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INSTALLATION OF A CRUISE SHIP'S TABLETOP EQUIPMENT OF GALLEY FURNITURE

– Seaking Oy/GmbH



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The objective of this thesis was to develop the installation of the galley furniture tabletop equipment of a cruise ship and compare the offboard and onboard installation. The rules and rule makers of the cruise ship industry are researched as well as the ergonomic side of the installation. The thesis was commissioned by Seaking Oy. The functional part of the thesis was done in Papenburg, Germany for the Seaking GmbH and the theory part in Finland.

The theory part deals with the rules and the rule makers of the industry. The information of the theory part was used in the functional part of the installation. The functional part researched the installation and different installation ways. The research methods used in the thesis were interviews and literature related to this research.

The result of the thesis was the comparison between the offboard and onboard installation. In the research good and bad was found from both installation methods. The conclusion of the research was that the offboard installation of tabletop equipment could be a solution in the future.

KEYWORDS:

Ship building, galley furniture, tabletop equipment, pre-installation

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RISTEILYALUKSEN KEITTIÖKALUSTEEN PÖYDÄNPÄÄLLYSLAITTEIDEN ASENNUS

- Seaking Oy/GmbH

Tutkimuksen tavoitteena oli kehittää risteilyalusten keittiökaluksien pöydänpölyslaitteiden asennusta ja vertailla laivan ulkopuolella ja laivassa tapahtuvaa asennusta. Työssä käydään läpi alaan liittyviä sääntöjä ja niiden laatioita. Työssä käsitellään myös asennusten tekotapoja ergonomian kannalta. Työn toimeksiantajana toimi Seaking Oy. Työn toiminnallinen osuus suoritettiin Saksassa, Papenburgissa ja teoria osuus Suomessa.

Teoriaosuus tutkimuksesta tutkii alalle liittyviä sääntöjä ja niiden laatioita. Teoriaosuudesta saatua tietoa hyödynnettiin työn toiminnallisessa osuudessa. Toiminnallinen osuus tutkii asennuksia ja asennustapoja. Tutkimusmenetelminä työssä käytettiin haastatteluja, sekä työhön liittyvää kirjallisuutta.

Työn lopputuloksena oli vertailu asennuksista laivassa ja laivan ulkopuolella tapahtuvista asennuksista. Loppupäätelmä työstä oli, että laivan ulkopuolella tapahtuvat pöydänpölyslaitteiden asennukset voivat olla parempi vaihtoehto tulevaisuudessa.

ASIASANAT:

Laivan rakennus, laivan keittiökaluksien, pöydänpölyslaitteiden, esiasennus

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LIST OF ABBREVIATIONS

Abbreviation	Explanation of abbreviation (Source)
CDC	Centers for disease control and prevention.
DNV GL	Det Norske Veritas and Germanischer Lloyd. Provider of risk management and quality (DNV GL 2020).
IACS	International association of classification societies.
IMO	International Maritime Organization. Specialized agency of United Nations that manage maritime regulations (IMO 2020a).
USPH	United States Public Health Service.
SOLAS	Safety of Life at Sea. Regulations for ships safety at sea. convention what is made by IMO (Räisänen 2000, 17-2).
VSP	Vessel sanitation program. Guide for vessel sanitation published by the United States health authorities (VSP Operations manual 2020, 3).
WHO	World Health Organization.

1 INTRODUCTION

Behind this thesis is the will of commissioner to find out what is the most effective way to install tabletop equipment for the galley furniture of a cruise ship. Previously tabletop equipment has been installed inside the cruise ship at the last part of the project.

Mission of this thesis is to compare offboard and onboard installation of the galley furniture tabletop equipment. Thesis investigates the ways to install the tabletop equipment and tries to develop installing methods. The thesis deals with the regulations relating to the installation of galley furniture and the standards set by the international organizations, classification societies and authorities. The thesis research also the ergonomic side of the installation. Researching methods for this thesis are interviews, literature, and test installations.

The aim of the work is to research would offboard installations be a profitable way to work. Tabletop equipment has been normally installed inside the ship at the end of the project and that period is often the busiest part of the project. By successful pre-installation of the tabletop equipment the commissioner of this thesis could save time at the end of the cruise ship building project.

The risks for both installation methods can occur in various situation. This thesis tries to find the risks and solutions how the risks could be avoided or at least minimalize. For finding the risks and analyzing risks is used interviews and literature for researching.

This thesis focuses on cruise ship building not in the whole shipbuilding industry point of view. Classification societies, authorities and international organizations which are in this thesis are taken account with the cruise ship galley construction point of view.

1.1 SeaKing

Seaking Oy was founded in Finland 1985. Seaking designs and delivers catering equipment packages for cruise ships and provides consulting services. The company has sister companies in France, Poland, Germany, USA, Italy, and headquarters in Switzerland. In 1992 company moved to Swiss ownership. Seaking's production facilities are in United States and Poland. All Seaking companies work under Seaking Group. (Seaking 2020.)

Seaking focuses on functionality, space use, safety, and life cycle costs in its projects to maximize the efficiency of catering operations. Seaking has delivered catering systems to more than 130 cruise ships and to more than 20 different shipping companies. Customers are mainly cruise ship owners and shipyards. (Seaking 2020.)

Seaking supplies entire areas with high quality to the cruise ship's galleys, bars, pantries, and storage areas. All furniture and solutions meet the requirements of the cruise industry and operate according to United States Public Health Service (USPHS), International Maritime Organization (IMO) and other relevant standards and rules (Seaking 2020).

1.2 Odyssey of the Seas

Galley furniture and the tabletop equipment what are dealing with this thesis will be installed to Odyssey of the Seas luxury cruise ship.

Odyssey of the Seas is the fifth luxury cruiser in its class. Royal Caribbean International has commissioned five Quantum class ships: Quantum of the Seas, Anthem of the Seas, Ovation of the Seas, Spectrum of the Seas and Odyssey of the Seas. (Meyer Werft 2020.)

The ship is being built in Germany at Meyer Werft shipyard and has the frame number Is 713. The vessel is expected to be delivered to the shipping company in autumn 2020. Vessels length is 347.1 meters and breadth moulded is 41.4m. Passenger capacity of the vessel is 4284 and the crew capacity is 1551. (Meyer Werft 2020.)

1.3 Comparing methods

Installation methods are compared by strengths, weaknesses, opportunities, and threats of the methods. Comparison meters are possibility of the damage, timing, installation ergonomics and transporting situations. For researching the comparison meters is used interviews and literature.

2 RULES AND STANDARDS IN CRUISE SHIP INDUSTRY

When doing construction work in cruise ship industry there are many different aspects to approach it. This thesis approach cruise ship building in aspect of galley furniture installation. This chapter goes through the organizations, classification societies and authorities that set standards and rules that need to take account for doing this thesis. The most relevant rules for this thesis are set by the United States Public Healthcare (USPH). USPH set rules and standards for the installation of the tabletop equipment.

2.1 International Maritime Organization

International Maritime Organization (IMO) works under United Nations and the mission of the organization is to improve safety and security of maritime industry and prevent pollution from ships. IMO has over 170 members all over the world. IMO guidelines and recommendations covers almost every aspect of maritime industry. IMO deals with design, construction, equipment, maintenance, and crew. (IMO 2020a.)

International Convention for the Prevention of Pollution from Ships (MARPOL) and International Convention for the Safety of Life at Sea (SOLAS) are the important maritime treaties of IMO. SOLAS includes the guidelines for construction, design, ship systems and how to work on-board. First version of SOLAS was establish two years after the sinking of Titanic at year 1914. MARPOL focuses on pollution prevention and responsibility at sea. (IMO 2020a.) International conventions (such as SOLAS and MARPOL) are approved at the conference of the member states of the IMO. To approve the convention there need to be enough signatures from the member states. Approved convention obliges member states bind to it. (Räisänen 2000, 17-1.)

2.2 Authorities

Ships registration or licensing location determines the flag state of ship. Flag states primary role in the ship industry is to enforce regulations for the ship that are registered under its flag. Regulations that flag states controls are related to inspections, certification,

safety, and pollution. (Maritime info 2020.) International conventions set the lowest level for the rules, so the rules of the flag state need to follow them (Räisänen 2000, 17-1).

Ship owner can basically choose their flag state. Ship needs to fill the standards that are set by the flag state registry administration. For attracting ship owners flag states can offer incentives like cheap registration fees, low taxes, or discounts for registration. (Maritime info 2020.)

2.3 Classification societies

Classification society is a non-governmental organization. Classification societies sets technical standards for construction and operation of marine vessels and offshore structures. Classifying and validating ships design and calculations in a way that their meet with the public standards is the primary role of classification societies. (Maritime connector, 2020.)

The original role for classification societies is to inspect the ship by their own rules. At the new building stage, the classification society works for the yard and after the delivery for the ship owner. For the ship-owners and shipyards classification societies certify compliance with these rules, ship's regards type, construction, equipment, maintenance, and surveys of ships. Inspections for the ships are made at regular intervals. If the ship meets the requirements of the class, it will be certified. The classification determines the seaworthiness of the ship and defines the ship's range of services. All passenger ships and cargo ships that are seagoing must be classified. (Deutsche-Flagge, 2020.)

International association of classification societies (IACS) is a consists of twelve classification societies. IACS sets the minimum technical standards and requirements for maritime safety and environmental protection. Over 90% of the world cargo carrying tonnage is working under some of IACS member societies. IACS is a non-profit making association and known as the principal technical advisor of IMO. (IACS, 2020.) Odysseys of the Seas classification is set by Det Norske Veritas and Germanischer Lloyd (DNV GL) (Meyer Werft 2020). DNV GL is one of the twelve member societies of the IACS (IACS 2020).

2.4 United States Public Health Service

USPH rules are developed by United States Public Health Service (USPHS) and Centers for disease control and prevention (CDC). For the USPH rules in the cruise ship industry is the Vessel sanitation program (VSP) what is developed by CDC. The first version of VSP was established by CDC in 1970s. The USPH rules apply to ships that operate in U.S territorial waters. (VSP Operations Manual 2020, 3.) For this thesis USPH rules defines the materials, sizes, installation methods, dimensions and other related standards used for installation (VSP Construction Guidelines 2020, 1).

The mission of VSP is to help prevent and control the spread of diseases to United States from other countries and protect the health of crew members and passengers aboard cruise ships. Although the use of the VSP is voluntary, USPH authorities have the right to take the necessary measures to prevent the spread of diseases to the United States (42 U.S.C). All vessels that carry 13 or more passengers and operate with US ports are under the VSP program and they are subject to unannounced inspections twice-yearly. (VSP operations manual 2020, 3-5.)

VSP is divided in two parts, VSP operations manual and VSP Construction Guidelines. Background for the VSP operations manual is set by Guide to Ship Sanitation what is made by World Health Organization (WHO) and by the U.S Food and Drug Administration (FDA) Food Code. VSP operations manual assists crew members to work by the sanitation rules. The program operates under public health standards, which can be found in the VSP Operations manual. (VSP Operations Manual 2020, ii.)

VSP Construction Guidelines set standards for construction and design guidelines that protect crew and passenger health. VSP Construction Guidelines defines materials and dimensioning onboard. (VSP Construction Guidelines 2020, 1.)

3 INSTALLATION OF TABLETOP EQUIPMENT IN THEORY

USPH regulations controls the installation of galley equipment. The VSP defines the materials, sizes, installation methods, dimensions and other related standards used for installation. The purpose of the standards is to protect the health of crew and passengers in the cruise ship (VSP Construction Guidelines 2020, 1).

3.1 Risk analysis

Risk analysis is used to identify the risks related to the implementation of the project and their effects on the objectives. For identifying the risks there can be used methods such as checklists, creative ideation, modeling and researching. In the analysis of this thesis is used researching methods. By researching methods risks can be identified and estimated by making extensive clearances which require know-how about the project. There can be several data collection methods and in this thesis is used expert interviews. (Artto K. & Martinsuo M. & Kujala J. 2006, 48, 206-207.)

Risk taking and risk management measures may be affected by type nature or size of the risk. For taking the risk there might be some benefit but the harm caused by its realization can be found to be too high in relation to the benefit. The risk strategy determines when it is worthwhile to take a risk and which risks are better not to take. (Artto K. & Martinsuo M. & Kujala J. 2006, 48, 217-218.)

3.1.1 Risks related to research

When installing tabletop equipment before the furniture is transported on board there will be some risks. The main risks relate how the equipment can be protected during the transport and while other construction work is in progress on board. During the transport tabletop equipment can get damage and protection should be strong enough to cover the tabletop equipment. SOLAS sets rules for the ship fire load and that must be taken account when selecting protective material (IMO 2020b).

Onboard installation risks relate to the timing of the installations. Usually, tabletop equipment is installed close to the delivery of the ship, and it is the busiest part of the project. If the furniture where the tabletop equipment is installed locates in a public area there can be a stone- or some other kind of surface on the top of the table what is installed by other company after the furniture is transported onboard. To install tabletop equipment after the stone- or some other surface the spotting for the legs needed to be drilled to the surface.

3.2 Background for installation

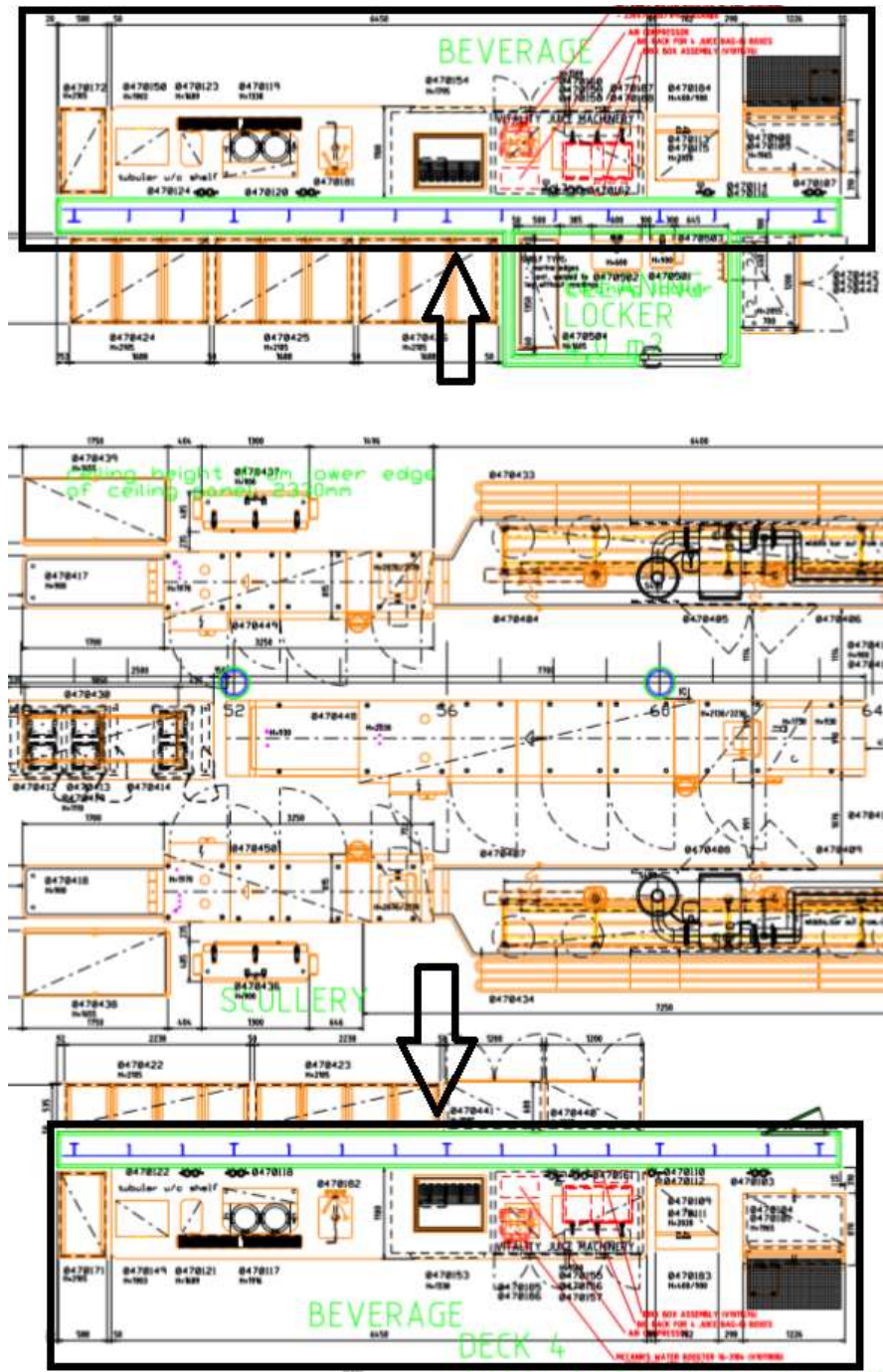
Usually tabletop equipment is installed onboard at the final stage of the project. This thesis compares the ways of installation offboard and onboard. For the offboard installation the main thing is to get more work out of the ship and to the beginning of the project. The installation of the tabletop equipment takes place in the workshop near the shipyard. Tabletop equipment are installed on the top of the table as in the picture below.



Picture 1. Tabletop equipment installed in previous project

The tabletop equipment in this research what are installed to furniture are milk dispenser, coffee maker, hot water dispenser and juice dispenser. Tabletop equipment to be processed in the thesis are installed with screws. Furniture are located onboard at deck

three and four in the upper and lower main galley. Below is a picture of furniture located at deck four.



Picture 2. Counters on deck 4

3.3 Transport onboard

Transportation from the workshop to the shipyard is carried out by truck. At the shipyard, the forklift transports the furniture to the lifting area where the furniture is lifted to the inlet area on-board. Transport on-board to the right area is carried out by a transport group of about five people. If tabletop equipment is installed before the transport the transporting routes should have enough space to get the furniture to right area onboard.

Moving the furniture is harder when the tabletop equipment is installed offboard because then the furniture weights more than without the tabletop equipment. The balance of the furniture changes due to tabletop equipment and moving of the furniture is then harder for the transport group.

3.4 Rules for the installation of the tabletop equipment onboard

When working onboard there are some rules for the installation. Every shipyard has rules for the hot works for example like welding, cutting, grinding, or torching. (Räisänen 2014, 45.) In this research the tabletop equipment are mounted with screws so the hot working permissions are not needed to take account when working onboard. In previous projects some of the tabletop equipment has also been moulded by welding so in the situation that needs welding or other hot works the working offboard would be better option for the installations.

3.5 Ergonomics

Working onboard sets challenges for good working ergonomic. When working onboard there is always various self-independent distractions.

Ergonomics means adapting technology and action to people. Mission of ergonomics is to ensure people safety and healthy and trouble-free and efficient operation of the system. With ergonomics working, tools, working environment and other operating systems are adapted to suit human traits. (Launis & Leppänen 2011, 19.)

Positive effects of ergonomics are improvements in people's work and workflow. Ergonomics improves also to the economic side for example by decreasing the amount

of sick leave from work, more efficient production, better quality of production and more flexible production. (Launis & Leppänen 2011, 36.)

3.5.1 Optimizing

Ergonomics can be condensed into three parts: physical ergonomics, cognitive ergonomics, and organizational ergonomics. Under physical ergonomics are physical working environment, workstations, working tools and design of working methods. (Launis & Leppänen 2011, 20.)

Technology has reduced the amount of physical work, but it has also brought new problems like repeating unilateral working movements. The problems caused by physical work are major problem in working life. To solving those problems ergonomics means plays the key role. Optimizing principle is develop the physical activity so that it will be suitable for human in a longer period also. A good working result must be achievable in a way that workers ability to work is maintained for as long as possible. (Launis & Leppänen 2011, 69-70.)

One mission of ergonomics is that anyone can use devices and operate in environment easily in a way that is effectively. According to European ergonomic standards a physical power which most women can produce should be enough to use the device. (Launis & Leppänen 2011, 21.)

3.5.2 Working environment

Environmental effects affect to information receiving. Good environment is a condition for optimal mental and physical working. Human operating limits must consider when working in extreme conditions caused by noise, temperature, or lack of lighting. (Launis & Leppänen 2011, 266).

In a good workspace the lighting intensity is adequate and adjustable. According to research, a clear increase in productivity has been achieved in demanding vision tasks by increasing the lighting. Also, the number of mistakes decreased by increasing the lighting. The purpose of lighting is to ensure good vision for working and make objects that pose a safety risk easily noticeable. Good lighting can be reach when all the aspects of lighting are in balance. The aspects of lighting are intensity, uniformity, luminance of

surfaces, the direction of the light, and the non-glare of the lighting, the color properties, and the use of the natural light. (Launis & Leppänen 2011, 266).

On-board the lighting for working is not always good enough. Objects that pose a safety risk is more easily to notice when doing offboard installations. Onboard all the aspects of lighting cannot be reached, because onboard there is not natural light. According to Launis and Leppänen (2011, 266) the lighting of a workspace is better in offboard installation because there is natural light, and the lighting can be adjustable.

Hard and continuous noise may cause hearing damage. Noise can also affect to working even if these dangers do not exist. Concentration on work is harder when the working environment is too noisy. (Launis & Leppänen 2011, 278.)

The noise onboard is louder than offboard because of the other construction works in the same area. Concentration on work is easier when doing the offboard installations because the workshop is not that noisy as the onboard environment.

Thermal conditions are an entity that affects a person physical activity and clothing, air temperature, air movement, ambient surface temperature and humidity. Thermal comfort means that people feels the temperature comfortable. Sweating can be considered as an upper limit and the lower limit is the feeling of cold. Too high or too low temperature increase the workload. High temperature decrease concentration. (Launis & Leppänen 2011, 283.)

Thermal conditions onboard changes during the time of the year and depends what stage the ship building project is at. When doing installation offboard the thermal conditions are more comfortable because the temperature can be adjustable. The ergonomic side is strongly favor of the offboard installations.

4 INSTALLATION

Off-board installation was carried out at Seaking GmbH workshop in Papenburg. Furniture are delivered there from the Seaking Poland factory. Tabletop equipment in this thesis are delivered by other suppliers. Tabletop equipment that are installed in this thesis are supplied by Silver King (milk dispenser), Fetco (hot water dispenser and coffee machine) and the owner Royal Caribbean International (juice dispenser).

4.1 Preparation

Furniture came from Poland on top of pallet what was covered with plastic and wood. Furniture total length is 6450 millimeters, and it was transported to workshop in two parts. Below is a picture of furniture in transport package.



Picture 3. Furniture in transport package

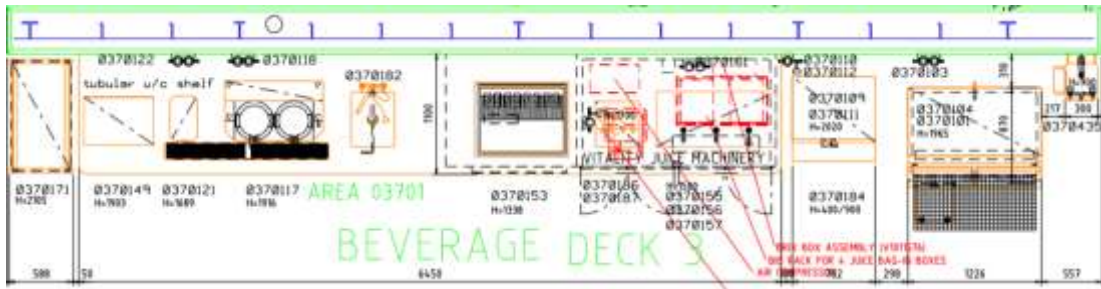
The tabletop equipment was packed on pallet in cardboard box. First thing to do is unpack the furniture and equipment and check that everything is unbroken. Below is a picture of Fetco coffee machine and hot water dispenser in transport package.



Picture 4. Fetco coffee machine and hot water dispenser in transport package

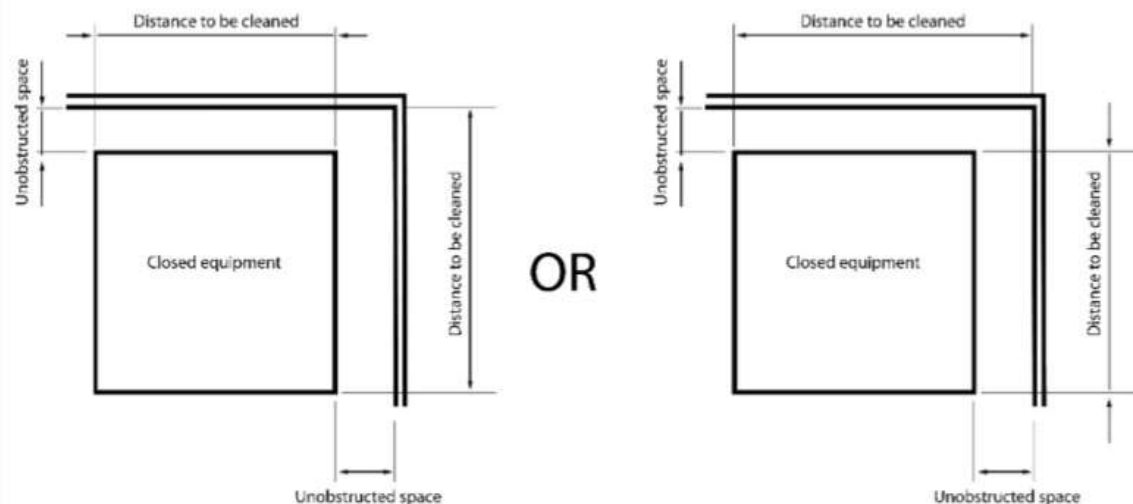
4.2 Positioning tabletop equipment

In the layout tabletop equipment were positioned on the correct place but there were not any dimensions. For drawings Seaking uses Bentley navigator software and by dimension tool the dimensioning of the tabletop equipment were able to determine. Next page is a picture of the layout of the furniture.



Picture 5. Layout of the furniture

For positioning the tabletop equipment USPH-rules set standards. If equipment is not sealed there need to be unobstructed space for cleaning around, behind and between equipment. Distance to be cleaned determines the space of the unobstructed space. (VSP Construction Guideline 2020, 31.) Below is a picture how to position the tabletop equipment.



Distance To Be Cleaned	Unobstructed Space
Less than 600 millimeters (24 inches)	150 millimeters (6 inches)
Between 600 millimeters (24 inches) and 1,200 millimeters (48 inches)	200 millimeters (8 inches)
Between 1,200 millimeters (48 inches) and 1,800 millimeters (72 inches)	300 millimeters (12 inches)
More than 1,800 millimeters (72 inches)	460 millimeters (18 inches)

Picture 6. Standards for distance to be cleaned around the equipment (VSP Construction guidelines 2020, 33).

4.3 Legs

After the tabletop equipment was lifted on top of the furniture the legs of the tabletop equipment need to be set on the right height. If tabletop equipment is not portable it must be mounted on top of the furniture with legs. The horizontal distance (depth) of the tabletop equipment defines the size of the leg. Standards for the leg length are set because of the cleaning space. (VSP Construction guidelines 2020, 35)

Horizontal Distance (Depth)	Equipment Leg Length
More than 750 millimeters (30 inches)	At least 150 millimeters (6 inches)
500 to 750 millimeters (20 to 30 inches)	At least 100 millimeters (4 inches)
75 to 500 millimeters (3 to 20 inches)	At least 75 millimeters (3 inches)
Less than 75 millimeters (3 inches)	50 millimeters (2 inches)

Table 1. Standards for tabletop equipment legs (VSP Construction guidelines 2020, 35)

4.4 Installation offboard

When the equipment is on the correct spot the position of legs needs to be marked to the furniture. To marked spots holes and threads are made by drill. Tabletop equipment need to be removed during the drilling of holes and threads. For the visual point of view all the screws of the tabletop equipment should be installed same way, either horizontal or vertical way to the furniture.

When making the places for the screws need to always make sure that there is not a stiffener below. Screw can be inside the stiffener but not through the stiffener. Tabletop equipment is lifted back to correct position after the holes and threads are made. The tabletop equipment is mounted with M8 size screws. Next page is a picture of a tabletop equipment leg with threads.



Picture 7. Threads for tabletop equipment leg

The installation of the tabletop equipment to the first furniture off-board was little slow because of the lack of installation experience.

4.5 Transporting furniture onboard

When all the pre-installation of tabletop equipment is done it is time to plan the transporting the furniture onboard. What is needed to find out before the furniture is taken onboard is the transport route onboard. The main thing of the transport routes is the space. With tabletop equipment installed the height of the furniture is over 1900 millimetre and without tabletop equipment 1000 millimetre. Width of the furniture (1100 millimetre) does not change when tabletop equipment is installed so that do not need to take consider.

All the tabletop equipment is mounted with two screws so if there is not enough space to transport furniture with the tabletop equipment on, they can be removed easily. Also, if the weight of the furniture is too high because of the tabletop equipment they will be removed during the transporting onboard.

Because of the postponed schedule the transporting of the furniture was not possible suit for the timing of this thesis.

4.6 Installation of furniture onboard

Furniture must be installed on top of foundation by welding. Foundations are installed on deck. The height of foundation depends on the installation method for the equipment that comes top of the foundation. Minimum height for the foundation is 100 millimetres above the finished deck. (VSP Construction guidelines 2020, 34.) The purpose of foundations is to ensure a stable, strong, and long-lasting installation base for all equipment. Back side of the furniture is welded to the wall behind the furniture.

When installing equipment to furniture USPH-regulations sets standards. Around the equipment must be enough space to clean, and gaps that are greater than 3 mm need to be closed. Gaps that are greater than 3 mm are closed with profile strips. (VSP Construction guidelines 2020, 24.)

4.7 Installation of tabletop equipment onboard

Onboard the tabletop equipment is installed same way that previously in this thesis offboard installation were done. Installation onboard is more complicated to do because of the other construction works in the same area. The onboard installation needed to be cancelled from this thesis because of the postponed schedule.

Basically, the amount of time to do the onboard installations would be close to do the installation in offboard but the starting the work may be more difficult. Issues to installing onboard are coming by the access to the installation area, timing, working environment and if there is installed stone or some other surface on the top of the table. When working onboard the access to the working area might be denied because of other construction works. This kind of works can be floor works and hot works. Usually the tabletop equipment has been installed at the last period of project what is the busiest part. The working environment is not that good and clear than in a workshop where the offboard installation was done.

5 COMPARING OF THE INSTALLATION METHODS

For comparing of the installation methods is used interviews of two expert of the cruise ship galley industry. For the summary of the interviews is made a SWOT analysis to compare the methods.

5.1 Interviews

Comparing the onboard and offboard installation for the tabletop equipment there is pros and cons in both ways. Doing the installation onboard is a safer way for the tabletop equipment because the risk of them getting damage is smaller. For the onboard installation speaks also easier transporting without the tabletop equipment. One question mark for the onboard installation is the timing of the tabletop equipment installation. Usually it is done at the end of the project what is normally the busiest part of the project. (Völker 2020.)

As Völker said the end of the project is the busiest part of the project and the inspections are scheduled at that stage. One reason for the rush at the end of the project is the claims related to the area inspections. Claims binds workers to fix them and because of that there is shortage of workers for the other installation works. The offboard installations would distribute the workload more evenly in the project.

After the area inspections will begin the equipment start-ups. In start-ups all the electrical equipment of the area is tested. For the start-ups all the tabletop equipment should be installed but it is seen that sometimes there might be equipment missing. The pre-installation would be a way to ensure that all the tabletop equipment is installed before the start-up.

The trending way in cruise ship building is to get the work offboard and to earlier stage of the project. Usually working conditions are better offboard, because onboard there is always various other workers who some way effect to your working. The biggest issue after the offboard installation is the transporting and protection of tabletop equipment. The main issues that make the transporting harder with the tabletop equipment installed are height, change of balance and grown weight of furniture. (Völker 2020.)

The pre-installation of tabletop equipment makes the other installation work onboard harder because of the lack of space. If the back part of the furniture must be welded to the wall behind the furniture, welding works are harder to do when the tabletop equipment are already installed to the furniture. The installation of ceiling is also harder if the furniture with the tabletop equipment is installed before the ceiling. Successful pre-installation needs a good cooperation with other companies. (Völker 2020.)

The risks for doing the installation offboard relate how to protect the tabletop equipment. Tabletop equipment might get damage during the transport or onboard because of the other construction works on the same area. When tabletop equipment is onboard there is always a risk of stealing easily removable parts. The above-mentioned risks exist also onboard installation but the probability of them is not as big as offboard installation. (Virtanen, 2020.)

To install the tabletop equipment offboard the furniture needs to be transported onboard at the early stage of the project because then the transporting routes are more open. The protection for the tabletop equipment onboard should be enough strong and not easily removable. A box which is made of stainless-steel and spot welded from the corners on top of the tabletop equipment would be one solution for the protection. If the furniture with the tabletop equipment is transported enough early stage with good protection the risk would be worth of taking. (Virtanen, 2020.)

Völker and Virtanen both mentioned that one of the biggest issues of the offboard installations is the protection of the tabletop equipment. The stainless-steel box that Virtanen mentioned could be a working solution for protection of the equipment because it fulfills the fire load requirements set by IMO. When the corners of the protection box are spot welded to the furniture the possibility of stealing removable parts decreases a lot.

5.2 SWOT Analysis

SWOT analysis is a simple and popular analysis method. Swot analysis is used to identify strengths, weaknesses, opportunities, and threats. SWOT analysis is separated to helpful and harmful parts and internal- and external origins. (PK-RH, 2020.) Picture below shows the parts of the SWOT analysis.



Picture 8. SWOT Analysis (Wikimedia, 2020).

5.2.1 SWOT Analysis onboard installation

Strengths (Internal)

- Smaller risk of damage to tabletop equipment
- Easier protection
- Easier transporting

Weaknesses (Internal)

- Timing
- More work onboard
- Bigger workload at the end of the project

- Working conditions not as good as in offboard installations

Opportunities (External)

- Smaller risk to get damaged/stolen onboard because of the other workers

Threats (External)

- Surface of the table installed before the tabletop equipment
- Tabletop equipment is not installed in a required schedule

5.2.2 SWOT Analysis offboard installation

Strengths (Internal)

- More work offboard
- Smaller workload at the end of the project
- Better working conditions

Weaknesses (Internal)

- Bigger risk of damage to tabletop equipment
- Transporting is more difficult
- Protection problems

Opportunities (External)

- The tabletop surfaces do not need to take account
- For the area inspections the tabletop equipment is on position

Threats (External)

- Bigger risk to get damaged/stolen onboard because of the other workers onboard

5.2.3 SWOT Analysis summary

Onboard installations are this point a safe way to do the installations, but with a more comprehensive research the offboard installations of the tabletop equipment could be a better solution at some point. To run a comprehensive analysis both installation ways should be tested operationally and after that compare them again.

Before doing the installation offboard there need to be cooperation with other companies to make sure that other installation works onboard can be done when the tabletop equipment is installed offboard. If the tabletop equipment does not get damage between pre-installation and delivery of the ship it would be worthwhile to do the installations offboard.

6 CONCLUSIONS

This thesis investigated the ways of installing the tabletop equipment for cruise ship galley furniture. Thesis operates in accordance with cruise ship industry rules and standards set by international organizations, classification societies and authorities. Thesis also investigated the ergonomic side of the installation works. Thesis was run during the spring 2020 until the late autumn of the 2020. Functional part of the thesis was done in Papenburg Germany during summer 2020.

Comparison of the installation methods succeeded well and knowledge on pros and cons of both installation methods was found. Risks of the installation were clarified well and there were various risks that the research identified. Ergonomic side of the installation was researched, and it turned out that onboard installation is a better way for the installing ergonomic. The development of the methods related to offboard installations. The stainless-steel protection box could be a good solution for the protection of the tabletop equipment as Virtanen mentioned in his interview.

This research succeeded in its mission well but to achieve a successful pre-installation of tabletop equipment there need to be made a more comprehensive study. Follow-up for this research could be done in the future. This research identified the risks and considered the development proposals. In the future a follow-up research could test how the development proposals would work and could the identified risks be avoided.

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