and there is a MSDS available. The MSDS provides the necessary information about the hazardous nature of the substance, what precautionary measures are required and any emergency measures that may be necessary. It includes information on disposal.

Operational controls

General requirements

If a chemical substance or a proprietary material is used on site, the following measures must be in place:

- All substances or preparations shall be labelled as to their contents as shown in Figure 20-1.
If there is a container on the ship without any label, do not use it.
- A SDS shall be available on the ship yard for any substance that is likely to be used.
- A risk assessment should be in place setting out the hazards and the required safety controls.
- Any person using a chemical substance shall consult the SDS for applying appropriate controls.

Toxic routes

Chemical substances can affect the body and its systems in a number of ways depending on the toxic route or pathway. Substances can be ingested through poor personal hygiene, inhaled or absorbed through the skin to enter the blood stream and then affect the various organs in the body.

Inhalation

The inhalation hazard is the most difficult to control. Inhalation is a high risk where the chemical substance is in use within a confined space, such as a compartment on board ship or in an Azipod unit.

Consider the following factors when dealing with airborne contaminants:

- Substances can become airborne as a result of hot processes (such as welding), cold processes (such as grinding), or as an aerosol (such as spray painting).
- Exposure limits are usually shown as ppm or mg/m³ and specified in the MSDS. There is no internationally approved system, but the limits published by the ACIGH, the US industrial hygiene agency are generally accepted globally. They should not be exceeded.
- Any exposure to airborne contaminants should be reduced to as low a level as is reasonably practicable using local exhaust ventilation (LEV). In confined spaces where such chemicals are likely in use, local exhaust ventilation is a mandatory requirement.
- Where the use of LEV is not practical or is insufficient to control the exposure, suitable respiratory protective equipment (RPE) must be provided and worn. See also COP 29 on the selection and use of RPE. If you have any doubts, contact the HSE/SA Advisor.

Skin contact or skin absorption

The skin is porous, and some chemical substances can pass through the skin into the blood stream. In such circumstances the use of barrier protection in the form of gloves and eye protection are required. Barrier creams may also be used in addition.

Gloves are also appropriate where there may be an injection risk using high pressure tools.

Ingestion risks

For chemical substances or preparations with an ingestion risk the controls require:

- Provision of suitable barrier protection, for example, PPE (such as gloves and goggles)
- Prohibition of partaking of food and drink within the work area
- Provision of a place for workers to take their meal breaks and practice of good personal hygiene prior to partaking to food or drink.

Confined space working

Some chemical substances can be used in normal conditions without being a major risk to the operator. However, when used in a confined space, for example, within the compartment of ship or the Azipod system, the risk increases dramatically.

In such situations a separate rigorous risk assessment must be done including checking the atmosphere in the confined space. In such circumstances enhanced or additional controls are required. For more information, see CoP 22.

Training and competence

All ABB employees or contractors who work in a ship or shipyard, must be briefed on the contents of this code of practice.

The briefing includes the following:

- Details of the chemical substances to be used and their hazardous properties
- Health effects (acute or chronic) on the body
- Safety controls applied for storage, transporting, handling, and use
- Provided PPE and its care and maintenance
- Disposal arrangements
- Any relevant emergency arrangements.

Monitoring and checking

ABB Supervisor on site is responsible for ensuring that persons working in a ship or shipyard environment are briefed on this code of practice. Supervisor is also responsible for ensuring that there is an MSDS on site for each chemical in use and that all containers are properly labelled.

This CoP forms a part of any HSE audits and reviews conducted by the LBL.

If any confined space work is done without the use of self-contained breathing apparatus, atmospheric checks must be done as part of the Permit-to-Enter process to ensure that the confined space is free of contaminants and has sufficient oxygen or air.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Examination and checking of equipment

LEV systems

When local exhaust ventilation is provided, it must be inspected and checked regularly every month to ensure that it functions at the appropriate level of efficiency.

Care and maintenance

Keep personally issued personal protective equipment (not disposable), such as RPE, clean and stored in suitable place. See also CoP 10 and 29.

Sufficient supplies of disposable equipment, such as gloves, eye protection or disposable half mask respirators, should be maintained.

Documentation and records

Copies of the following must be available:

- MSDS for the chemical substances in use
- Risk assessment for the task and safe working instruction
- Monthly inspection records for personally issued respiratory protection (non-disposable)
- Inspection records of LEV equipment
- Inspection reports of any breathing apparatus provided.

CoP 20: Compressed gases in a ship

Introduction

Compressed gases supplied in cylinders are in common use throughout the industry and in particular in the marine sector. In a shipyard, compressed gases are more likely supplied via manifolds and multiple hoses. Their use on board a ship can create a number of significant hazards.

This Code of Practice (CoP) provides information about the safe handling and use of these materials when working on board a ship.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

General

Cylinders that contain compressed gases can create hazards such as:

- Effects of blast of gas under pressure
- Direct effects of the contents, such as toxic, flammable and corrosive
- Fire or explosion of flammable gases, such as propane
- Manual handling injuries from the movement of cylinders or falling cylinders
- Leaking of gas resulting in a build-up of concentration of gas, for example, oxygen enriched atmosphere in confined spaces.

Confined space working

Working within a ship can result in the above hazards whose significance increases because of the environment. A ship below decks is often a confined space and the use of gases in this environment increases the overall hazard. Most gases are also heavier than air and they accumulate in compartments or other similar places, such as Azipod propulsors. For work inside an Azipod propulsor, a separate rigorous risk assessment must be carried out including checking the atmosphere in the confined space. See hazard sheet 22.

Fire and explosion

Chemical properties of certain gases create significant fire and explosion risks. Oxygen enrichment is a hazard because the concentration of oxygen in air increases with the real possibility of a fire and explosion. This is a particular hazard on board a ship. If oxygen is allowed to accumulate, the fire characteristics of materials change dramatically leading to a serious fire. The increase of oxygen in air need only be 1% before this becomes a reality.

Propane and butane are two liquefied petroleum gases (LPG) and have wide use. Propane is generally used for flame cutting and burning, and butane tends to be used for heating. If not used carefully, serious incidents can result ranging from small burns or fires to serious explosions. The vapors are also heavier than air and accumulate, for example, in ship compartments, ducts and bulkheads. When vaporized, both propane and butane produce a large volume of gas at normal temperature and pressure, 230 times for butane and 270 times for propane.

Example: 1 liter of liquid propane, when vaporized, produces 270 liters of gas. The gas mixed with air at its lowest explosive limit of 2% produces 13 500 liters of flammable mixture which, if ignited, will result in a major explosion.

Operational controls

General

Best practices for storage, transportation and handling of compressed gases in cylinders:

- Compressed gases must have labels to identify their contents.
- Gas cylinders, especially the valves, are protected from weather (e.g. rain).
- Gas cylinder storage area must have good natural ventilation and cylinders should be stored in an upright position, on a flat surface and secured against falling over.
- Smoking is prohibited in the storage area and firefighting equipment must be readily accessible.
- Fuel gases must be stored separately from oxygen (more than 1 m apart).
- Cylinders should be lifted using suitable cradles and slings when using a hoist or crane.
- Pipe work connection checks are done to ensure that connections are of good quality with crimped fittings.
- Checks are carried out after use to ensure that valves always closed after use.
- Hoses are checked periodically for wear and damage.
- Flashback arrestors are used on cylinders containing fuel gases.



Figure 21.1: Flashback arrestors






Common gases and hazards



WARNING

Red and white must not be next to each other. They must always be more than 1 m apart.

Table 14: Common gases and hazards in a ship building and dry-docking environment

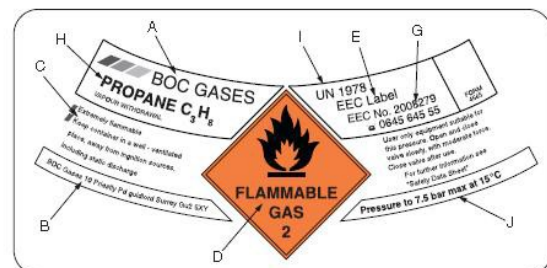
Gas	Color code		Places it accumulates	Hazardous effect	Prevention measures
Oxygen (O ₂)	White RAL 9010		Gas is heavier than air and will collect in low lying areas, pits, sumps etc.	Increase oxygen levels will increase the risk of fire. An increase of 1% can give rise to serious fires.	If you smell a leak close the valve in the distribution manifold or on the cylinder. Prevent sparks or other sources of ignition and any increase in temperature. Ventilate the space. Repair any leaking component e.g. valve, hose etc
Acetylene (C ₂ H ₂)	Maroon RAL 3009		Tends to be slightly lighter than air	Explosive when mixed with air	
Liquified petroleum gas LPG (C ₃ H ₈)	Red RAL 3000		Gas is heavier than air and will collect in low lying areas, pits, sumps etc.	Explosive when mixed with air	
Inert gases: Helium (He) Argon (Ar) Nitrogen (N ₂) Often used as shield gases in welding.	Bright green RAL 6018		Argon is slightly heavier than air and will collect in low lying areas, pits, sumps etc. Helium and Nitrogen are lighter than air	Will replace oxygen and hence cause suffocation	Inert gases are very difficult to detect as they are odorless. Check for leaks by applying soapy water to fittings.
Carbon dioxide (CO ₂)	Grey RAL 7037		Gas is heavier than air and will collect in low lying areas, pits, sumps etc.	Will replace oxygen and hence cause suffocation	Very difficult to detect as it is odorless. Check for leaks by applying soapy water to fittings.

Labeling

There is no internationally recognized standard for color coding of gases but within Europe there is an EN standard (EN1089). There is also a UN standard for hazard symbols. Gases are color coded according to the risk diamond on the main label as shown in the following table.

Table 15: Risk diamond and contents of main label of gas container

- A. Company name
- B. Address of the company
- C. Risk & safety phrases
- D. Hazard symbols (UN classification)
- E. EEC label
- F. Revision number
- G. EEC number if applicable
- H. Product name
- I. UN identification number and proper shipping name
- J. Additional information



Training and competence

Persons working on ships must know the contents of this Code of Practice.

If persons use compressed gases on site, they must:

1. Check equipment before use to ensure that it is in good order.
2. Check the area for smells to detect if there are any leakages. If there is any suspicion of any leak, call the nearest supervisor on the ship.



WARNING

Do not proceed until this is done.

3. On completion of the work, ensure that all regulators are fully closed.
4. At the end of the shift, check the regulators on the cylinders or on the manifold and remove the manifold and the hoses to the open air. If this is not done, gas can build up in a compartment of a ship if there is a leak or if the valve is not fully closed. This is very dangerous if the leak is oxygen.
5. If another contractor works in the same area, make sure that ABB's activities do not adversely affect the contractor's health or safety.

Monitoring and checking

- Supervisor is responsible for ensuring that persons who work on a ship are briefed on this Code of Practice.
- Individuals who work on a ship are responsible for following the requirements of this Code of Practice.
- This Code of Practice must be part of HSE/SA audits and reviews conducted by the LBLs.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

None required.

CoP 21: Hydraulic pressure

Introduction

Hydraulic power is widely used for machinery and tools in ABB Marine & Ports and in most cases quite safely with few incidents. The hazards of using such systems are often hidden and not obvious to workers.

This Code of Practice (CoP) reminds ABB Marine & Ports staff and contractors of the hazards and risks of hydraulic power systems and tools. It tells about the required control measures to mitigate the risks.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work with or near hydraulic pressure systems and tools.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

The hazards of hydraulic fluid systems include effects of high pressure contact with the fluid, fire, lacerations, burns, and in the case of hydraulic powered machinery, the potential for crushing in the event of failure.

Effects of high-pressure injection

Hydraulic systems store hydraulic fluid at high pressure, for example, at 150 bar (2000 psi). If a line fails, a jet of fluid at a very high pressure can be released. If the operator is in contact with the fluid stream, the fluid can be injected directly through the skin. This can result in serious damage particularly if the fluid penetrates muscles or organs. In severe cases this can lead to amputation as a result of possible gangrene. Fluid entered in the body must be removed by surgery. The risk is highest if operators search for pinhole leaks by using their hands.

Fire

Most hydraulic fluids are not highly flammable because their flash points range between 149°C - 315°C. Temperature of a hydraulic system can increase under normal operating conditions but without any significant increase in the risk of fire. However, if there is a high-pressure leak, the fluid atomizes and ignites on contact with hot surfaces or other sources of ignition, such as welding arc. The resulting fire is usually torch-like with a high heat release rate and can cause serious burns and so on. Where the release is confined, an explosion can result.

Mechanical damage

If there is a failure of a flexible hydraulic line, the line can lash about spraying oil in all directions and the impact of a flailing hose can injure people nearby.

Occupational health

Hydraulic oil is petroleum-based lubricating oil and contains certain additives. Avoid skin contact when working with the oil, wear gloves and avoid any prolonged breathing of its vapor, mist or fumes. Check the Safety Data Sheet (SDS) for use of correct PPE.

Operational controls

High pressure injection

High pressure injection injuries are probably the most likely with hydraulic systems and the majority are those that involve pinhole leaks. Pinhole leaks are often difficult to locate, and operators often use their hands to determine the location. Always use a piece of card or similar material to locate the leak. Do not use your hands as the fine jet of pressurized hydraulic fluid pierces the skin.

Maintenance

The prevention of fire involving hydraulic systems is based upon ensuring that the system and in particular any lines or flexible hoses are inspected or maintained.

Inspect all hoses, lines and associated fittings periodically but do not use hands to locate any possible pinhole leaks. Examine any deterioration carefully to determine if it is significant. If there is any doubt, replace the component. Typically, conditions requiring replacement:

- Any evidence of hydraulic fluid leakage at the surface of a flexible hose, or its junction with the metal and any couplings
- Any blistering or abnormal deformation to the outer covering of a hydraulic hose
- Any leakage at any threaded or clamped joint that cannot be eliminated by normal tightening or other recommended procedures
- Evidence of any excessive abrasion or scrubbing on the outer surface of a hose, rigid line or other hydraulic fitting. Where this has occurred then some modification will be required to protect the hose or line.
- Replace filters regularly.



WARNING

Do not use your hands to locate a pinhole leak in a hydraulic hose or line.

Summary

Don'ts

- Never work on a hydraulic system unless you have been trained and are competent.
- Do not disconnect any hoses or couplings without first making sure that the pressure is reduced to atmospheric.
- Never search for pinhole leaks in hoses using your hands, you can be injected with oil.
- Do not cross hydraulic lines.
- Do not remove cylinders until the working units are at rest on the ground or are otherwise supported or blocked.
- Do not connect a high-pressure pump to a low-pressure system.

Dos

- Always refer to the manual on the equipment being worked on and check the circuit diagrams.
- Maintain a work area that is free from obstruction and general slipping hazards.
- Use the correct personal protective equipment (PPE) which includes safety footwear, overalls, chemical resistant gloves and eye protection. See the Code of Practice on PPE.
- Always block, secure or lower to the ground any equipment that might move, rotate or fall.
- Always relieve system pressures including any accumulators that may be in the system.
- Use test equipment, e.g. pressure gauge, that has a higher rating than the system to apply a suitable factor of safety.
- Always clean up any spillage promptly to not leave a slipping hazard.
- Do not work under any hydraulic equipment unless it is made safe by mechanical propping, lowering to the ground and so on.
- Always wash your hands before eating or drinking.

Emergency preparedness

When you work with hydraulic systems and tools, make sure that you know the emergency eye wash facilities and general first aid. If a skin injection injury occurs, see a medical practitioner immediately.



Do not leave it.

WARNING

Check the location of fire extinguishers and the emergency means of escape.

Training and competence

ABB Marine & Ports staff must be briefed on the requirements of this CoP.

Monitoring and checking

Inspect hydraulic hoses and connections on a regular basis according to the manufacturers' instructions.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

None required.

CoP 22: Entry into Azipod

Introduction

This Code of Practice (CoP) provides ABB Marine & Ports staff and contractors with practical information about the hazards and risks of entering Azipod and related confined spaces, and about the required controls.

Entering confined space is always permissible work. ABB and customer practices to be followed.

This CoP does not provide any permit to access Azipod and is not all-inclusive. Persons entering the Azipod confined spaces must be authorized and trained and required controls must be in place. For further details, contact your HSE/SA advisor.

Confined spaces

Examples of confined spaces on board:

- Azipod propulsor, cooling air unit and slip ring unit
- Double-bottoms and compartments in ships
- Storage tanks
- Rooms or areas with no or poor ventilation, such as cable ducts.

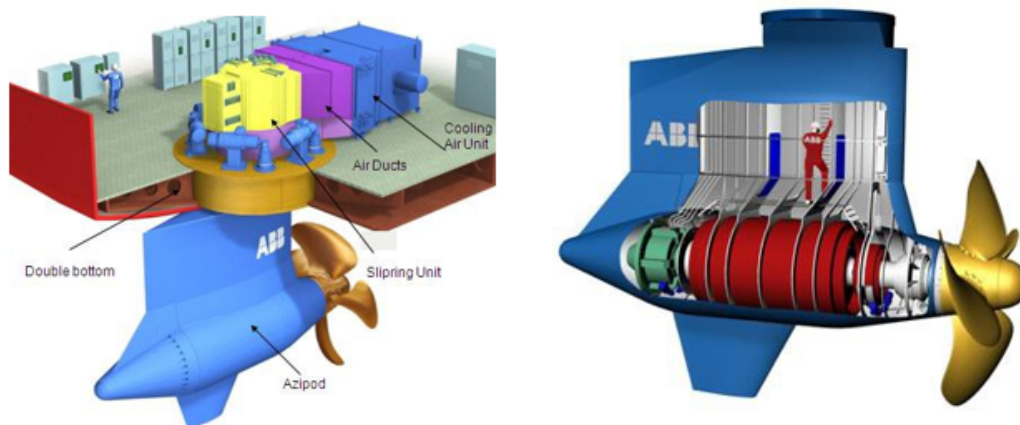


Figure 23.1: Examples of confined spaces related to Azipod system

How to identify a confined space

- Limited openings for entry and exit
- Unfavorable natural ventilation
- Not designed for continuous worker occupancy
- Potential to contain hazardous substance
- Potential to have hazardous energy

Scope

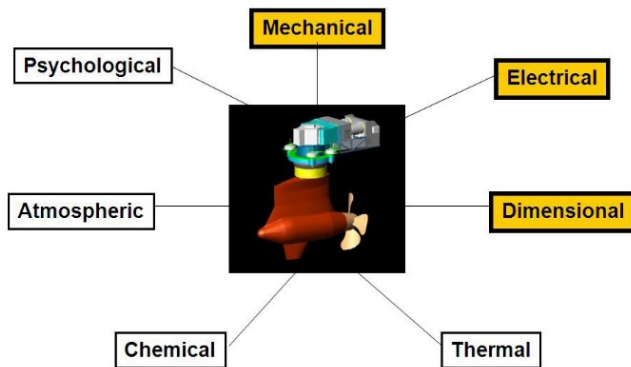
This CoP applies to all ABB Marine & Ports employees and contractors who work on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard shall be followed. In such cases this must be documented.

Hazards and risks

Employees can be exposed to the following hazards (but not limited to) when they are inside the Azipod system:

- Atmospheric
- Moving mechanical parts
- Electrical live parts
- Vertical entries
- Oil contamination that can cause skin irritation
- Thermal, such as the high temperature of the propulsion motor
- Inconveniences due to the confined space.



Operational controls

Risk avoidance

As with health and safety risks, the hierarchy of control should be properly applied, and risk avoidance is the best and most preferred option. If it is possible to do the work without entering the Azipod system, the working method should be preferred.

If it is necessary to enter the Azipod system, answer the following questions.

Before entering the Azipod confined space, can you answer YES to all of the following questions?

- Are you authorized to enter this confined space?
- Is the hazard assessment completed?
- Are you trained to do this? Do you have a valid Azipod Space Training or equivalent?
- Is the pre-entry testing and inspection completed?
- Are the rescue arrangements in place, in case something goes wrong?
- Is LOTO completed?
- Is ventilation working?



WARNING

If you answer NO to any of these questions, you are not allowed to enter the Azipod system.

Risk reduction and control

The following actions are required to ensure protection of workers from hazards in confined spaces.

Entry without respiratory breathing equipment

Entering the Azipod confined spaces requires special training, special tools, some specified PPE, rescue tools and rescue personnel. Details of these requirements are trained as part of the Azipod Space entry training. Person responsible for sending the personnel to work inside Azipod confined space must verify that all required controls are available on site when the work takes place.

**WARNING**

Minimum of two trained persons are required for any entry into the Azipod system.

- One enters the Azipod system.
- One is the safety person in the Azipod room.

**WARNING**

Never enter the confined spaces without first making sure that the atmosphere is safe.

Acceptable limits for entry without self-contained breathing apparatus are listed in Table 16 and 17.

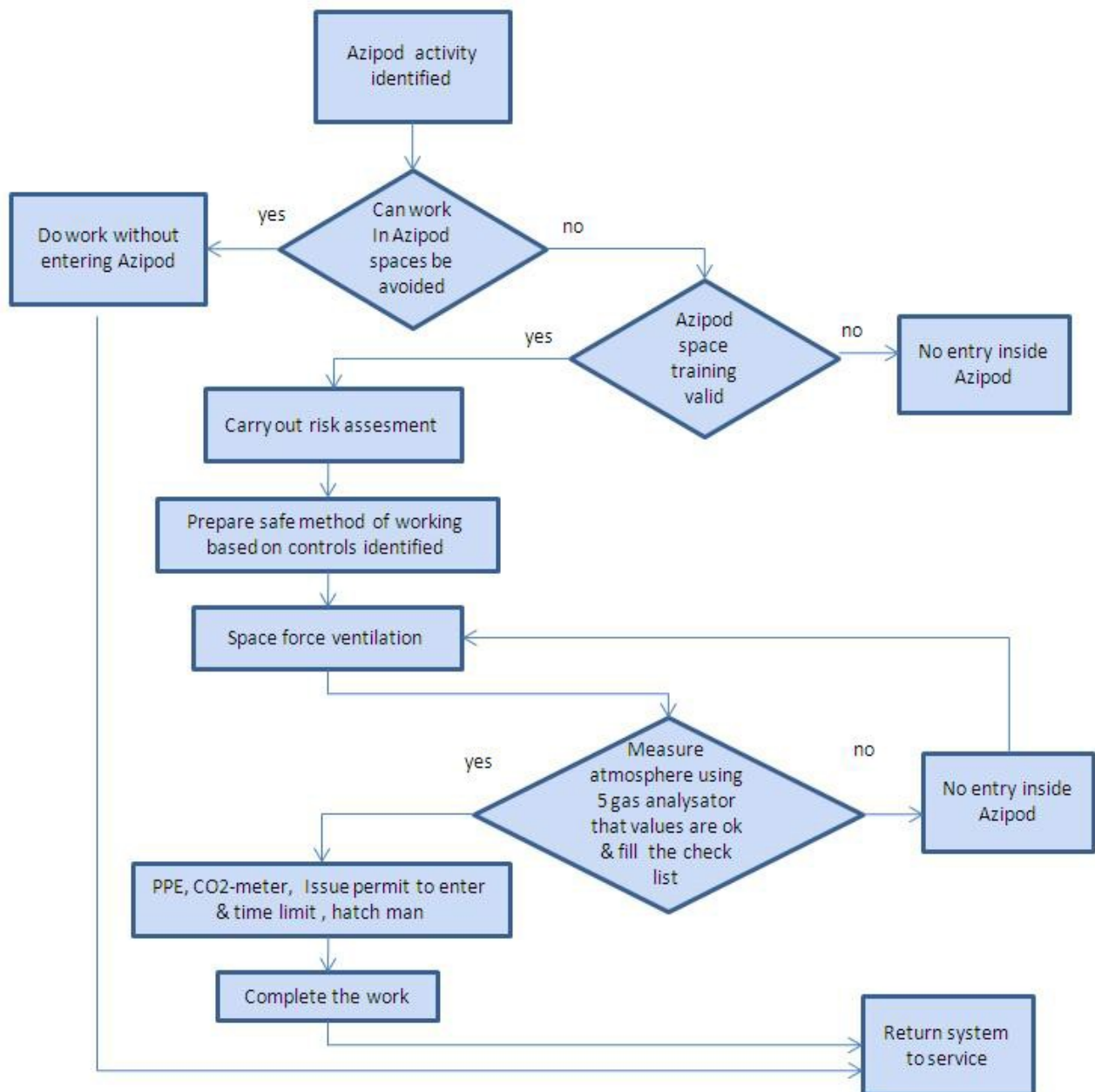
Table 16: Oxygen levels in air and their health effects

Level of oxygen / air	Health effect
> 22%	Oxygen enriched atmosphere and fire
20.8%	Normal - safe for entry ($\pm 0.2\%$)
19.5%	Oxygen deficient atmosphere
16%	Impaired judgement and breathing
14%	Rapid fatigue and faulty judgement
11%	Difficulty in breathing and death

Table 17: Acceptable substance limits

Substance	Acceptable limits
Oxygen O ₂	Greater than 19.5% and less than 23.5%
Flammability (LEL)	Less than 10% of lower explosive limit (LEL)*
Carbon monoxide (CO)	Less than 30 ppm**
Hydrogen sulphide (H ₂ S)	Less than 10 ppm**
Other substances	Less than permissible exposure limit (PEL)
* same as lower flammable limit (LFL)	
** parts per million	

Flow diagram for use in drawing up a permit to enter the Azipod confined space:



Entry for rescue

Entry for rescue requires certified Azipod confined space entry training, ensuring persons capability to use the rescue equipment and correct rescue methods.

In case the rescued persons are unconscious or confused, that is, there are any signs that the atmosphere is endangered, the atmosphere must be secured before entering for rescue.

Training and competence

All persons who work in the Azipod confined space must be instructed and trained properly on:

- Azipod confined space training (working and rescue as specified)
- Hazards of Azipod confined spaces
- Documentation and checklists
- Operation of the gas monitor
- Use of safety harness and lanyard
- Other required PPE.

Protective equipment

The required tools and PPE for Azipod confined space works:






- a. General tools
- b. PPE
- c. Rescue tools.

All tools and PPE must be fit for purpose and comply with the relevant EN or ANSI standard or their equivalent. The following lists are indicative.

General tools





For practical reasons (less travel items), it is recommended to make arrangements with the customer for having the general tools on board a vessel and an inspection process. Following table shows the general tools.

Table 18: General tools

Tool	Quantity	Description
	Retractable life-line 1 pc. Min. 5 m	To avoid tangling, consider using rope for releasing the lifeline up and for pulling it down if several people are entering.
	Anchor point(s)	Suitable for the location, use if a permanent one is not available.
	Screw lock carabineer	Set of screw lock carabiner, with different openings and sizes.
	Climbing carriage 1 pc.	For Azipod X product only.
	Atmospheric safety device	Min. 4 gases. For the monitored substances, see Table 17.

Personal Protective Equipment (PPE)

The following is an indicative list of PPE and other safety equipment that must be provided for all persons who enter the Azipod confined spaces. Requirements for general PPE on site are listed in CoP 10.

PPE	Note	
	Integrated safety harness and coverall	Alternatively, safety harness and coverall
	Safety cap, with a small visor or without a visor	Instead of a safety helmet
	Led headlight	
	Safety glasses and safety shoes	Other PPE based on need
	Portable atmospheric safety device	For monitorin O ₂

Rescue tools

For practical reasons (less travel items), it is recommended to make arrangements with a customer for having the rescue tools on board a vessel and an agreed inspection process. The rescue tools are:

Tool	Quantity
Tools listed in Personal Protective Equipment (PPE) on page 111 .	1 set
Rope, abrasion resistant	50 m / rescuer
Rope, abrasion resistant	110 m / lifted person
Rope belayer brake	1 pc.
Double pulley	2 pcs.
Rope clamp, right-handed	2 pcs.
Spreader	1 pc.

Tool	Quantity
Neck support, adjustable	1 pc.
Seal for rescue pack	20 pcs.
Sealed box for rescue tools	1 pc.



Figure 23.2: Example of pre-assembled lifting equipment, ready to use in emergency



WARNING

Trained personnel must do the rescuing. Always make sure that the atmosphere is safe before entering.

Monitoring and checking

The LBL ensures that, where Azipod space working is required, SOT and any scheduled safety inspections include checking of compliance with the procedure for confined space working. This includes:

- Checking that employees have been trained and instructed in the requirements.
- That they follow the requirements when working in confined spaces.
- Permits are properly completed and issued by the supervisor.

The confined space program must be evaluated on an annual basis to ensure that the program is functioning as required to protect confined space workers.

All tools and PPE must be checked, tested or calibrated at least once a year. Follow the standard EN 365 "Personal protective equipment against falls from a height – General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging" or equal.

Documentation and records

The following records must be kept:

- Personnel qualification and training records must be maintained for a minimum of five years.
- Records pertaining to an incident must be maintained for the duration of the involved individuals' employment.
- Valid calibration records of atmosphere testing devices.
- Entry permits must be retained for the duration of the project.
- Records of inspection of safety harnesses and lanyards to be retained for 12 months.

CoP 23: Falling objects

Introduction

This Code of Practice (CoP) provides guidance to ABB Marine & Ports staff and contractors on the required safety precautions to protect persons below the ship who are at risk from objects falling from the decks above to the bottom of the dry dock.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors working on customer sites.

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

On any work site where work is done on different levels, tools and other items can always fall. Every time a ship is in a dry dock there are many different contractors who work on the vessel at different locations. Works such as blasting, painting, outer deck works, and rail works can be done on the side of the ship.

These risks especially affect ABB Marine & Ports personnel who work on the bottom of the dry dock during service of Azipod propulsors. The main hazard is not when persons work under the ship but when they walk in and out of the area and can be in a drop zone.

It is a bad practice to get rid of material by throwing it over the side to the dock bottom for collection and disposal.

Operational controls

Initial on-site meeting

One of the most important controls is that the shipyard advises all the contractors on the vessel that ABB personnel work below the ship on the bottom of the dry dock.

Another key control is that ABB Site Manager asks in the regular shipyard meetings what works will be done at the aft area of the vessel. Pay attention to works that are done on the exterior area of the vessel. If any such works are done, make sure that the shipyard in particular informs these teams of ABB's presence below the vessel aft.

Physical protection

One way to greatly reduce the risk from falling objects is to provide a dedicated access point around the stern of the vessel. A better way is to construct the access point of simple scaffold tubes to form a simple corridor with the scaffold boards acting as a crash deck.

Instruct everyone to always use the dedicated access point and the risk of any falling object landing on a person is virtually eliminated. The corridor should be long enough to ensure that persons can leave the safety of the underside of the vessel without being exposed in the drop zone which is next to the ship's side.

Personal Protective Equipment

When working at a dry dock, all personnel wear a type-approved and valid safety helmet or hard hat to protect from objects falling from the work area or from other parts of the ship. For more information, see CoP 10.

Training and competence

No special training is required. All persons must attend a site induction where access to the work area and egress from it is told.

All persons must however be briefed on the requirements of this CoP.

Monitoring and checking

The Supervisor on site is responsible for ensuring that a safe means of access is provided, and everyone uses it. Compliance must be checked during SOT.

Documentation and records

None required.

CoP 24: Azipod hauling and lifting operations

Introduction

ABB Marine & Ports does service and maintenance on Azipod propulsors. Sometimes the maintenance work requires the pull-out of the entire Azipod rotor, sometimes just the components, such as the hull cap, propeller, DE or NDE bearings, or all.

The works can take place at dry docks around the world and typically in close cooperation with a local shipyard and the ship operator.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work with Azipod propulsors.

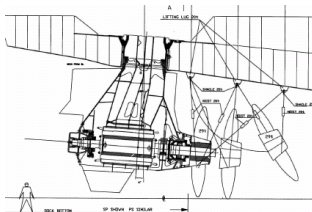
If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Typical Azipod shaft line works during dry-docking

Shaft line overhaul

Overhaul of the Azipod shaft line typically has three main steps:

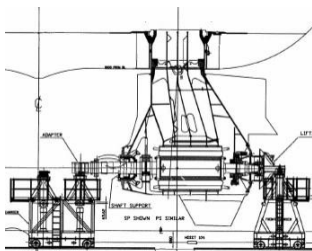
1. Drive end works, including the removal of the propeller



2. Non-drive end works (removal of the hull cap and the bearing)



3. Overhaul of the shaft line



Part	Weight
Propeller	25...75 tons

Part	Weight
Propeller cap	3...6 tons
Shaft line	65...125 tons

Thrust shaft and bearing change

In some cases, the thrust bearing can be changed individually with special tools without the pull-out of the entire rotor.

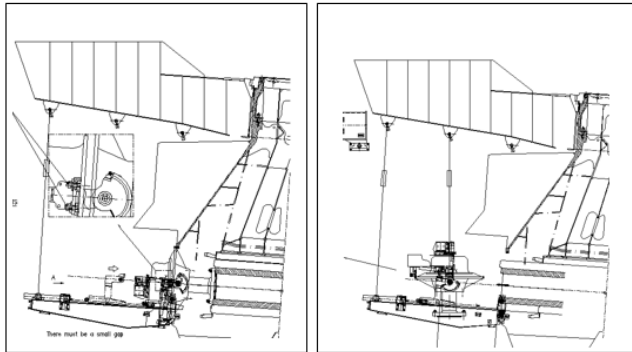


Figure 25.1: Thrust bearing change with a special lifting tool

Hazards and risks

Typical hazards and risks of dry docks are communicated to all employees who work on site. Information on these risks is most commonly received at site safety trainings. The sites also often use safety signs that show hazardous or risky work areas.

This CoP uses these signs to show the risks of Azipod hauling and lifting operations.



Figure 25.2: Typical safety signs at dry-docking site



Shape, color and message text language on signs can vary in different countries. If you have any questions about the signs, ask ABB Site Manager or a local safety contact person for clarification.

NOTE

For more information on safety signs, see CoP 7.

Typical risks of dry-docking works

The most typical risks of the hauling and lifting operations of the shaft line are listed below. The risks are collected from near miss reports at dry-dockings.

- Heavy lifting
 - Lifting tools (hydraulic and pneumatic)
 - Lifting eyes (quality of steel and welding)
 - Communication during operations



Use ABB-owned and well-maintained equipment. If you use equipment of other parties, ensure its condition and the competence to use it before use. Make sure that lifting eyes are suitable for use.

NOTE

- Fall risk when working on scaffolding (see CoP 15)
 - Scaffolding safety culture
 - Scaffolding inspection procedure in different countries
- Traffic at dock bottom (see CoP 6 and CoP 23)
 - Forklift and other traffic near the Azipod work area
- Airborne hazards (see CoP 16)
 - Flying particles from grinding or welding
- Tools dropped from higher decks (see CoP 23)

Always check the risks from the project HSE plan and the site-specific HSE Risk Review matrix.

Marine, On-site works EVALUATION OF RISKS ON SITE		Updated on 17 March 2019 I. Svendsen, J. Rasmussen, J. H. Holten				
DESCRIPTION OF THE HAZARDOUS SITUATION	UNDERLYING CAUSES	ACTIONS	NOTE:	Probability of residual	Risk magnitude 1-3	Level of risk
Third party equipment	Insufficient competence for operation, condition of equipment	Use own, well maintained equipment. Ensure the condition and competence when using other parties' equipment (3AFV000245 Emergency on site))				
Lifting manually	Lifting aid not available	Use lifting aid whenever possible, and use the correct lifting method (3AFV000245 Emergency on site))				
Lifting using a lifting aid	Insufficient competence for operation, condition of equipment	Use own, well maintained equipment. Ensure the condition and competence when using other parties' equipment (3AFV000245 Emergency on site))				
Lifting gear in the store	Poor storage conditions, Availability of lifting aid	Use sub contracting when possible (3AFV000245 Emergency on site)) The safety of scaffolding to be ensured by in-house inspector				
Scaffolding and ladders	Deficient solutions	Pay attention to climbing routes and fall guards Valid scaffolding work safety training Use of safety harnesses as per instructions (3AFV000412 Working in high places) (3AFV000245 Emergency on site))		1	3	3
Hand tools	Foreign tool	Use own, well maintained equipment. Ensure the condition and competence when using other parties' equipment (3AFV000245 Emergency on site))				
Hand tools	The tool is unsafe	Change safe hand tool (3AFV000245 Emergency on site))				

Figure 25.3: Example of HSE Risk Review matrix

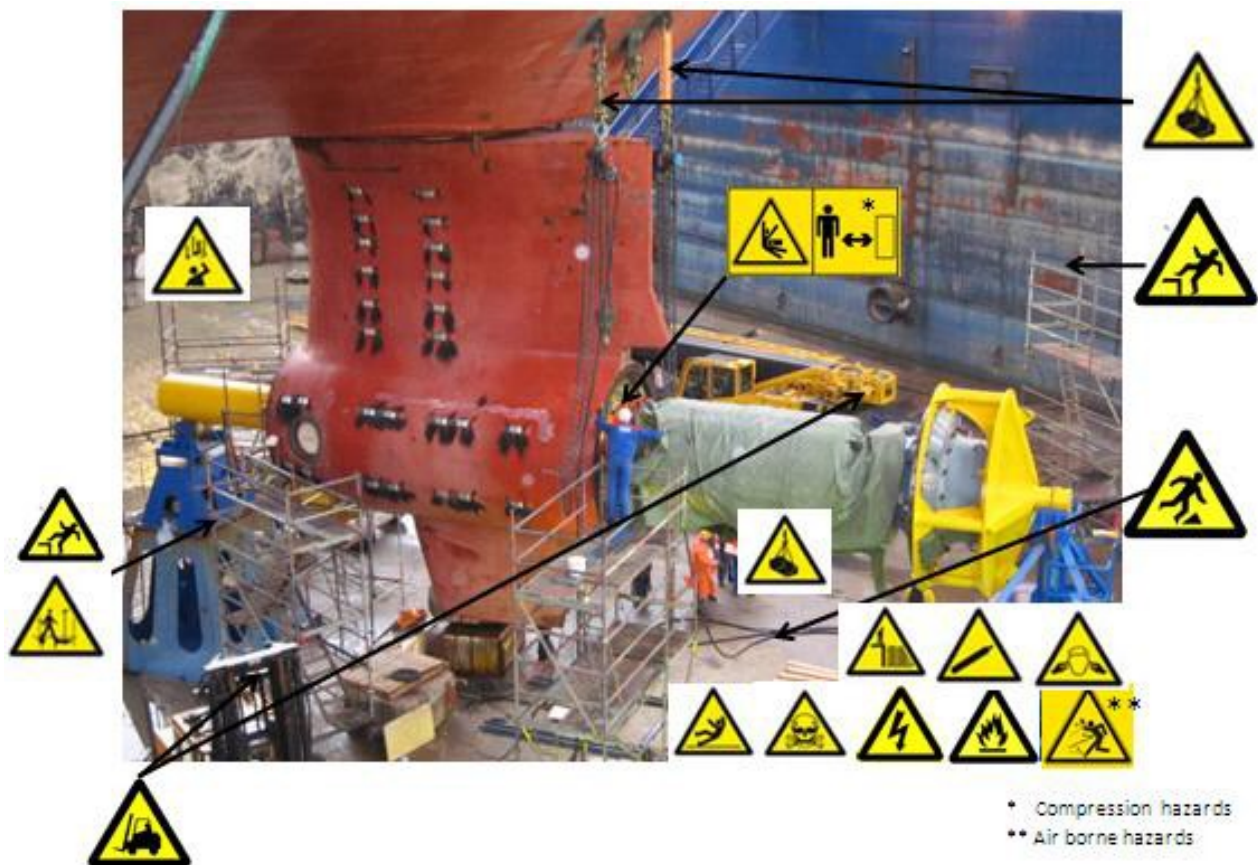


Figure 25.4: Typical risks when overhauling a shaft line at a dry dock

Identifying risks

When you work at a dry dock, follow ABB Stop Take Five philosophy. Always plan before each task and think the work through before starting work. Also follow the related safety and work instructions. If you notice any problems compared to the safety instruction, contact the Site Manager or your supervisor. If necessary, a separate Safe Job Analysis (SJA) must be performed (see CoP 1).

Operational controls

Working on the dock bottom has many hazards. Some of them are due to the many interfaces that can exist between ABB's activities and those of other parties who can also work on the dock bottom. Hazards can therefore arise as a result of other persons working in the same area as ABB.

Dry docking responsible of ABB Marine & Ports is usually the nominated ABB Site Manager. They introduce the site for the service team and also manage the project HSE plan. Project Manager for the ABB dry-docking prepares the project HSE plan that ABB Site Manager follows during dry-docking.



Site specific HSE Risk Review matrix must be prepared for each individual dry dock and attached to the project HSE plan.

NOTE

If ABB's activities are not properly controlled, they can also adversely affect other persons in the same area. As with all risks, there is a preferred hierarchy to apply suitable controls. First consider risk avoidance and elimination, then apply risk reduction, isolation and control measures. As the last resort, apply personal protective equipment.

1. When contracting with the dockyard or ship owner, the work scope and work responsibilities must be agreed. Also, a contact person for safety must be nominated.
2. Always prepare a project-specific HSE plan with risk assessment (see CoP 1).
3. Plan required controls.

4. Implement adequate controls.

Project Manager or Site Manager for the dry-docking is responsible for ensuring that ABB Marine & Ports employees and contractors do not generally get involved in risky situations. If a high-risk task is absolutely necessary, the Project Manager or Site Manager checks that the precautionary measures to control the risks are adequate based on the risk assessment. Also, the employee concerned must be informed of all the requirements before starting any such work on site.



If dry-docking takes place at a new shipyard, the Project Manager must ensure that HSE/SA advisor verifies the quality of the project risk matrix.

NOTE

Training and competence

ABB employees and contractors must have the required training, be skilled for the work in question and have the needed instructions available (such as lifting plans and assembly documents) before working on a dry dock.

Monitoring and checking

Accountable managers must follow that this CoP is implemented. Compliance must be followed with SOT. HSE site assessments will be reflected against this CoP.

Documentation and records

The filled dry-docking safety plan must be available at the site for both ABB engineers and contractors as a live document, including risk matrix.

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

CoP 25: Permanent magnets

Introduction

Large equipment, such as electrical motors, which contain permanent magnets (PM) become more and more common in the industry. This creates a new type of risk, mainly when PM equipment is opened for maintenance.

This Code of Practice (CoP) guides ABB Marine & Ports employees and contractors about the hazards and risks in such work and the precautions to use and follow.

Scope

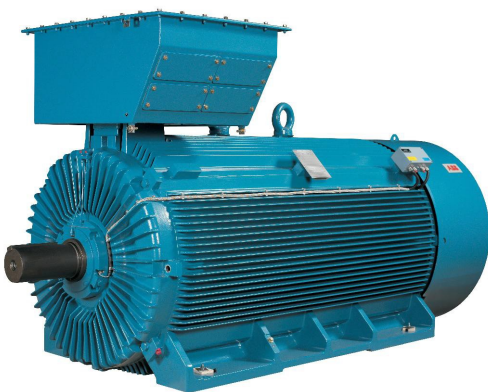
This CoP applies to all ABB Marine & Ports employees and contractors who work with machinery.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

As such there is nothing extraordinary if magnetization is done with permanent magnets (PM). Typically, it does not make any difference to the surroundings or to the equipment. For example, if the same output electrical motor is generated by an induction motor or PM motor, the magnetic field strength inside the motor is almost identical when the motor is running, and the surroundings of the motor are identical.

The difference is that the magnetic field of the PM motor also exists when the motor is not running. Therefore, personnel who open and maintain such PM equipment must be familiar and competent with the required safety measures. Persons who are not familiar with the dangers of PMs must not enter areas where PMs are exposed.



Low Voltage Permanent Magnet Motor



Ferromagnetic tools cause real danger

Permanent magnet stray fields, caused by open or disassembled PM equipment or parts of it, may disturb or damage other electrical or electromagnetic equipment and components, such as cardiac pacemakers, credit cards and equivalent.

Loose magnetic parts, tools and waste must also be kept away from PMs. Ferromagnetic tools in a magnetic field generated by a large PM result in large forces being generated, which can easily bruise or even break fingers or limbs.

In addition, rotating or moving PM parts or PM materials may cause induced voltages, which may cause damage to surrounding equipment and can create a DC voltage shock potential due to the discharge of an induced voltage via a person touching the object with an induced voltage potential.

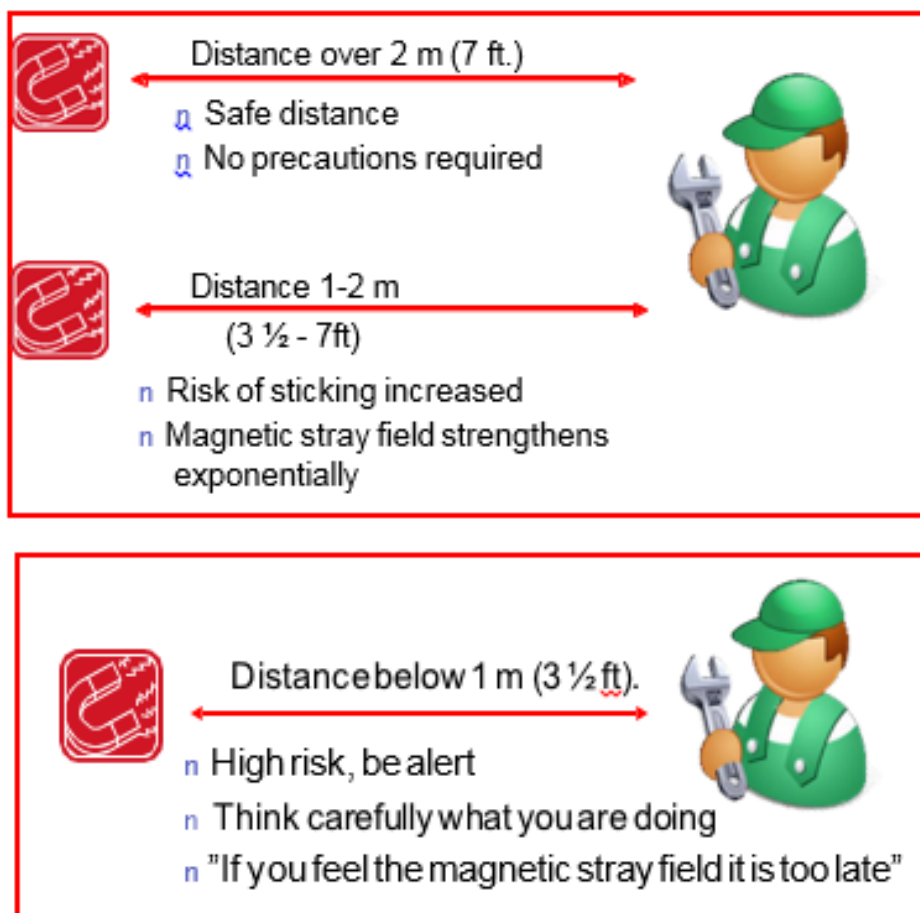
Operational controls

Those who work in an environment where there are PMs must know the involved hazards and risks and the required control measures. ABB Marine & Ports personnel must be familiar with the risks and competent to do the work and apply the required control measures.

Control measures include:

- Recognize the dangers and adopting the right attitude.
- Understand that a permanent magnet is not a tool.
- Follow the equipment manufacturer's instructions.
- Place warning signs and limit the work area to authorized persons only.
- Do not work if unsure, seek help from your HSE/SA advisor.
- Ensure that there are no ferromagnetic materials near the PM.
- Ensure that magnets are handled only at planned locations and with approved tools.
- Limit the time near the magnets.
- Ensure that a good standard of general tidiness is maintained.

Typical safe distances and risks with permanent magnets



Visitor precautions near permanent magnets

Visitors who enter areas where PMs are exposed, must be:

- Informed of PM magnets and the dangers.
- Check that they do not have a pacemaker fitted.
- Always guided when moving in the area.
- No visitors must be permitted to enter into the high-risk area (area within 2-meter distance).

Training and competence

As a minimum, training for workers must include the following:

- What is a permanent magnet?
- Risks while working with permanent magnets
- Tools and working methods

Monitoring and checking

Responsible (LBL) managers ensure that the requirements of this Code of Practice are implemented and followed.

Documentation and records

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

CoP 26: Microwave radar safety

Introduction

Radar installations are a source of nonionizing radiation which can represent an occupational health hazard.

This Code of Practice (CoP) guides ABB Marine & Ports personnel about what steps they can take when working on board a ship or other structures which use similar equipment to ensure their safety and health.

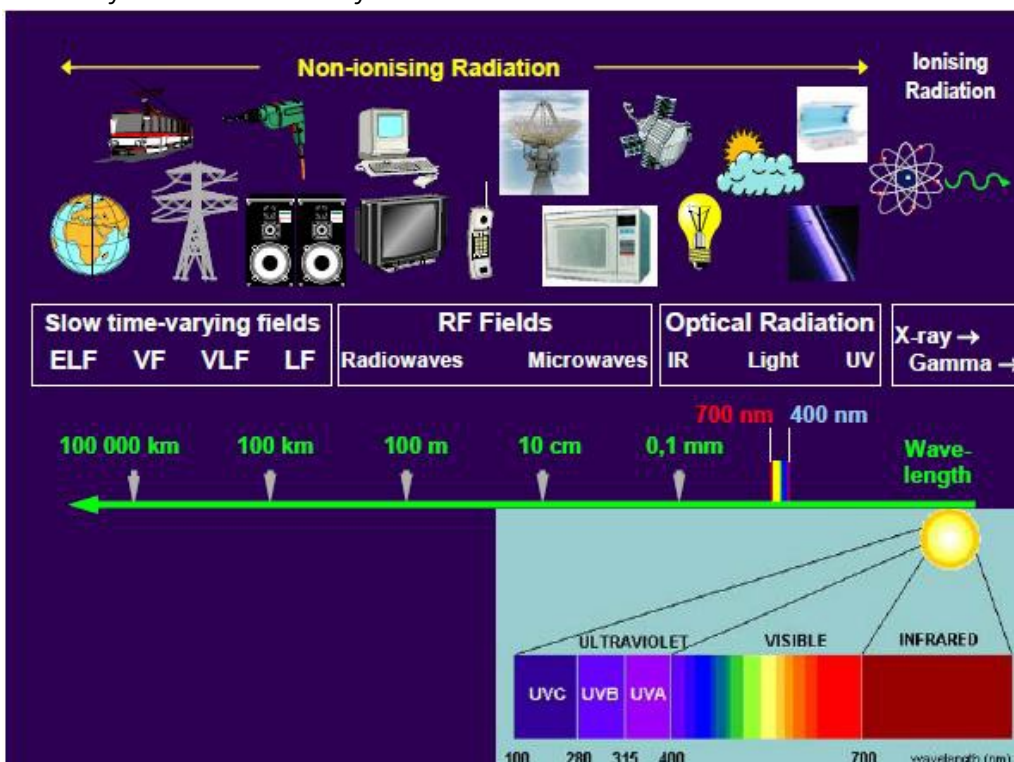
Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work on customer sites. If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

EMF emissions

Radars usually operate at radio frequencies (RF) between 300 MHz and 15 GHz. They generate electromagnetic fields (EMF) that are called RF fields. RF fields within this part of the electromagnetic spectrum are known to interact differently with the human body.



RF fields below 10 GHz (to 1 MHz) penetrate exposed tissues and produce heating due to energy absorption. The depth of penetration depends on the frequency of the field and is greater for lower frequencies. Absorption of RF fields in tissues is measured as a Specific Absorption Rate (SAR) within a given tissue mass.

The unit of SAR is watts per kilogram (W/kg). SAR is the quantity used to measure the "dose" of RF fields between about 1 MHz and 10 GHz. A SAR of at least 4 W/kg is needed to produce an adverse health effect in people exposed to RF fields in this frequency range. RF fields above 10 GHz are absorbed at the skin surface, with very little of the energy penetrating into the underlying tissues. The basic dosimetric quantity for RF fields above 10 GHz is the intensity of the field measured as power density in watts per square meter (W/m²) or for weak fields in milliwatts per square meter (mW/m²) or microwatts per square meter (μW/m²).

Exposure to RF fields above 10 GHz at power densities over 1000 W/m² are known to produce adverse health effects, such as eye cataracts and skin burns.

Human exposure to radio frequencies

The power that radar systems emit varies from a few milliwatts (police traffic control radar) to many kilowatts (large space tracking radars). However, a number of factors significantly reduce human exposure to RF generated by radar systems, often by a factor of at least 100:

- Radar systems send electromagnetic waves in pulses and not continuously. This makes the average power emitted much lower than the peak pulse power.
- Radars are directional and the RF energy they generate is contained in beams that are very narrow and resemble the beam of a spotlight. RF levels away from the main beam fall off rapidly. In most cases, these levels are thousands of times lower than in the main beam.
- Many radars have antennas which are continuously rotating or varying their elevation by a nodding motion, thus constantly changing the direction of the beam.
- Areas, where dangerous human exposure may occur are normally inaccessible to unauthorized personnel.

Other health hazards

Studies conducted to date examined health effects other than cancer such as eye conditions (cataracts) and adverse reproductive effects. Overall conclusion is that there is no clear evidence to support a causal link between nonionizing radiation emitted by radar systems.

Operational controls

Protective measures

As a general principle, activities of ABB Marine & Ports do not require employees to work within the effective range of the radar installation. However, if there is an exposure potential to RF energy during ABB field operations during works on elevated structures, such as marine cranes or elevated shipboard structures, this hazard must be considered as part of the risk assessment for the task.

In such cases the risk assessment must include exposure potential to RF energy emitted from radar and radio antennae. No work must be done in close proximity to any radar or radio antennae unless the radar or radio system has been de-energized and locked out, or other means have been applied, such as electronic means to exclude the radar pointing in certain areas and shielding.

Also, the ABB employee should determine if administrative controls including audible and visible alarms, warning signs, and restriction of access through barriers, locked doors, or limiting access time to radar have been applied.



WARNING

Do not work close to any radar installation without checking that it has been isolated and locked out, or maintain a safe distance of more than 10 m.

Exposure limits

Human exposure to EMF emitted by radar systems is set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), see also <http://www.icnirp.de>.

The exposure limits:

- For occupational exposure: 100 W/m² or 10 mW/cm²
- For general public exposure: 10 W/m² or 1 mW/cm²

Training and competence

All persons engaged in activities where potential for exposure to RF or microwave exists must be instructed on the content of this Code of Practice. In particular on:

- Occupational health hazards associated with RF energy and the required safety controls
- What action to take in cases of emergency.

Monitoring and checking

- All LBLs ensure compliance with this Code of Practice (CoP). This must generally be achieved during the planning stage by finding out whether there are any radar installations on board a ship operating under power and in the area that is occupied by ABB personnel.
- Compliance is monitored by auditing.
- Noncompliance with this CoP may result in disciplinary action and removal from the project or service site.

Examinations and checking of equipment

Before any ABB personnel or contractors work in places where RF energy exposure exists, the operator does a pre-start check to ensure that the installation is isolated and that it is recorded in the risk assessment.

Documentation and records

The following documentation and records must be kept if there is potential to RF energy exposure:

- A site-specific risk assessment or job safety analysis and obtained approval and authorization.
- Copy of the work permit(s) on site during the work.

CoP 27: Sea trial

Introduction

A lack of hazard awareness or working in environments which are unfamiliar can increase the risk of injury purely because persons do not have the specific knowledge about the hazards and about control measures and procedures in place to deal with those risks.

This Code of Practice (COP) explains some basic requirements to follow when attending sea trials on vessels to ensure that all ABB staff and contractors know the specific hazards and general arrangements to control the risks.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who attend sea trials of newbuilds or of vessels after a dry-docking.

If national legislation or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Working within any unfamiliar environment increases health and safety risks because of the lack of knowledge about any specific hazards and specific rules, practices or procedures, or any prohibitions that are applicable.

Operational controls

There must be a nominated responsible person for the sea trial (ABB Supervisor). This person is the customer contact during the trial and manages ABB works, employees and contractors.

Planning

- Before attending sea trials, suitable enquiries to the shipyard or customer must be made to ensure that details of the sea trial, details of specific hazards and safety rules that apply are obtained before ABB employees attend sea trials.
- The information obtained must be included in the H&S plan for the project or contract and it should be prepared during the tender or contract phase.
- The information includes details of any prohibited areas on board the vessel and location of the first aid or medical care facility on the vessel.
- Details of the customer organization and the customer's contact person on the vessel.
- Details of the HSE/SA rules of the shipyard or vessel during the sea trial must be obtained and they should include information about any or all of the following:
 1. Requirements for personal protective equipment on the vessel, such as life vests
 2. Radio practices, such as frequencies
 3. Announcement practices, such as evacuation signals
 4. Lockout/tagout practices
 5. Fire and emergency procedures including emergency telephone numbers for fire and emergency contact of the vessel (such as muster stations and signals)
 6. Incident reporting requirements including near miss and hazard reporting requirements.
- Based on the details received from the customer, ABB Supervisor prepares a sea trial manning plan to ensure that sufficient resources and competences are available for the sea trial.

- ABB Supervisor also secures that adequate spares, tools, measurement equipment and safety equipment are available for the sea trial.

Before sea trials

Before attending sea trials, the ABB Supervisor gives a briefing on:

- Roles during the sea trial, that is, the chain of command. For example:
 - Name, position and phone number of ABB responsible person on board the vessel during the sea trial (and substitute during rest periods)
 - Name, position and phone number of HSE responsible person on the vessel
 - Name, position and phone number of responsible people on board the vessel for connection or switching.
- The length and scope of the sea trial
- Principal hazards and risks on site including presence and location of hazardous sources and in particular any nondestructive testing on board the vessel
- HSE requirements during the sea trial
- Ongoing and completion of works during the sea trial that could not be finished while the vessel was on a shipyard or dry dock.
- Details of any other contractors who work in the same work area as ABB or work with interfacing systems and any risks that may affect ABB.
- Location of general arrangements including:
 - Storage of personal protective equipment, such as life vests
 - First aid and medical facilities
 - Emergency muster station
- ABB Supervisor also does a safety check on board. It includes, for example, verification that emergency exits from ABB work areas are not locked.

After sea trials

Sometimes checks, replacements, modifications or adjustments of equipment or systems are required following a sea trial after reaching a shipyard (newbuild) or port (dry-docking).

Before starting any work, ABB Supervisor gives a briefing on:

- Scope of the work
- Details of specific hazards and safety rules that apply
- Communication.

In these cases, ABB Marine & Ports specific work procedures and HSE/SA rules must be followed, and they should include information on any or all of the following, when applicable:

- Confined space entry
- Electrical safety
- Testing of equipment
- Hot work.

Training and competence

This CoP must be communicated to every project team member before attending any sea trials.

Monitoring and checking

The Project Manager or ABB Supervisor is responsible for ensuring that all project team members are familiarized with the requirements to follow for attending sea trials. This includes contract personnel working on behalf of ABB.

This CoP must be part of HSE/SA audits and reviews conducted by the LBLs.

Documentation and records

- Signed document of Sea Trial familiarization
- Actual working hour sheets per person.

CoP 28: Pneumatic tools

Introduction

Pneumatic tools are widely used in shipyards and sometimes misused or improperly maintained.

This Code of Practice (COP) guides ABB staff and contractors on the basic safety precautions that are required when using or working near pneumatic equipment.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work on customer sites.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Pneumatic tools generally operate using an air supply of about 80 psi or 550 kpa for normal power tools. Lower pressures can be used, for example, for blow guns. The hazards and risks involved include:

- Failure of a pressure hose due to damage or wear causing injury to eyes etc.
- Subsequent whipping or snaking of a flexible hose
- Possible serious injuries from a direct contact with the pressure nozzle of the tool. The direct contact can result in air getting into the bloodstream which can be dangerous. It is particularly dangerous when directed to a person's anus as a fatal injury can occur.
- Tripping hazards from a trailing hose
- Possible fire or explosion hazard if using a blow gun to remove flammable dust from the work area etc.
- Possible toxic hazard if potentially hazardous materials are made airborne
- Exposure to high noise levels from tools.

Operational controls

There is likely to be a wide range of pneumatic tools that are used in a shipyard. They include, for example, grinders, chippers and nut runners. The supply of air is generally provided by the shipyard by means of a main compressor which supplies air to several operating points via a manifold. A portable tool is connected via a quick release coupling to the manifold.

Hoses

1. Hoses must be fit for purpose in all their uses and capable of withstanding general wear and tear in the operating environment. A shipyard is a heavy environment and the hoses used must be of heavy-duty material. Hoses should also be resistant to oil. Synthetic grade hoses should be used where mineral oil may be present and natural for vegetable oil.
2. Hoses should be reasonably light if they are to be handled by the operator but consistent with the environment in which they are used.
3. Hoses should be coupled to the supply manifold by means of a quick acting coupler. This should be designed so that when disconnected it automatically seals the air pressure on the upstream side while slowly venting the air pressure on the downstream side.
4. Hoses that are larger than 10 mm in diameter and 10 m in length or subject to a pressure higher than 7 bar or 723 kpa must be fitted with a self-venting socket which releases downstream pressure before disconnection is possible.

An alternative is to fit a plug with a controlled venting action. Items (c) and (d) prevent any whipping or snaking in the event of a failure.

5. An alternative to (c) and (d) is to fit emergency shut-off valves as close to the coupling as possible.
6. If possible, it is useful to fit a restraining wire to the tool end of the hose to prevent any snaking or whipping.
7. All hoses should be located as far as is practicable to not cause a tripping hazard.

Blow guns

- a. Blow guns for removing dirt must be designed either with reduced jet velocity safety nozzles or air curtain safety nozzles. These designs reduce the risk of eye injury or any danger that arises from direct skin contact. Use a brush or vacuum cleaner for removing dirt or debris.
- b. Do not use air guns or blowers to clean yourself and do not under any circumstances engage in horseplay.
- c. Do not use simple reduced orifice devices in direct line with the supply hose as they can be extremely dangerous unless they are fitted with a tamper proof pressure regulator.
- d. Do not use blow guns in areas where there is flammable or hazardous dust present.

Portable tools

- a. Use pressure regulators to reduce the pressure to the optimum value for the tool. The required pressure should be marked on the tool.
- b. Fit filters and lubricators to the supply pipe (tools need proper lubrication).
- c. Use ear protection because pneumatic tools cause high noise levels. They also cause vibration. Take noise and vibration levels into account when selecting or buying tools for use.

Summary of operational controls

Don'ts:

- Do not use compressed air to blow debris or to clean dirt from your clothes.



WARNING

Never play with air hoses or clean yourself with them. You can do serious harm to yourself or other persons.

- Do not use damaged hoses or lines.
- Do not use airlines that were used for water because they can damage the tool.
- Do not carry or handle a pneumatic tool by its hose.
- Do not use tools without whip-checks or restraint fitted.
- Do not change tools without isolating the air first. Do not crush the hoses.
- Do not leave a compressor running unnecessarily.

Dos:

- Ensure that the compressed air supplied to the tool is clean and dry. Dust, moisture, and corrosive fumes can damage a tool.
- Ensure that the compressed air is free of carbon monoxide.
- Keep tools clean and lubricated.
- Use only the attachments that the manufacturer recommends for the tools you use.
- Inspect the points of couplers for signs of wear and replace them as required.
- Turn off the air pressure to a hose when not in use or when changing power tools.
- Check hoses regularly for cuts, bulges and abrasions. Never use defective equipment. Report defects to your supervisor.
- Ensure that all connections are fitted with whip-checks or restrains before use.
- Avoid creating trip hazards caused by hoses placed across walkways or curled underfoot.
- Use ear protection while using pneumatic tools.

Training and competence

There is no specific safety training required for pneumatic tools, but all ABB Marine & Ports staff must be briefed on the requirements of this COP and a record kept.

Monitoring and checking

- Inspect hoses, tools and connections on a regular basis according to the manufacturers' instructions.
- Monthly checks for signs of cracking and other deterioration are recommended on hoses that are subject to flexing and mechanical damage.
- Persons using a tool should check the condition of the tool and hose including its connection at each end to ensure that it is fit for purpose before use.
- Never return damaged equipment to storage but start a replacement process.

Documentation and records

None required.

CoP 29: Respiratory protective equipment

Introduction

This Code of Practice (COP) guides ABB Marine & Ports personnel who work in shipyards, ports and onboard vessels on the use of respiratory protective equipment (RPE).

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work on customer sites. If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. Where such decisions are made there must be documented evidence, such as a gap analysis, to show that the selected requirement imposes a higher standard.

Hazards and risks

General

Respiratory protection is required when an employee is exposed to a hazardous level of airborne contaminant which cannot be removed by other means. Airborne contaminants can be present in a number of different forms, see the table below. Therefore, the hazard is based on the hazardous nature of the substance and the concentration of that substance in air.

Airborne hazards

Table 19: Examples of airborne contaminants

Solids	Liquids	Gases or vapors
<ul style="list-style-type: none"> Asbestos fibers Engine exhaust particulates Lead dust and fume Silica dust Welding fume Shot blasting dust Wood dust Smoke Fungal spores Bacteria Virus Parasites 	<ul style="list-style-type: none"> Sprayed droplets Paints Pesticides Powder coatings Liquid jetting Sewage water <hr/> <p>Mists</p> <ul style="list-style-type: none"> Chrome acid Cutting fluids Oil mist 	<ul style="list-style-type: none"> Ammonia Carbon monoxide Carbon dioxide Freons Helium Nitrogen and oxides Mercury vapor Solvent vapors Exhaust gases

Respiratory protective equipment is required where there is a potential risk of inhalation of the hazardous substance. Hazardous substances can include substances which are:

- Very toxic or toxic
- Carcinogenic (incl. mutagens and teratogens)
- Harmful
- Irritants
- Sensitizers
- Radioactive substances

- Biological agents
- Dust
 - > 4 mg/m³ for respirable dust (< 5 µ)
 - > 10 mg/m³ for total inhalable dust (> 5 µ)

Operational controls

General

Generally, work done by ABB Marine & Ports personnel does not involve being exposed to airborne concentrations of airborne contaminants and does not require respiratory protection. However, they can work alongside or close to other contractors on the vessel whose work can generate airborne contaminants. Work should be planned so that such situations can be avoided.





If you doubt that the air quality in the work area is poor, leave the area for fresh air and report the matter to your supervisor.

WARNING

When workers feel that they are affected by short-term airborne contamination, they should wear a suitable half mask respirator. Examples of half mask respirators are shown in the following table.

For more information, see also CoP 10, 18 and 19.

Table 20: Respiratory protective equipment types

Half masks for particulates only	
	Disposable half mask
	Reusable half mask. Its filter should be changed periodically.

Control of airborne contaminants using RPE depends on the type and form of the substance, see Table "Examples of airborne contaminants". For protection against particulates, the correct required filter is a P3, which can also be used for protection against fume (P1 and 2 filters are suitable only if the manufacturer specifies them as being adequate).



If you are unsure which filter type to use, check with your HSE/SA advisor.

NOTE

Ergonomic factors

The use of half mask respirators is acceptable for relatively short duration, for example, up to 1 hour as better control measures should be achieved with the use of local exhaust ventilation. However, half mask respirators are not suitable for employees who have facial hair because they do not create a good mask-to-face seal. Employees with facial hair need a full-face respirator.

Care and maintenance

Proper functioning of non-disposable respirators depends on a regular maintenance and cleaning schedule. In general, respirators should be inspected for basic function before each use and cleaned as often as necessary to prevent their unsanitary condition. Non-disposable RPE must be issued on a personal basis. Users are responsible for ensuring that their RPE is in good condition and that the filters are changed at appropriate intervals.

As a general rule, if you use RPE daily for significant periods, change the filters daily. In all other cases follow the manufacturer's instructions. If the RPE has two filters, change them both at the same time. It is useful to write the date it was changed on the filter. All ABB Marine & Ports personnel who work on customer sites must be issued with a sufficient supply of filters if they use half mask respirators or a sufficient supply of disposable masks if they are used.



Do not exceed the useful life of the filter.

WARNING

Storage

All ABB staff who travel to sites must be provided with a suitable bag where to store all the required PPE. It ensures that the PPE is kept in good order and is prevented from being damaged in transit to the site.

Summary of RPE requirements

Don'ts:

- The RPE covered in this CoP does not protect against lack of oxygen.
- Never use the RPE if it is dirty, damaged or incomplete.
- Never leave the RPE lying around where it may get contaminated.
- If the work area has large amounts of contamination, do not work in the area.

Dos:

- Always ensure that the complete device is in good order before you go the site and before first use.
- Ensure that the mask fits correctly before you start work. Check the tightness of the straps and refer to manufacturer's instructions.
- If you have a beard or similar facial hair, you need a full-face respirator and you need to do a fit test (RPE supplier can advise on this).
- Always check that you have the correct filters and that they are OK.
- Always change both filters of a two-filter mask at the same time.
- Always clean and store the mask properly.
- If the fan of a powered set of equipment stops, stop working and leave work area immediately.
- Always wear an RPE if there are airborne contaminants from grinding, welding or painting in the work area.

Training and competence

All ABB employees must receive suitable training and instruction on HSE/SA requirements for their work activities. It includes the requirements of this CoP.

The employees must be instructed in the correct use of the RPE, how to take care of it and to obtain replacements.

Monitoring and checking

Active monitoring

1. All ABB staff must be issued with a suitable RPE, either sufficient supplies of disposable half mask respirators or a personally issued half mask respirator (see Table 20) with a supply of filters.
Everybody is responsible for checking their equipment before they go to the site. It ensures that the equipment is in good order and they have the necessary replacement supplies, such as spare filters and disposable equipment.

2. When at the home location, everyone must have their equipment checked periodically by their supervisor to ensure that the RPE is maintained in a reasonable state.
3. RPE compliance forms an essential part of any SOT carried out at the site.
4. Always dispose used cartridges and replace them with new ones.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses related to contaminated environment, defective condition of PPE, incorrect use of PPE, no use of PPE etc. must be reported to the applicable database.

Documentation and records

The following records must be kept by the LBL:

- Risk assessment or JSA which specifies the requirement for PPE including RPE
- Record on training and instruction.

CoP 30: Hygiene when travelling

Introduction

This Code of Practice (COP) provides practical information to ABB Marine & Ports employees and contractors on the hazards and risks related to hygiene while traveling.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors.

Hazards and risks

Hygiene is one of the many considerations to be aware of when travelling. Ways to manage hygiene vary by country, whether it is because of facilities or the lack of them, cultural differences, or simply the water that is available.

Typical hazards are:

- Food poisoning
- Protozoan diseases
- Fungal infections.

Operational controls

Risk avoidance

As with health and safety risks, apply the hierarchy of control properly. Risk avoidance is the best and most preferred option. To avoid risks during travel, some tips on hygiene:

Water

- Even if the water in a country is fine for consumption, it can have a different composition that can affect our systems and make us ill.
- Always use bottled water for drinking when abroad, even for making hot drinks just to be extra careful.
- Be careful about using ice in drinks, washed fruits and vegetables.
- Use bottled water for cleaning teeth.
- If you have no other water source, boil the water before you drink it by holding it at a rolling boil for one minute.
- Remember to drink lots of water to keep your urinary tract healthy.

Bathing

- Pay attention to the cleanliness of hotel bathrooms.
- Do not accept a poor clean-up because fungal diseases spread especially on wet surfaces and locations.
- If no other means are available, use sandals or thongs when taking a shower. Although the fungal disease typically affects the feet, it can spread to other areas of the body, including the groin.
- Do not share a towel with anyone.

Eating

- Avoid shellfish that is in a buffet as it may have been there all day. Shellfish can cause food poisoning very easily.
- Always have your meats and fish cooked 'well done' as sometimes storage of meats differs greatly, and our systems may struggle to digest it efficiently.
- Make sure any dishes, cups or other utensils are totally dry after they are washed.

General hygiene

- Wash your hands, most infections are caught by touching dirty objects.
- Always wash your hands after using the toilet and after touching animals.
- Wash your hands before eating and when possible, after touching anything that everyone else touches, such as public phones, ATMs, public computer keyboards or handrails.
- Clean your nails whenever they are dirty and keep them short.
- When you wash your hands, make sure they are totally dry before you touch any food.

Training and competence

All ABB Marine & Ports employees and contractors who travel and work internationally must be briefed on the content of this CoP.

Protective equipment

When you travel, have the following items with you:

- Personal travel kit, such as toothbrush and toothpaste, razor and shaving cream, hairbrush or comb, skin cream, contact lenses and contact lens disinfectant solution
- Travel first aid kit.

Monitoring and checking

None.

Documentation and records

None required.

CoP 31: Rigging and slinging

Introduction

This Code of Practice (CoP) provides ABB Marine & Ports personnel and contractors with practical information on the safety requirements for rigging or slinging loads while working on customer sites.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work on customer sites. This CoP is based mainly on European Union Machinery Directive.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

This CoP applies for rigging and slinging equipment. The rigging and slinging equipment include:

- Wire ropes
- Chains
- Synthetic fiber rope belts or slings
- Means of attaching the load to the hook including shackles, hooks, and eyebolts.

Hazards and risks

Any lifting system is only as strong as the weakest link and therefore every part of the lifting system must be rated for the loads to be lifted. If any part fails, then it is likely to be catastrophic resulting in the load falling. This can cause injury to persons directly involved in the lifting operation but can also damage the load itself.

Typical factors involved in a lifting failure:

- Persons are not trained and are not competent to rig or sling loads.
- Lifting equipment is not rated in terms of safe working load for the load being lifted (lifting tools that are used in EU to be CE marked).
- Lifting equipment is in a damaged state and as a result, has a reduced safe working load.



- General misuse of lifting equipment.

Operational controls

General requirements

Identification and marking of working load limits (WLL or SWL)

- All lifting accessories must be marked with their working load limit (WLL) or safe working load (SWL).



- In the case of lifting equipment that can be used in different configurations, the information of the working load limit must be kept with the lifting equipment.
In the case of lifting slings, the identification tag must indicate the maximum working load limit.
- Each item of lifting equipment including lifting accessories must have a certificate issued by the manufacturer specifying the working load limit or safe working load.
A register of all the certificates of lifting equipment must be maintained by the LBL (Also ABB designed tools, for example, CE-documented in Europe).
- All items of lifting equipment must have a unique identification number or plant number.
An inspection record, card index or inspection register must be maintained, containing essential information that include the plant ID number, inspection dates, perceived faults and defects, and any performed repairs, or that the item has been scrapped.

Inspection and maintenance

- All lifting accessories must be inspected once every 12 months and a report of the inspection kept. Where the equipment has been subject to severe conditions, such as marine or chemical, the period of inspection must be reduced to a frequency that is appropriate for the type of use.
- All equipment must be checked before each lifting activity.
- All inspections must be carried out by a competent person.
- The lifting equipment must not be used until any defects that were identified are fixed or the item has been removed from use and destroyed.



Storage of lifting accessories

- All lifting accessories must be stored correctly to ensure that they are not damaged.



Figure 32.1: Storage of lifting accessories

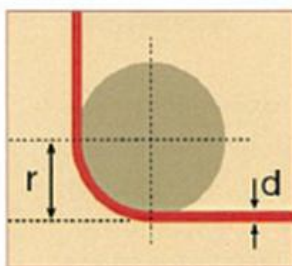
Safe rigging and slinging

- All persons must be trained and competent in rigging and slinging of the likely loads that are lifted within the work on board a ship. If you are not trained or have doubts on your competence, do not get involved in the rigging or slinging of loads.
- Before the lift, always check the following issues:
 - Weight
 - Center of gravity (marked on the product)
 - Correct lifting angle (table info)
 - Lifting gears (table info)

Each item of the lifting equipment must be marked with its designated working load limit with an identification tag. If there is no tag, do not use the item.

- Before lifting, check the condition of the lifting accessories to make sure that they have the correct safe working load and that they are in good condition.
- Before lifting, check that there are no sharp edges that could damage the lifting straps. See the pictures below.

What is sharp edge ?



$$d \geq r \quad r \leq d$$

Sharp edge = when corner radius is smaller or equal than used lifting strap diameter !



Definition of sharp edge

Corner protectors in use

- Always do a trial lift with the load just raised off from the ground to check the stability and fixing or attachment points.
- The hooks of the cranes or lifting accessories must be equipped with safety latch or another reliable backup, such as a self-locking hook. When using shackles, position the pin across the hook.



Hook with safety latch

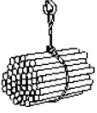

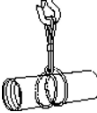


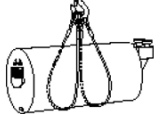
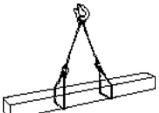
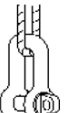



Correct positioning of shackle

- Hooks must be loaded from the bottom of the gap as shown in the figure above.
- Master link must be compatible with the hook of the crane (i.e. big enough).
- Sling must be long enough to ensure a safe lifting angle which must not exceed 60°. Confirm the acceptable lifting angle from the lifting tool instructions

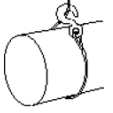

Permitted slinging arrangements

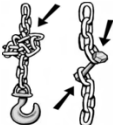


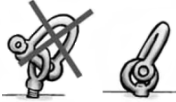
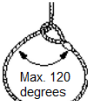

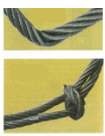
Table 21: Permitted slings and slinging practices

Practice	Description	Practice	Description
	Reeving sling For lifting short lengths of tube (limited lifting capacity)		Cradle sling For lifting coils of steel strip
	Hashing sling Method of using a single sling in place of an endless sling where a bight is required. A stirrup fitted temporarily in the bight minimizes damage to the sling.		Double wrap slings The double wrap grips the load and helps to prevent it from slipping sideways out of the slings.
	Reeving slings For lifting tubes, bars and rods.		Cradle slings For lifting boilers and packing cases.
	Combination slings For concrete beams, steel joists, etc.		Slings around shackle A sling which is 'doubled' around a shackle has a Safe Working Load equivalent ONLY to that of a SINGLE rope.
	Sling sliding obstructed For packing cases.		

Bad slinging arrangements

Table 22: Bad slinging practices

Practice	Description	Practice	Description
	Do not 'Hook back' to the leg of a sling.		Do not use single slings this way (slippage risk).

Practice	Description	Practice	Description
	Do not use tangled or “tuned” chains.		Do not use hooks with eyebolts.
	Do not hook to points which are not designed for hook lifting.		Tighten the shackle always to the bottom.
	When using a hashing sling or reeving sling do not force the bight down on to the load. The angle formed by the bight should not exceed 120 degrees.		Do not use a sling which has a severe kink or flattening.
	Do not use a sling which is fluted or has a node.		

Training and competence

All persons who work on customer sites must be briefed on the requirements of this Code of Practice.

Site manager and supervisor

Site Manager, Supervisor and other relevant persons must be instructed in the requirements of this CoP.

Slinger or rigger

All personnel involved in lifting operations must receive adequate training, instruction and guidance in safe lifting practices. Training includes both theory and practical training with a relevant crane.

Training must include at least the following topics:

- - Influencing factors that affect the safe working load.
 - Rigging and slinging of typical loads in ABB Marine & Ports.
 - Use of lifting accessories.
 - Inspecting for defects.
 - Abnormal situations, such as swinging of the load, and jammed load.

Training must be rearranged at least every second year.

Monitoring and checking

Active monitoring

Active monitoring includes:

- Persons who use lifting equipment must inspect the equipment before use.
- Inspection of lifting accessories (12 monthly or as prescribed for equipment used in harsh environments) and a record kept.
- Checks that training and instruction of persons involved in lifting operations is up to date.
- Managers and supervisors do safety inspections and SOTs.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

The following records must be retained:

- Register of lifting equipment including accessories
- Manufacturers' certificates of proof load for all equipment in use.
- Reports of thorough inspection in respect of inspections of lifting accessories (12 monthly or as prescribed).
- Certificates of training and instruction.

Summary of requirements

- Make sure that the weight and center of gravity is known and that the safe working load of the lifting equipment exceeds the weight of the load by at least 50%.
- Make sure that all the equipment to be used is in good condition and has been inspected within the previous 12 months or sooner if the equipment is used in harsh environments.
- If a lifting sling or other accessory has no tag or other ID indicating when it was last inspected, do not use it.
- Where lifting equipment is used with two or more legs, make sure that the proposed configuration does not exceed the safe working load. Confirm the angle from the lifting equipment instructions.
- Connect multiple leg slings with a suitable ring.
- Make sure that the lifting hook is vertically above the center of gravity of the load.
- Secure the loads directly to the lifting hook or by using a shackle where the pin of the shackle is across the hook.
- Secure the lifting hoist to a suitable beam or other anchor point.
- Where eyebolts are used, connect them vertically.



- Avoid dragging the lifting equipment on surfaces where they can be damaged.

CoP 32: Boarding and leaving ships

Introduction

When the personnel do service jobs or commissioning on ships that have left dock, they must be transported to the vessels with small boats. The boat trips are usually safe, but the transfer between small boats and big ships can be hazardous.

This Code of Practice (CoP) tells about the hazards and how to lower the risks.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Transferring between ships is one of the most dangerous activities ABB Marine & Ports personnel face during work.

Hazards

- You can fall into the sea and drift away or into the propellers. You can drown in cold water.
- You can fall onto the tugboat and hit hard metal.
- You can get squeezed between the ship and the tugboat.

Risks

- High waves
- Darkness at night
- Unsafe temporary gangway
- Lack of or wrong use of safety equipment
- Panic caused by motion and height
- Pressure by customer or others on board to behave in a risky manner
- Fatigue caused by jetlag and long working hours.

Operational controls

As a minimum requirement, always ask for a life jacket from the customer and wear it. Never board or disembark a vessel without a life jacket.

During boarding or disembarking, remember the following points:

- Always have three points of contact: Two hands and one foot or one hand and two feet in contact with the ladder all the time.
- Do not carry equipment or a backpack.
- Wear the life jacket correctly.
- Do not board if the ladder appears damaged or unsecured.
- Walk to the ladder, do not jump to reach it.

- Only one person at a time on the ladder.
- Keep your body close to the ladder.

Training and competence

This CoP must be communicated to all personnel who board or leave ships by transferring from or to small boats.

Monitoring and checking

- Line managers have the responsibility that their relevant personnel are familiarized with this CoP.
- Managers who hire or send contractors to the site must send them this CoP before service or commissioning jobs.
- All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

None required.

CoP 33: Working hours on site

Introduction

When personnel work in site or factory conditions, it is very important to ensure sufficient rest.

This CoP sets the minimum criteria for working hours at a site or factory.

Scope

These requirements apply to all ABB Marine & Ports employees and contractors.

If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

Hazards and risks

Fatigue can adversely affect safety at the workplace.

Fatigue reduces alertness which can lead to errors and an increase in incidents. This happens particularly when:

- Operating a fixed or mobile plant, including driving vehicles
- Doing critical tasks that require a high level of concentration
- Doing night or shift work when a person would ordinarily be sleeping.

Operation controls

Project Manager is responsible for finding out the local rules and regulations and for making sure that the ABB site team applies the local rules and regulations.

Commissioning works at shipyards

1. Daily normal working hours shall not exceed 10 hours per day and the maximum weekly working hours shall not exceed 60 hours.
2. The minimum uninterrupted rest period must be 11 hours per 24-hour period.
3. Each calendar week contains one mandatory rest day (Sunday, if not otherwise agreed).
4. Average weekly working time in 6 months or 24 weeks shall not exceed 48 hours.
5. If an exceptional situation occurs which requires the ABB employee to work additional hours over and above the 10 hours, Project Manager obtains the necessary approval from the Manager, Project Execution who informs the employee's direct superior immediately.
Any approval must be based on a revised assessment of risk taking into account the additional hours, any fatigue factors and the type of work involved with particular reference to any safety-critical work. The fatigue evaluation includes a dialogue with the Site Manager or the person in charge of work.
6. If the permission is granted as described in e), working hours shall not exceed 16 hours per day (max. 2 successive days >10 hours a day) and 84 hours per week in any circumstances.
7. Travel, stand-by or lunch breaks are not calculated to working hours. See item 1 above.

Dry-dockings, sea trials and service jobs that last no more than 3 weeks

1. Daily normal working hours shall not exceed 12 hours per day and the maximum weekly working hours shall not exceed 84 hours (for example, 7 x 12 h per week).
2. The minimum rest period must be 8 hours per 24-hour period.

3. 1 rest day during the first 15 working days on site.
4. Average weekly working time in a calendar year shall not exceed 48 hours.
5. If an exceptional situation occurs which requires the ABB employee to work additional hours over and above the 12 hours, Site Manager or person doing the work obtains the necessary approval. Approval can be granted by Project Manager who informs employee's direct superior immediately.
Any approval must be based on a revised assessment of risk taking into account the additional hours, any fatigue factors and the type of work involved with particular reference to any safety-critical work. The fatigue evaluation includes a dialogue with the Site Manager or the person in charge of work.
6. If the permission is granted as described in e), working hours on site shall not exceed 16 hours per day (max. 2 successive days >12 hours a day) and 92 hours per week in any circumstances.
7. Travel, stand-by or lunch breaks are not calculated to working hours. See item 1 above.

Training and competence

All personnel who work at the ABB site must be trained on this CoP.

Monitoring and checking

- Line managers have the responsibility that their relevant personnel are familiarized with this COP.
- Managers who hire or send contractors to the site must send them this CoP before service or commissioning job.
- All incidents, unsafe conditions, unsafe behaviors and near misses must be reported to the applicable database.

Documentation and records

Time sheets.

COP 34: Batteries of an Energy Storage System

Introduction

Large Energy Storage Solutions (ESS) including batteries has become more common during the last few years and a high volume of these systems are forecasted in the future. This creates a new type of risk which are different than those of traditional power system components.

This Code of Practice (CoP) guides ABB Marine & Ports employees and contractors about the hazards and risks in such work, and the precautions to use and follow.

Scope

This CoP applies to all ABB Marine & Ports employees and contractors who work with batteries (Li-ion type) where the batteries are used as part of an ESS. If the local regulatory or customer requirements impose a higher standard, then the higher standard must be followed. In such cases this must be documented.

For batteries used as part of UPS, reference is given to ABB way document SA-S-107-07 Service manual: Safe working on UPS systems and batteries.

Hazards and risks

Batteries represent number of hazards and risks. These risks are manageable, and it is feasible to ensure a safe battery system. The risks, and challenges need to be identified and appropriately addressed by any person working with batteries or in the vicinity of where batteries are installed. Correct working of the Battery Management System (BMS) is of vital importance to maintain the risk at an acceptable level. Regardless of mitigation measures in place, there will always be a risk of thermal runaway (an exothermic chemical reaction). Temperature control at cell level is the first barrier to prevent a temperature increase inside the battery installation. A consequence of a thermal runaway is production of hot, flammable and toxic gases which can cause fire and potentially explosion.

A holistic risk assessment of battery system of the vessel shall be coordinated and prepared by overall integration responsible (the yard). This will include special considerations on how to secure safe return to machinery spaces after some battery incident, for example, partial or full thermal runaway. As a general guideline the spaces cannot be entered due to various hazards until cleared to be safe.

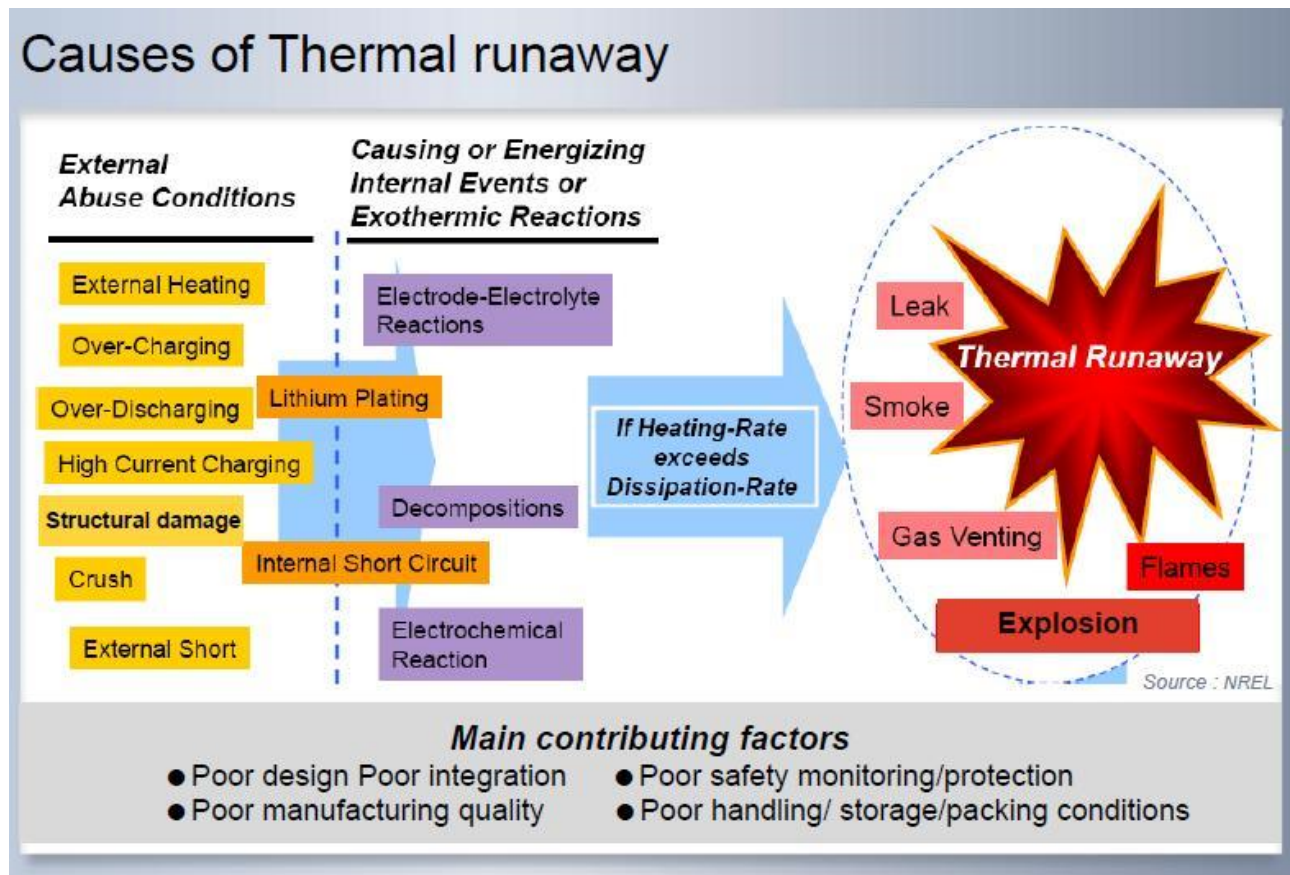


Figure 35.1: Causes of battery thermal runaway

The main risk factors can be grouped into the following four categories:

Chemical Hazards (from gasses)

Li-ion battery systems are sealed systems with nominally insignificant external gas generation during normal operation. A range of abusive factors affecting a battery cell can lead the electrolyte to start to decompose and further to form gasses inside the cell. The gas quantity and composition will depend on the chemistry of the cell, the voltage, the temperature and the failure mode. Tests have shown that gases produced are likely to be both toxic and flammable, and potentially explosive. Incorrect design or failure of the battery venting system will increase the risk of presence of toxic gases in the vicinity of a battery installation.

Also, in the case of submersion of the battery in water toxic gases will be produced. Submersion can cause electrolysis of the seawater and the generation of Cl_2 and H_2 gasses.

Thermal Hazards

There is a risk of fire and high temperature in the battery either caused by an internal fault in the battery (i.e. short circuit in a cell) or ignited by external fire. In both cases the battery will contribute to the fire since it acts as an energy source. Temperature control at different level as part of the battery installation and room installation will act as barriers against uncontrolled temperature.

Battery fires often have the characteristics of both ABC as well as D class fire at different stages, and thus likely require advanced fire-fighting capabilities. In many cases water and/or standard engine room inert gas fire extinguishing is preferred for the battery installation.

Due to the importance of heat dissipation, water is often being selected as the preferred cooling medium for fire protection.

Electrical Hazards

Li-ion batteries can never be fully discharged and should always be considered as live equipment. There is a risk for electric shock, arc flash and very high short circuit currents from the batteries. The battery should be equipped with equipment for isolation and protection (i.e. contactor with fuses) to allow for safe working conditions. The isolating device should be in locked out/tagged out position for any work on the cable/SWBD side of the battery including implementations of ABB's 7 steps. Note that method and procedure is different for different vendors and models of ESS. Please refer to the battery supplier's guidance. ABB person should normally not perform any work on the battery installation itself (on the battery side of the contactor). The battery vendor should normally carry out the work on the battery installation. If work is strictly required to be performed on the battery side of the isolating device by ABB, additional training and level of competence, as well as a specific operating instruction and special equipment (not covered by this document) is necessary. For all electrical work in the vicinity of live parts in the battery installation an arc flash risk assessment should be performed, and PPE should be selected accordingly.

Mechanical Hazards (explosion)

The risk of an explosion is closely related to the gas development and must be analyzed based on the gases that can be emitted from a battery system in a failure situation. Mitigation measures like for example pressure relief panels in addition to ventilation built into the battery system should be implemented by battery manufacturer. Many battery suppliers specify requirements on battery room ventilation (air changes per hour, etc.) and the classification societies also have such requirements. Sufficient space in the room where battery is installed is required to ensure safe exit ways.

Operation controls

A correctly working Battery Management System (BMS) is the key to reduce the risk of malfunctioning of the battery system. The BMS is responsible for monitoring voltage, current and temperature limits inside the battery system and evaluating signals to provide indication of when the system operations need to be curtailed/disconnected. BMS is typically connected to a higher-level supervision system (i.e. ESCS/PEMS/IAS) for remote control/ monitoring. BMS needs to be connected and working at all times after installation of batteries onboard the vessel. Note that most battery suppliers do not require BMS to be active when ESS is not in use, i.e. when the battery modules are stored in warehouse before installation.

The automation system should be designed in such a way that all operational limits for the batteries are respected. This should be done by limiting:

- Maximum charge and discharge current rates
- Maximum and minimum battery voltages, i.e. over charging and excessive discharge

State of Charge (SOC) and State of Health (SoH) should also be monitored by automation system. Note that SOC and SoH are estimated parameters available from most battery suppliers today with an associated estimation error.

For the electric hazards posed by the battery system the same operational controls as for electrical safety should be applied. Reference to CoP 12 Electrical Safety, Operational Controls. In addition, when working with batteries for ESS applications the following electrical hazards should be evaluated carefully as part of the risk assessment:

- Battery modules are always live
- Danger of voltage from parallel strings/packs
- Risk of back feed to main SWBD
- Make sure the polarity is correct before energizing

Training and competence

The persons who work with battery systems need to be skilled with relevant experience. Especially they must have adequate experience and training for the work they perform. They must be familiar with the ABB's 7 steps and the risks associated with batteries as described in this document. They must have valid electrical safety training.

It is of the highest importance that the person has made himself/herself familiar with all technical documentation for the battery system, including schematic drawings, single line diagrams and relevant documentation made by the battery supplier as well as the ABB engineering team.

Before any work commences, the person needs to review the battery safety description and safety assessment made for the installation. The safety description describes battery cell chemistry and design and includes identification, assessment and documentation of the safety hazards that are relevant for the specific battery system. This document should describe the primary features of the battery with regards to safety, and a philosophy on how these are all interrelated, and the system is able to ensure safe operation.

The safety assessment document is the responsibility of the shipyard (or 3 party integrator) and shall include a description about battery space and system integration of the battery into the vessel. Note: Even if a third party is responsible of the safety assessment, it is ABB PICW responsibility to ensure that such document is available and reviewed by persons working with the battery system.

Monitoring and checking

- Line managers have the responsibility that their relevant personnel are familiarized with this COP.
- The Responsible (LBL) Manager must have adequate arrangements in place to ensure that all persons who attend a customer site with batteries are competent for the work to be undertaken.
- The Responsible (LBL) manager must also ensure that SOTs and audits are carried out periodically to check that the requirements of this and any other CoP are being complied with.

Active monitoring

- All ABB personnel and contractors who work on battery systems must have valid electrical safety trainings (covering also safety aspects of live works).
- Supervisors must make sure that persons working for them are skilled and are taking the required trainings.

Reactive monitoring

All incidents, unsafe conditions, unsafe behaviors and near misses related to electrical safety must be reported to the applicable database.

Documentation and records

Every LBL is responsible for keeping up-to-date documentation of electrical and other relevant safety training undertaken by the staff. This documentation must be available on site when needed.

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