Commoditization

Commoditization of HI-FOG® fire protection systems

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**Abstract:**
The intention of this degree thesis is to investigate the possibility to commoditize HI-FOG® systems. The current project based work method within Marioff Corporation Oy devotes the same amount of resources and work effort for all projects, disregarding the economical benefits or the complexity of the projects. In this thesis a study is conducted in order to examine if it is feasible or even possible to commoditize some systems in Marioff Corporation Oy’s product range. The goal is to achieve a process for commoditization to simplify, or eliminate, the need for internal sales- and project work. This could be achieved by allowing the distributors and agents to handle the sales, project and maintenance independently, without involvement from Marioff Corporation Oy’s sales and project departments. In order to achieve this goal, the Kitchen Accumulator Unit (KAU) and Machinery Local application Pump Unit (MLPU) systems are used as study examples in this thesis.
The information for the investigation has been gathered through internal expert interviews, literature studies (internal and external), questionnaire to distributors and agents and from the authors own experience and knowledge of Marioff Corporation Oy processes and products.

**Keywords:** Commoditization, KAU, MLPU

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Sammandrag:
Information för denna undersökning har samlats in genom interna intervjuer med experter, litteraturstudier (interna och externa), frågeformulär till distributörer och agenter och från författarnas erfarenhet och kunskap om Marioff Corporation Oy processer och produkter.
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Abbreviations

ABS = American Bureau of Shipping
AFP = Active Fire Plan
AISI = American Iron and Steel Institute
BRE = Building Research Establishment
BV = Bureau Veritas
CCS = China Classification Society
CNPP = National Centre for Prevention and Protection
CSC = Customer Service Center
DBI = Danish Institute of Fire and Security Technology
DCC = Diagram Component Calculator
DIN = Deutsches Institut für Normung
DNV = Det Norske Veritas
ERP = Enterprise Resource Planning
FDS = Fire Detection System
FSS Code = the International Code for Fire Safety Systems
GA = General Arrangement
GL = Germanischer Lloyd
IACS = International Association of Classification Societies
IMO = International Maritime Organization
IPR = Intellectual Property Rights
IRS = Indian Register of Shipping
IT = Information Technology
KAU = Kitchen Accumulator Unit
KR = Korean Register of Shipping
LPCB = Loss Prevention Certification Board
LR = Lloyd’s Register
MA = Machinery Arrangement
MLPU = Machinery Local application Pump Unit
MSC = Maritime Safety Committee
NK = Nippon Kaiji Kyokai
OEM = Original Equipment Manufacturer
P&ID = Piping and instrumentation diagram
PDM = Product Data Management
PFP = Passive Fire Plan
RFQ = Request For Quotation
RINA = Registro Italiano Navale
Ro-Ro = Roll on – Roll off (vessel type)
RS = Russian Maritime Register of Shipping
SAE = Society of Automotive Engineers
SOLAS = Safety of Life at Sea
SP = Technical Institute of Sweden
TAC = Type Approval Certificate
UTC = United Technologies Corporation
VTT = Valtion Teknillinen Tutkimuslaitos
1 Introduction

1.1 Marioff Corporation Oy

Marioff was founded in 1985 by Mr. Göran Sundholm. Marioff began by providing specialized hydraulic service and products, mainly to the marine and offshore market. Hence the name, that comes from marine (mari) and offshore (off). The company name was later changed to Marioff Corporation Oy. The company achieved great success after developing a new fire protection technology, high pressure water mist system named HI-FOG®, which was launched in 1991. The HI-FOG® system can protect a wide range of applications including machinery spaces, special hazard areas and turbines, commercial cooking and frying systems, all fire protection areas which conventional water spray systems could not protect. The company grew to become the world leader in water mist fire protection. In 2007 the company was acquired by United Technologies Corporation (UTC) and became a part of the UTC Fire & Security division.1 Net sales for UTC Fire & Security were $6.5 billion in 2010.2

1.2 Marioff Technology

The HI-FOG® Water Mist Fire Protection System is a high-pressure system that uses extremely small volumes of fresh water as the fire fighting agent to produce HI-FOG® water mist. The water mist, composed of micro-droplets, is discharged at high velocity, allowing the mist to penetrate to the seat of the fire. This eliminates two of the three prerequisites that fire needs to persist and grow, namely heat and oxygen, the combustible material being the third.

![Figure 1. (from HI-FOG® sales brochure)](image-url)
The water mist cools the fire itself and the surrounding air effectively, and displaces oxygen locally around the fire, suppressing the fire before it can spread.

HI-FOG® generates a very large surface area of water by propelling water under high pressure through special, patented nozzles creating a fine mist of micro-droplets. The enormous number of micro-droplets represents a vast surface area of water providing fast cooling. The micro-droplets are extremely small and vaporize instantly, consuming the heat energy very efficiently.

<table>
<thead>
<tr>
<th>Typical drop size range (mm)</th>
<th>Number of droplets per litre of water</th>
<th>Surface area (m²)</th>
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<tr>
<td>1...5</td>
<td>15 thousand to 2 million</td>
<td>1...6</td>
</tr>
<tr>
<td>0.2...1</td>
<td>2 million to 250 million</td>
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</tr>
<tr>
<td>0.025...0.2</td>
<td>250 million to 160 billion</td>
<td>30...260</td>
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Figure 2. (from HI-FOG® sales brochure)

HI-FOG® is entirely harmless to people and can therefore be activated the moment the fire is detected, with no need for evacuation, ventilation shutdown or closing openings. This is a great advantage in marine and offshore applications in comparison with gas- and foam-based systems.

Using extremely small amounts of fresh water, HI-FOG® also minimizes post-fire water damage. Post-fire smoke damage is minimized by the extremely fast suppression process and HI-FOG®’s effective smoke scrubbing effect: much of the smoke will bind to the mist and gravity will press the particles to the floor, clearing the air. HI-FOG®’s superior cooling effect is the single most important factor involved in minimizing post-fire damage and the prevention of re-ignition.

Water is the world’s oldest fire fighting agent. When used in the form of HI-FOG® water mist, water is also the world’s safest and most environmentally-friendly fire
fighting agent. HI-FOG® uses up to 90% less water than traditional sprinkler systems. C02 and halon-based system are both lethal and very damaging to the environment.

HI-FOG® tubes, ranging in diameter from 12 – 60 mm, are about one-quarter the diameter of the equivalent traditional sprinkler system pipes. The total weight of a HI-FOG® system is therefore substantially less than that of a traditional sprinkler system. The small-diameter HI-FOG® tubes easily fit the tight spaces typically available aboard vessels and little welding is required. HI-FOG® is easily retrofitted on vessels even when they are in service. HI-FOG® tubes are made of high-quality stainless steel, ensuring a long and trouble-free system lifecycle.

With thousands of full-scale fire tests behind it, the HI-FOG® Water Mist Fire Protection System is the world’s most tested water mist system for fire protection. HI-FOG® has been tested thoroughly for accommodation spaces, public spaces, service areas, machinery spaces, ro-ro and special category spaces.

*Figure 3. Picture from HI-FOG® fire test (from HI-FOG® sales brochure)*
Marioff Corporation Oy has worked with the following fire laboratories and institutes on HI-FOG® fire testing:

- VTT, Finland
- SP, Sweden
- LPCB, UK
- BRE, UK
- DBI, Denmark
- CNPP, France
- Factory Mutual, USA
- Underwriter Labs, USA
- US Fire Admin., USA
- US Navy, USA
- Hughes Associates, USA

Marioff Corporation Oy has also conducted fire tests in its own fire testing facility, located at Lohja, since May 2001./3/.

1.2.1 Intellectual Property Rights (IPR)

With the launch of HI-FOG® in 1991, Marioff pioneered the use of water mist for fire fighting with worldwide patent protection.

Today, Marioff Corporation Oy has patent protection for every key aspect of HI-FOG® technology with hundreds of granted and pending patents worldwide. Key Marioff patents cover critical HI-FOG® components and system designs as well as fire fighting methods.

Marioff and HI-FOG® are registered trademarks of Marioff Corporation Oy, a UTC Fire & Security company./1/
1.3 Marioff Distributors and Agents

Marioff Corporation Oy has a number of distributors and agents throughout the world. In order to become a distributor or agent there are some quite strict criteria one needs to fulfill.

Marioff Corporation Oy’s main distributors and agents, as of today, and their respective sales areas are presented in figure 4.

Figure 4. Distributor and agent locations (from Marine Sales Channel presentation)

As the distributors and agents are widely spread globally the main marine market is well covered, giving the possibility for extensive sales.
1.4 Intention of thesis

The intention of this thesis is to develop a commoditization process for HI-FOG® systems. In this thesis the main focus will be on developing a common commoditization process using two existing HI-FOG® systems, Kitchen Accumulator Unit (KAU) and Machinery Local application Pump Unit (MLPU), as examples. The main reason for the work is to make the somewhat complex systems to a pre-engineered package or commodity which is easy to understand and thus easy to sell and install.

2 Commoditization

The word commoditization can be described as the transformation of goods or services into a commodity or to make it suitable as a commercial product. /4/.

The basic idea behind the commoditization concept is to develop a (new) product or service and getting it out on the market. The goal is to achieve a competitive product. The development process gathers information to ensure that the product meets as accurately as possible the customer’s demands. By commoditization one gets a realistic view about the price/value ratio. /5/. Internal commoditization aims to ensure that the administrative and process creating work that is already done does not have to be done again. This includes e.g. work practices, guidelines, databases, research and development procedures as well as internal product, service and process descriptions. /6/.

Usually commoditization is done for different services, such as IT services, and not for hardware products as is intended in this degree thesis.

In this thesis the commoditization can be described as producing a pre-engineered package which content, price, tools, documentation and terms & conditions are defined.

2.1 Commoditization at Marioff
achieve the project target, which is to provide the customer with a class approved firefighting system meeting their requirements and schedules. As all sales cases are handled as projects and there is a limited number of resources available to make the needed design and documentation, there is a risk that the lead time for a system, including the needed documentation, is too long from the customers point of view. This can lead to loss of sales, as less profit bringing projects, such as KAU and MLPU systems, cannot be prioritized within Marioff Corporation Oy. If the contract is signed even though there is a risk for a delay, there is, depending on the contract, a possibility for penalties due to late delivery. In the worst case, these penalties can in small profit projects, cause that the project brings a financial loss to the company. With a commoditized system, the resource need and the risk for delays in documentation delivery would not be with Marioff, it would instead be the distributor and agent’s responsibility.

What would then be the benefit of commoditizing a Marioff Corporation Oy HI-FOG® system? With a commoditized product the benefit for Marioff Corporation Oy would be that the project work, which at current state, is performed by Marioff Corporation Oy project department could be done by the distributor or agent, thus freeing project department resources for more challenging tasks. With the commoditized system there is also a possibility for increased sales. The increased sales can be a result of a more streamlined sales process through distributor or agents or a shorter lead time for a commoditized system. To increase the willingness of the distributors and agents to sell the commoditized system, a good incentive would be to offer the distributor and agents a complete responsibility of the commoditized system. This would include the responsibility for documentation, installation, commissioning etc. but at the same the responsibility for after sales activities, e.g. service and spare parts, which are easy and profitable sales, would be with the distributor or agent.

For the distributor or agent the benefit would be that they can independently sell the commoditized system to final customer without the need to contact Marioff Corporation Oy for a quotation. This would allow for shorter lead time between the RFQ and the
2.2 Scope of thesis

The scope of the degree thesis is to develop a commoditization process for HI-FOG® systems, using the KAU and MLPU systems as examples. This thesis is restricted to define the critical dimensioning and design tools for the example system only, and to generally discuss what should be considered when, or if, HI-FOG® systems are commoditized. Process maps or commoditization model as well as marketing material, distributor and agent templates, standard system manuals and other standardized system documentation is excluded from the scope of this thesis.

2.3 Methods (Research & Development)

Methods used in this thesis are literature search (internal and external literature), survey in form of questionnaire to distributors and agents, internal expert interviews with legal-, sales-, and after sales & service department as well as customer service center. Also the authors own experience and knowledge of the systems and processes within the company have been used, as both have been working for Marioff for several years in different positions within the sales-, project- and after sales departments. During the work the authors have used their knowledge of Marioff Corporation Oy systems electrical features, made layout drawings using Computer Aided Design (CAD)
program (AutoCAD LT 2007) and performed calculations using the Darcy-Weisbach calculation method for pressure losses.

As this degree thesis has two authors the work has been divided between them. The introduction, sales- and project processes, interviews, questionnaire and general discussion of the commoditization of the example systems as well as the conclusion has been for most parts done in collaboration between the authors. This collaboration has been performed by freeform discussions and brainstorming sessions to decide e.g. the questions for the questionnaire and interviews. The presentation and definition of parameters and critical tools for system design and dimensioning has been done individually by each author, one concentrating on the KAU system and the other on the MLPU system. With the collaboration and division of the specific systems for each author, the work effort of both authors has been equally divided.

3 The internal work process

The following chapter describes the internal work processes currently used in our project based business.
3.1 The current sales process

Currently the sales process follows more or less a standard routine. The customers (ship owners, ship yards, etc) contact the sales department with a request for quotation (RFQ).

3.1.1 Request for Quotation (RFQ) review

The RFQ usually contains the specifications for the vessel in question, general arrangement drawings (GA), machinery arrangement drawings (MA), see figure 6 for reference, and fire plan drawings (PFP, AFP) which indicates which areas require fire protection. The sales manager and assigned sales support engineer reviews the received documentation to check that everything relevant is included. This is not always the case, but it is possible to make a budgetary proposal based on drawings only.
3.1.2 Preparing the quotation

Based on the information described above, the sales support engineers make the calculations needed to produce the quotation for the customer. The required calculations determine the approximate amount of nozzles needed to fulfill the rules and regulations. Based on these calculations, it is possible to determine what kind of pump unit the system requires. This data is used as an input in a calculation tool that calculates an estimated amount of pipes and fittings needed. The output from the tool also gives price information. When this information is obtained, the quotation material is gathered and sent to the customer. The quotation material includes information about the quoted system, such as which rules the system complies with, scope of supply, price, delivery, and payment terms and applicable data sheets.

3.1.3 Negotiations & purchase order

Some time after the customer has received the quotation, the sales manager makes a follow-up call to the customer to see whether they found it economically and scope wise interesting enough to sign a contract. When the scope of supply and price is suitable for all parties, the customer issues a purchase order. Once the official contract is signed, there is arranged an internal kick-off meeting with the sales team involved in the project, the assigned project team, and the project department manager. In the kick-off meeting, the project is handed over to the project department, who then takes the responsibility of executing the project according to what has been agreed with the customer.
3.2 The current project work process

After the contract for supplying a fire protection system has been awarded to Marioff Corporation Oy a project team is established. The project team consists of a project manager, an electrical engineer and a layout designer, when deemed necessary also a
project engineer is included to the team. This team is then responsible for the project execution so that the deliverable is satisfactory to both customer and Marioff Corporation Oy.

![Figure 7. SOLE model – Execution phase activities and milestones (from Marioff Corporation Oy internal documentation)](image)

### 3.2.1 Design phase

The design phase is further divided into four main parts which are system design, electrical design, system documentation and authority approval.

#### 3.2.1.1 System design
Figure 8. Example of completed HI-FOG® layout for local application system (author's own drawing)
3.2.1.2 Electrical design

Based on the completed piping diagram layout the electrical designer designated for the project makes the needed electrical drawings for manufacturing of pump unit starter cabinet, release panel, repeater panel as well as the cabling diagram and connections diagram which shows the installer the needed connections and cabling for the system.

Once the electrical design has been completed the drawings are sent to customer for review and any possible comments to the electrical drawings will be considered and implemented if possible. When the customer has given his approval for the electrical drawings the manufacturing of electrical equipment can start.

3.2.1.3 System documentation

Based on the piping diagram the system documentation is prepared. This system documentation contains the necessary information required for classification society approval of the system, as well as the operation and service manuals for the end user. The system documentation includes a description of the components used in the designed system, the operating instructions for the release and starter panels, all electrical drawings of the system and calculations for pump dimensioning, pressure drop and reserved fresh water capacity.

The pump size used for the system depends on how many and what type of nozzles are used in the system. The needed pump size is defined by a pump capacity calculation, which takes into consideration the nozzle amount per protected section, type of nozzle and required minimum pressure at the nozzle. In figure 9 below is shown an example of a local protection system pump dimensioning calculation.
Figure 9. Example of pump dimensioning calculation (from Marioff Corporation Oy project specific system manual)
3.2.1.4 Authority approval

Once the piping diagram, electrical design and system documentation has been completed, the full system documentation is sent for authority approval. The process for submittal of documentation differs depending on which classification society handles the approval for the vessel in question. Some authorities require several hard copies of the system documentation while some are using electronic approval processes where the system documentation is uploaded to a server controlled by the classification society.
Once the documentation has been submitted, the classification society will investigate if the proposed system fulfills applicable rules and regulations. If there are any unclear issues the classification society will issue comments regarding the system which must be clarified and, if needed, re-submitted to the classification society. When all pending comments have been satisfactorily replied, they will be closed by the classification society and the proposed system is approved.

### 3.2.2 Deliveries – internal material orders

Material calculations are made based on the layout drawing. Nozzle, pipe, fitting, valve etc. amounts are calculated from the CAD drawing using a DCC calculation program or manually from the drawing. When the material amounts are known the material is ordered from the factory by entering an internal material order using an ERP program, iScala. Each component has its own stock code which needs to be entered into the program. If a stock code is unknown, it can be searched from a database using a PDM program, Enovia. When entering the order to the factory it is required to specify when, where, how (e.g. truck, sea- or air-freight) and with which delivery terms (Incoterms 2010) the material is to be delivered. Once the order is entered into the system it needs to be confirmed by the user in order to release it to the supply chain for purchasing and production for manufacturing.

### 3.2.3 Installation and training

In turnkey projects where the installation is a part of Marioff scope of supply, the installation agreement with chosen subcontractor must be controlled by the project team. In this document we will not go further on the issue of installation as it cannot be a part of a commoditized package.

### 3.2.4 Commissioning

Once the system has been mechanically installed and all electrical installation have been completed, the system is commissioned by a trained Marioff Corporation Oy commissioning engineer. During the commissioning all mechanical installation are checked that they have been done according to Marioff Corporation Oy instructions and all electrical signals are tested and checked. In the final stages of the commissioning the
classification society representative and usually also the end users representative are present and they give the final acceptance of the designed and installed system.

4 Authorities and Classification Societies

4.1 International Maritime Organization (IMO) and SOLAS

The International Maritime Organization - IMO is the United Nations (UN) specialized agency with responsibility for the safety and security and the prevention of marine pollution by ships. IMO was formally established in 1948 by an international UN conference held in Geneva. The reasons behind establishing the IMO was the fact until then, each shipping nation had its own maritime laws, and only a few international treaties existed. This resulted in that the standards and requirements varied much and were often even contradictory. Several countries proposed that a permanent international body should be established to develop international standards, which would replace the different national legislations that existed.\footnote{7}.

The International Convention for the Safety of Life at Sea (SOLAS) is an international maritime safety treaty. The SOLAS convention in its successive forms is generally regarded as the most important treaties concerning the safety of merchant ships. The first version of the treaty was passed in 1914 in response to the RMS Titanic disaster. It prescribed numbers of lifeboats and other emergency equipment along with safety procedures.

The intention had been to keep the convention up to date by periodic amendments, but the procedure to incorporate the amendments proved to be very slow. It could take several years for the amendments to be put into action since countries had to give notice of acceptance to IMO and there was a minimum threshold of countries and tonnage.

The 1960 convention, which was activated on 26 May 1965, was the first major achievement for IMO after its establishment and represented a massive advance in updating commercial shipping regulations and in staying up-to-date with new technology and procedures in the industry.\footnote{8}.
4.2 Classification Societies

4.2.1 General

There are more than 50 classification organizations worldwide who define their activity as providing marine classification. Of these 50 societies, eleven are a member of the International Association of Classification Societies and class approximately 94% of all commercial marine tonnage involved in international trade worldwide.

Classification societies are organizations who develop and apply technical standards for marine facilities, i.e. ships and offshore structures, in relation to design, construction and survey. The standards are issued by a classification society as a published rule. A marine facility which is designed and constructed following these published rules can apply for a certificate of classification from the society according to whose rules the facility has been built. The classification society will conduct surveys during the design and construction stage and if found to be as per published rules the society will issue a certificate that the facility has been designed and constructed as per applicable rules. Surveys will be conducted throughout the service time of the facility to control that the facility is maintained correctly and that it fulfills applicable rules also after completion.

The technical standards are developed to assess the structural strength and integrity of essential parts of the ship’s hull and equipment. The standards are categorized by several subareas, e.g. hull, machinery, propulsions, steering, fire safety etc. The standards are developed so as to make the use of a marine facility as safe as possible. The classification societies mission is to contribute to the development and implementation of technical standards for the protection of life, property and the environment.

Classification societies are only one element within the marine safety network, several other partners are also involved in the safety of marine facilities, e.g. shipowner, shipbuilder, flag state etc.
Classification societies also grant type approvals for standard designs or routinely manufactured components. The type approval of a product or a system implies that the examination of the design is done once for the product or system and the approval is made valid for all subsequent components or systems of identical design. For type approving a system, the classification societies control that the suggested system will follow and fulfill requirements laid out in IMO documents./9/.

4.2.2 International Association of Classification Societies Ltd (IACS)

Today the members of IACS are;
- American Bureau of Shipping (ABS)
- Bureau Veritas (BV)
- China Classification Society (CCS)
- Det Norske Veritas (DNV)
- Germanischer Lloyd (GL)
- Indian Register of Shipping (IRS)
- Korean Register of Shipping (KR)
- Lloyd’s Register (LR)
- Nippon Kaiji Kyokai (NK)
- Registro Italiano Navale (RINA)
- Russian Maritime Register of Shipping (RS)

In 1930 the International Load Line Convention recommended that classification societies should secure “as much uniformity as possible in the application of the standards of strength upon which freeboard is based...” /10/

After the load line convention RINA hosted the first conference of major societies in 1939, which was attended by ABS, BV, DNV, GL, LR and NK. In this conference the societies agreed on further cooperation between the societies. This can be considered as the origin of IACS, even though the IACS was officially formed in 1968 by seven of the leading societies.

The value of IACS combined technical knowledge and experience was quickly recognized and already in 1969 IACS was given consultative status with IMO. It is still
the only non-governmental organization with observe status in IMO which is able to develop and apply rules.

The purpose of IACS is to establish, review, promote and develop minimum technical requirements in relation to design, construction, maintenance and survey of ships and other marine related facilities. IACS also assists international regulatory bodies and standard organizations to develop, implement and interpret statutory regulations industry standards in ship design, construction and maintenance, with a view to improving safety at sea and the prevention of marine pollution. /11/

5 Presentation of the example systems and regulatory requirements

5.1 Presentation of the KAU system

The Kitchen Accumulator Unit, referred to as a KAU, is a self-contained HI-FOG® water mist distribution system for fire protection of deep fat cooking equipment only. It is a twin-fluid, single pipe type employing water as the suppressant and nitrogen or compressed air as the atomizing medium in a single discharge.

Each system arrangement is configured to cover the deep fat cooking area using a water and a gas or pressurized air supply for a total suppressant requirement for about four (4) minutes. The system consists of the following main components;

- a Kitchen Accumulator power Unit (KAU) which comprises of a 20 liter water cylinder interconnected with a pressurized (200 bar) 20 liter or 10 liter nitrogen / pressurized air cylinder
- a spray head installed above the protected equipment for discharging of water mist
- assembly body for the spray head
- stainless steel tubing

The distribution tubing is isolated from the accumulator unit by an actuator valve or an isolation valve. In standby position the valve is closed and the tubing up to the spray head is dry. In its simplest form the system is activated manually by opening the
isolation valve. Alternatively it may be activated by either remote electric actuation or remote pneumatic actuation, both being supplemented by local manual release.

The deep fat fryers to be protected can be single-vat fryers, multiple-vat fryers and split-vat fryers with a cooking area of a single vat not exceeding 0.1 m$^2$. /12/.

In order to produce the high-pressure water mist a special nozzle is used which converts the water into water mist. The nozzle for the KAU system is an open nozzle, so the water mist will be created as soon as water under high pressure is led into the section.
The assembly body is used to connect the spray head to the distribution piping. The connection between assembly body and piping is done with a cutting ring fitting. The spray head is then screwed into the assembly body and tightened using a special tool.

![Assembly body](image)

*Figure 13. Assembly body (from Marioff Corporation Oy’s internal documentation)*

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1. Nitrogen Cylinder (10 or 20 L)
2. Water Cylinder (20 L)
3. Header Body Kit
4. Flexible Hose
5. Pressure Gauge
6. Venting Plug
7. Fill Port Plug
8. Burst Plug
9. Pressure Switch
10. Solenoid Valve
11. Pneumatic Valve
12. Micro Leakage Plug
13. Check Valve

![Typical KAU system – P&ID](image)

*Figure 14. Typical KAU system – P&ID (from Marioff Corporation Oy’s internal documentation)*
Figure 15. Typical KAU Unit – General assembly (from Marioff Corporation Oy’s internal documentation)
Figure 16. Typical KAU – Single fryer protection (from Marioff Corporation Oy’s internal documentation)
5.2 Authority requirements and rules for KAU systems

The requirements and rules for deep-fat cooking equipment fire-extinguishing systems are mentioned in IMO SOLAS. Further, classification societies can have specific requirements in regard to design or components used in the system.

5.2.1 IMO/SOLAS/FSS Code

The basic rules and requirements for deep-fat cooking equipment fire-extinguishing systems can be found in IMO SOLAS Chapter II-2: Regulation 10.6.4, where it is stated the following;

6.4 Deep-fat cooking equipment

Deep-fat cooking equipment shall be fitted with the following:

1. an automatic or manual fire-extinguishing system tested to an international standard acceptable to the Organization;*
2. a primary and back up thermostat with an alarm to alert the operator in the event of failure of either thermostat;
3. arrangements for automatically shutting off the electrical power upon activation of the fire-extinguishing system;
4. an alarm for indicating operation of the fire-extinguishing system in the galley where the equipment is installed; and
5. controls for manual operation of the fire-extinguishing system which are clearly labeled for ready use by the crew

*Refer to the recommendations by the International Organization for Standardization, in particular publication ISO 15731:2009, Fire-extinguishing systems for protection of galley deep-fat cooking equipment – fire tests. /xx/

5.2.2 Classification Societies

The classification societies issue type approvals for systems that are in conjunction with the rules and regulations mentioned in the IMO SOLAS. The type approvals are usually valid for a period between three (3) and five (5) years, unless for some reason revoked. As the type approvals are issued only for systems fulfilling the set regulations it can be concluded that a system following the type approvals are fulfilling all the rules.
Although every classification society follows the same base rules from SOLAS, there are differences between the requirements stated in the type approvals issued by different classification societies. Therefore, for this commoditization work, the most stringent requirements have to be considered. Or alternatively, there must be developed a tool for the distributor and agents from where they can choose the applicable classification society and the output will show which components are needed to fulfill the rules for that class.

5.3 Presentation of the MLPU system

The HI-FOG® Machinery Space Local Application Unit is designed to supply high pressure water to a HI-FOG® water mist distribution system used for fire protection. It is used with single-fluid, single-pipe type HI-FOG® spray head systems that use water, in the form of fine mist, as the fire suppressant. The system is designed for constant pressure discharge.

The basic features of the MLPU are:
• Automatic start in connection with a third-party Fire Detection System (FDS)
• Manual local start
• 70 or 90 bar pressure, depending on the application

The optional features of the MLPU are:
• Voltage options
• 50 Hz or 60 Hz frequency
• Feed water pump starter in the Starter Cabinet
• Emergency start at a remote location

The MLPU system consists of the following main components;
• Pump unit
• Starter cabinet for pump unit
• Stainless steel piping in the distribution network
• Section valves
• Spray heads for discharging the water mist
• Assembly bodies for spray heads
- Control panel (release panel)
- Repeater panel
- Alarm beacons
- Local release buttons

The pump unit consists of the following main parts:
- pump module which consists of one 3-phase electric motor, one plunger pump and one unloader
- stand-by pressure water connection
- pressure indication
- test connection

Figure 17. Machinery space local application pump unit (MLPU)(extracted and modified from Marioff Corporation Oy’s data sheet for MLPU)
The Starter Cabinet is used to monitor, operate, and control the MLPU fire protection system. It indicates all operation and fault signals concerning the pump unit. The Starter Cabinet is installed near the pump unit.

The Starter Cabinet has the following manual operations and selections (numbers in brackets correspond to the figure 18 below):

- Unit manual start switch with 10 s delay (1)
- Unit reset push button (7)
- Lamp test push button (6)
- Main power switch (8)

The Starter Cabinet has the following indications:

- Pressure gauge (2)
- Control system on (3)
- Pump unit fault (4)
- Earth fault (5)

Tubes and fittings are used to distribute the water, pushed under high pressure by the MLPU pump unit, to the nozzles located in the protected space. The tubes are made of corrosion-resistant AISI 316 stainless steel according to DIN or equivalent standards. The tubes are coupled using S-class cutting ring couplings that are compliant with DIN
2352. The tubing network is designed to cover the areas to be protected as effectively as possible.

The section valve controls the water flow to the protected section. The valves are connected to the distribution piping between the pump unit and the spray heads inside the protected section. The section valve is normally closed, so the piping is filled with water up to the section valve and dry after the section valve. The valve is normally opened by a signal from the release panel, which will activate the solenoid and open the section valve. If the solenoid is malfunctioning, there is a possibility to open the valve manually by turning the manual release wheel. The opening of the section valve is detected by the piston position indicator.

![Machinery section valve](Image 19)

Figure 19. Machinery section valve (extracted and modified from Marioff Corporation Oy’s internal documentation)

To produce high-pressure water mist which is used in the MLPU system a special nozzle is used which converts the water under high pressure into water mist. The nozzle for the MLPU system is an open nozzle, so the water mist will be created as soon as high pressure water is led into the section.

![Spray head](Image 20)

Figure 20. Spray head (from Marioff Corporation Oy’s internal documentation)
The assembly body is used to connect the spray head to the distribution piping. The connection between assembly body and piping is done with a cutting ring fitting. The spray head is then screwed into the assembly body and tightened using a special tool.

*Figure 21. Assembly body (from Marioff Corporation Oy’s internal documentation)*

The release panel is used to monitor and control the MLPU system. It has the following manual operations and selections (numbers in brackets correspond to the Figure 22 below):

- Push button to release a section (1)
- Buzzer acknowledge to silence the alarm in panel (7)
- Lamp test button to check that all lamps on panel are functioning (8)
- Reset button, to reset system to stand-by position after fire has been extinguished (9)
- Switch to choose if automatic release from FDS is on/off. Off position used only during maintenance (10)

The release panel has the following indications:

- Control system on, to indicate that system is in stand-by position (2)
- Pump unit running, to indicate that pump unit has been activated (3)
- Pump unit fault (4)
- Automatic release request on, to indicate that system is in automatic mode (release from FDS) (5)
- Buzzer to give audible alarm if system is released (6)
The repeater panel has the same indications as the release panel, but the system cannot be operated via the repeater panel.

Each section is to be equipped with an alarm which is installed within the protected space. This alarm will sound if the corresponding section is released to warn any crew members that might still occupy the area when the system is released.
Each section is to be equipped with a local release button which is to be installed within the protected space. This local release button can be used by the crew while they are evacuating the area to release the system.

![Local Release Button](image)

*Figure 24. Local Release Button (picture by author)*

The equipment requiring local protection are separated each under its own section. The flow to each section is controlled by a normally closed section valve which is controlled by the release panel. The distribution network from pump unit until section valve is pressured to stand by pressure, 25 bar, and after the section valve the distribution network is of dry type.

When a section is released the section valve is opened and water will flow to the spray heads and discharge as water mist. At the same time the electrical motor will start via a command from the starter panel and create a high pressure water flow in the distribution network, thus giving continuous supply of high pressure water to the spray head.

The section valves can be opened in several ways. Local application sections must be connected to automatic fire detection systems which will give a release signal to the HI-FOG® system. This signal is led to the release panel which opens the section valve and gives start pump unit signal to pump unit. The section can also be released by pressing the corresponding section button on the release panel, opening the section valve and starting the pump unit as in automatic mode. Third possibility for release of system is via the local release button which is located within the protected space. When this button is pressed the section will open and pump will start in the same way as in the two other release methods.
5.4 Authority requirements and rules for MLPU systems

The requirements and rules for a local application fire-extinguishing system are mentioned in IMO SOLAS and in the IMO circular. Further, classification societies can have specific requirements in regard to design or components used in the system.

5.4.1 IMO/SOLAS/FSS Code

The basic requirements for a local application fire protection system are mentioned in SOLAS, where in chapter II-2, regulation 10.5.6 Fixed local application fire fighting systems is stated the following;

5.6.1 Paragraph 5.6 shall apply to passenger ships of 500 gross tonnage and above and cargo ships of 2000 gross tonnage and above.

5.6.2 Machinery spaces of category A above 500 m³ in volume shall, in addition to the fixed fire-extinguishing system required in paragraph 5.1.1, be protected by an approved type of fixed water-based or equivalent local application fire-extinguishing system, based on the guidelines developed by the Organization. (Refer to the Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces (MSC/Circ.913)). In the case of periodically unattended machinery spaces, the fire-extinguishing system shall have both automatic and manual release capabilities. In the case of continuously manned machinery spaces, the fire-extinguishing system is only required to have a manual release capability.

5.6.3 Fixed local application fire-extinguishing systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces:

.1 the fire hazard portions of internal combustion machinery used for the ship’s main propulsion and power generation;
.2 boiler fronts;
.3 the fire hazard portions of incinerators; and
.4 purifiers for heated fuel oil.

5.6.4 Activation of any local application system shall give a visual and distinct audible alarm in the protected space and at continuously manned stations. The alarm shall indicate the specific system activated. The system alarm requirements described within this paragraph are in addition to, and not a substitute for, the detection and alarm system required elsewhere in this chapter.
SOLAS chapter 10.5.6 refers to IMO MSC/Circ. 913, which has been revised in December 2010 and the requirements are now specified in IMO MSC.1/Circ. 1387. This circular states in paragraph 3 “Principal requirements for the system” the following which has relevance for the commoditization of the MLPU system in regard to the mechanical and electrical arrangement of the system;

3.1 System operation

.1 The system should be capable of manual release.

.3 The operation controls should be located at easily accessible positions inside and outside the protected space. The controls inside the space should not be liable to be cut off by a fire in the protected areas.

.5 Where automatically operated fire-fighting systems are installed:

.4 visual and audible indication of the activated section should be provided in the engine control room and the navigation bridge or continuously manned central control station. Audible alarms may use a single tone.

3.2 Arrangement of nozzles and water supply

.2 The location, type and characteristics of the nozzles should be within the limits tested in accordance with the appendix to these Guidelines. Nozzle positioning should take into account obstructions to the spray of the fire-fighting system. The use of a single row of nozzles or single nozzles may be accepted for installation where this gives adequate protection according to paragraph 3.4.2.4 of the appendix.

.3 The piping system should be sized in accordance with a hydraulic calculation technique such as the Hazen-Williams hydraulic calculation technique* and the Darcy-Weisbach hydraulic calculation technique, to ensure availability of flows and pressures required for correct performance of the system.

3.3 System components

.8 A fitting should be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions.
5.4.2 Classification Societies

The classification societies follow the requirements in SOLAS and relevant MSC Circulars. In this aspect the classification society requirements will be taken from the type approval certificates which the MLPU system has received when it has been tested according to requirements in the MSC Circulars. The requirements for nozzle spacing and minimum and maximum nozzle heights in different classification society type approvals are the same regardless of society. They all require maximum 4 meter spacing between the nozzles and minimum 1,5 meter and maximum 5,5 meter height of nozzle above the protected object.

Some societies have additional requirements in the type approval certificates which must be taken into consideration as the most stringent requirement must be followed in this commoditization. They are,

- Nozzles should be placed in a uniform grid, but if a single row is used then they must be installed at half spacing, i.e. 2 meters.

- If only a limited number of objects are protected within a space the outer nozzles of the grid shall be placed outside the protected area to a distance of at least 1 meter.

- DNV requires that the section valve used must be type approved by DNV, this valve will be considered as standard type in MLPU commoditization as it is also accepted by all other societies.

The classification society type approvals cover normally only the spray heads and some minor components of the system. The final design of the system must be submitted for case-by-case approval to the society. Societies require that at least the following information is submitted for approval; system manual, general ship arrangement plan showing the location of pump unit, location of section valves, nozzle quantities and locations, distribution piping layout and sizes, electrical control system diagram, P&ID for the system and hydraulic calculations showing that the required flow and pressure is available at the spray heads.
6 Commoditization of the example systems

In order to determine the need, possibilities and interest for commoditized systems a questionnaire regarding KAU and MLPU systems was sent out to distributors and agents and also internal interviews were conducted.

6.1 Goal of commoditized systems

The goal is to create a standardized pre-engineered package, using the KAU and MLPU systems as an example, which Marioff distributor and agents could sell without the need to involve Marioff sales team or project team in the selling and design process.

The sales and project processes described in paragraph 3 are the same for all Marioff Corporation Oy projects, regardless of the amount of equipment installed and regardless of economical profitability of the project. If the need of Marioff Corporation Oy participation in the sales and project work phases could be eliminated, the resources which are normally needed for the heavy process to execute a project could be directed elsewhere to more challenging or economically more profitable projects.

To achieve the goal, customer requirements and Marioff Corporation Oy requirements should be investigated and a process for commoditization should be developed and tools for designing and dimensioning the systems should be developed.

6.2 Customer (distributors and agents) demands/requirements

The questionnaire to distributors and agents with ten questions did not generate as many answers as hoped, only about 20% of the recipients showed any interest by replying. The questions and feedback received is compiled below.

1. Is there a need for a pre-engineered package for KAU or MLPU systems that you could sell directly to customers without involving Marioff Corporation Oy sales and project departments?

-The general point of view was that there would be a market for a commoditized KAU system, but the MLPU system did not get the same favourable response.
This might be due to the fact that distributor and agents are unfamiliar with the MLPU system. If training regarding the MLPU system would be arranged for distributor and agents, the willingness of distributor and agents to sell pre-engineered MLPU packages could possibly be increased.

2. Do you foresee possibility to sell a standardized package or will there be many modification requests from customer?

- Generally it was seen that a standardized package could be sold, but one concern was that the price could be too high if all the components would be delivered from Finland. Some components, excluding any key components, were wished to be possible to source locally.

3. In your opinion, what is the minimum and maximum this package should contain? (pump/cylinder unit, nozzles & assembly bodies, section valves, pipes & fittings, release valve/panel, local release buttons)

- As anticipated by the answer to the previous question, the minimum the pre-engineered package should contain are the key components, such as spray head, pump unit and release valve(s). On the other hand, this was also in most cases the maximum a package should contain.

4. What is your required lead time for a pre-engineered package?

- The general opinion stated that a lead time between 3 to 6 months would be suitable.

5. What price range would you expect the systems to have?

- As an average, our prices should be around 15% lower than our competitors for KAU systems in order to secure deals. For MLPU systems, the price range couldn’t be determined since it highly depends on the amount of sections etc.

6. How do you see that the classification procedure should be dealt with? Do you have possibilities/resources to deal with the approval process? (details of the design, calculations etc. are required by the class to issue approval)

- There were shown some interest to handle the approval process locally, but the majority would prefer that there wouldn’t be a need as e.g. the KAU’s type approvals usually would be enough.
6.3 Marioff demands/requirements

From a company strategic point of view, the commoditization of Marioff Corporation Oy systems would be desirable, as it would allow growth in sales and revenue without the need for major increase of personnel. To determine Marioff Corporation Oy’s demands and requirements for commoditized systems internal interviews were conducted with Hilppa Rautpalo from the legal department and Lari Laakso from the after sales & services department.

6.3.1 Legal viewpoint

From a legal aspect there are several issues that need to be considered when making the decision about the commoditization of Marioff Corporation Oy systems.
As the systems would be designed and installed without direct Marioff Corporation Oy influence, how can it be ensured that the quality of subcontractors which distributor or agent uses for, e.g., installations, is according to Marioff Corporation Oy requirements? In unclear situations or in claims for damages, the final responsibility is again with the original manufacturer of the equipment (OEM).

As Marioff Corporation Oy is a part of UTC, these are some restrictions on where Marioff Corporation Oy manufactured equipment can be sold. Sales cannot be done to countries that are sanctioned by the EU or USA, how can Marioff Corporation Oy control where the distributor or agent sells the equipment? Partly this is covered by the distributor agreement which is made between Marioff Corporation Oy and the distributor, as it requires that also distributors must follow UTC requirements. The UTC requirements are extremely strict on issues like bribery, sanctioned countries, economical abilities, etc. This agreement is renewed every 2 years, possibly checking of where sales have been made during these 2 years could be included in the renewal process to ensure that distributor has followed the agreed terms.

The legal aspects of warranty issues should also be considered when making the decision. The agent or distributor can agree on their own warranty terms with the end customer and Marioff Corporation Oy cannot influence the price for the warranty. In case, that the distributor or agent files for bankruptcy, the warranty obligations, and all other obligations are transferred to Marioff Corporation Oy. This could pose a financial risk for Marioff Corporation Oy, as we cannot negotiate the terms of warranty, but the obligations can in worst case still be Marioff Corporation Oy responsibility.

If, for some reason, Marioff Corporation Oy decides to terminate a distributor agreement with one of its distributors, the terms require that the commissions for one year are to be paid to the distributor upon termination in compensation of lost business. If the distributor then would have been successful in selling the commoditized packages, the economical impact of the compensation would be significantly higher than in present state.
6.3.2 After sales & services viewpoint

To receive a view regarding the after sales activities of commoditized system the manager of Marioff Corporation Oy after sales department was interviewed, the conclusions of the interview are presented below.

For Marioff Corporation Oy to be able to fully utilize the benefits of a commoditized system, the maintenance and service tasks for a distributor or agent sold system should, in first hand, be handled by the distributor or agent who has sold the specific system. This would be suitable for Marioff Corporation Oy's strategy, as the intention from a service and maintenance perspective is to concentrate on cruise vessels and luxury yachts. There are however some issues which can make it difficult to arrange in practice. Firstly, the main difference between marine and land projects are that land projects are stationary, while systems for marine applications sail around the world. This causes that in marine applications the possibility of service performed by distributor or agent is decreased by their restricted service network. In land systems this is not an issue as the system is usually sold locally close to the distributor or agent. Also the spare parts for these should in first hand be sold by the original distributor and agent, the part should however be purchased from Marioff Corporation Oy after sales department. The pricing of these should be considered so that the final customer would not be tempted to purchase them directly from Marioff Corporation Oy, otherwise the benefit for the distributor and agent will decrease and possibly lessen the distributors or agents interest to sell a pre-engineered system.

To be able to ensure that service, maintenance and spare parts sales would be according to Marioff Corporation Oy guidelines and required quality, the distributors and agents should be trained and certified as Marioff Corporation Oy service partners. The certification, or authorization, to perform service and maintenance would be valid for a two or three year period at a time. The training of distributors and agents would require that Marioff Corporation Oy have the available resources to give the training.

If the systems would be serviced and maintained by distributor or agent, there are some issues which need careful consideration. One concern is how to ensure that the
Some sort of service database where distributor or agent could input what services have been made should be developed. This database could be based on the LR ship information and tracking database which Marioff Corporation Oy is planning on implementing to keep records of sold systems. Another main concern is quality issues in distributor sold systems. How can Marioff Corporation Oy ensure that the distributor or agent performs needed quality upgrades for the systems they have serviced and maintained? This could also be controlled by the information and ship tracking database, but the database cannot ensure that the quality upgrade has in fact been done. Marioff Corporation Oy must in these cases be able to trust the distributor or agent, or then face the possible claims from malfunctioning system as the manufacturer’s responsibility is valid also for distributor or agent sold systems.

Further discussion is needed on several items regarding the service and maintenance of distributor or agent sold systems. How to handle extension and upgrade issues of the distributor or agent sold systems, should the extensions and upgrades be handled by the distributor or agent, or directly from Marioff Corporation Oy? How can the end user know who their main contact point is for issues that they have with their system? Can end users who have a distributor or agent sold system utilize the Marioff Emergency Hotline, if so, how can we guarantee that the needed documentation is available in Marioff Corporation Oy?

7 Defining the required tools and processes for commoditization of the systems

To successfully complete the commoditization of the systems there are several issues which need to be considered. The issues involve both Marioff Corporation Oy internal processes as well as a change in the distributor and agents’ role or resource allocation.
would still be done by Marioff Corporation Oy project team making the whole commoditization process unnecessary.

The needed system documentation which distributor and agent should create can be divided into two parts, documentation for classification society approval and documentation for final customer system manual. The layout and format of this documentation should be standardized. For the system manual the standard should be based on IACS recommendation 71, Guide for the development of shipboard technical manuals. The approval documentation should only include necessary items which are required for the approval, e.g., system manual, general ship arrangement plan showing the location of pump unit, location of section valves, nozzle quantities and locations, distribution piping layout and sizes, electrical control system diagram, P&ID for the system and hydraulic calculations showing that the required flow and pressure is available at the spray heads. Both these standards need to be defined and a template needs to be prepared which can then be sent to the distributor and agents.

When the system documentation is prepared by a distributor and agent, a suitable process must be developed to ensure that information and documentation about sold systems are sent to Marioff Corporation Oy for after sales purposes. The documentation should also include a copy of the classification society approval letter and preferably also a copy of the communication between classification society and distributor and agent as this communication can be valuable for Marioff Corporation Oy for future projects.

The easiest solution to ensure that Marioff Corporation Oy would receive the documentation would be to require that it is sent to Marioff Corporation Oy prior to any shipments of material. This would however not be the best solution as it will unavoidably make the lead time for the dispatch too long as the preparation of documentation will require a certain amount of time.

There should also be a defined process for the follow up of the submittal of this documentation to Marioff Corporation Oy. Possibly it could be done by the same team that would process the material orders received from the distributor and agents.
A process for ordering pre-engineered systems should be developed. One possibility would be to use the same process as Marioff Corporation Oy subsidiaries are using, i.e. the order is sent to the CSC team who processes the order for materials and sends the order confirmation to distributor and agent. An ordering sheet for the pre-engineered systems should be developed. The ordering sheet should include the different possibilities given by the pre-engineered system and should include all vital information for the order, e.g. exact iScala codes, delivery address, contact person at delivery location, order number etc.

A distributor and agent support unit is needed to assist the distributor and agents in more complex designs. This unit should however not do the actual design of the system, only give advice upon request.

To achieve a working process for the system documentation and order handling the distributor and agents must be trained. The training should include the basics of system design, i.e. basics for preparing the piping and nozzle layout, preparing system documentation (what is essential and what can be left out), classification society communication and approval process and order handling process.

As the goal of the commoditization process is to have the distributor and agents selling, designing and commissioning the systems independently, training for the installation and commissioning of the system should also be arranged. It should also be ensured that the distributor and agent have sufficient and qualified personnel to complete the commissioning.

The goal of the commoditization poses also some risks for Marioff Corporation Oy. If the distributor and agent becomes too independent and technically too familiar with the systems, they might want to produce their own version of the same systems instead of purchasing the hardware from Marioff Corporation Oy. The nozzles and other main components of the system are protected by intellectual property rights, but it does not guarantee that copies could not be made. The decision to what extent the system should be commoditized should be carefully considered from all aspects before any decision is made.
For the commoditization of the KAU system a standard package should be defined. This package should include some base documentation that the distributor or agent could easily modify to their specific project. This documentation should include as a minimum:

- layout drawings
- P&ID
- a system manual describing the system functionality
- relevant classification society type approvals.

So that the project specific layout drawings could be easily made by the distributor or agent, some drawing templates should be made. The drawing templates should include both Marioff Corporation Oy HI-FOG® logos and the distributor or agent's information. This way, it would always be shown who, in the end, made the drawings.

As for the P&ID there already exist standard drawings for standard KAU units, so these can be included in the document package as is. The system manual should also contain the pressure drop calculations, as some classification societies require them to be submitted for system approval. The pressure drop calculations could be done using an Excel tool containing all the information already known, such as system pressure and pipe size etc. The only information required would be to fill in the pipe lengths, bends and elbows. The output from the tool would then be the total pressure drop in the system. With a simple macro the tool could alert the user if the pressure drop would be too high. The user should then have to reconsider the pipe routing in order to maintain a tolerable pressure drop in the system.

Based on conducted tests the system pressure is sufficient when the distribution piping is done with Ø12mm pipe with a length between 4-12m and the installation is done in accordance with Marioff Corporation Oy guidelines for installation of HI-FOG® systems. /14/.

As the KAU system in its simplest form consists of a cylinder unit connected by piping to a spray head located above the protected deep fat fryer, the necessary parts provided
by Marioff Corporation Oy, could be restricted to a small package. The package should include as a minimum the following components;

- Spray head 4S 1FA 4FA/4FB 1000 (C31140)
- Assembly body C40032
- Release valve D21050
- KAU 20/N 10W 1.2/1.5E (E21470)
or
- KAU 20/N 20W 1.2/1.5E (E21470.1)

As the KAU system is, engineering wise, a quite simple system, some add-ons or options could be allowed for the customer to choose. These add-ons could include e.g.;

- Release valve (solenoid actuator valve) D21070
- Release box (with automatic deep fat fryer shut down signal)
- Piping and fittings as per Marioff Corporation Oy standard
- Nitrogen cylinder (empty or filled, depending on country specific regulations)

Adding a release box to the package would mean that some electrical design would have to be done. But if it is decided to include this as an option, standard electrical drawing packages should be developed to cover all different voltage options.

A simple Excel tool should be produced to allow the customer to choose the required parts for their specific need. Figure 25 shows an example layout of how the tool could look like. By choosing the required parts the tool shows the necessary codes and amounts to make an order from Marioff Corporation Oy's factory.
7.2 Defining parameters and critical tools for system design/dimensioning for MLPU system
Section valve D01024.2
- MLPU unit with option for voltage and frequency and showing maximum flow available with chosen voltage and frequency
- MLPU control cabinet with standard outgoing signals and standard size. The control cabinet will be disconnected from MLPU frame, distributor or agent to confirm length of cable needed between pump unit and control cabinet.
- One release panel with connection to fire detection system and standard outgoing signals and interlock for foam system or aerosol system.
- One repeater panel in standard setup

Piping and fittings as per Marioff Corporation Oy standard

For calculating the needed amount of components a simple tool should be created. This tool should calculate the amount of fittings needed once the piping and nozzle amount is inserted.

To define the needed amount of nozzles for the system, best practice would be to complete the design of system and then calculate actual amount of needed nozzles. However, it might be possible to develop a tool which would calculate the needed amount of nozzle based on the size of the protected equipment, as the spacing between nozzles and location of nozzles outside protected area are known parameters. This tool could however not take into account any possible obstructions or other special arrangements in the protected space, so it would in best case only be a calculated estimate.

There are two main pitfalls for defining dimensioning and design tools for the MLPU system. The first one is the actual piping diagram of the system, as no fixed rules can be given on where to route the pipe and place the nozzle. The actual arrangement for each protected area will be influenced by the general arrangement of the vessel, possible openings located within or close to the protected area, engine cranes which obstruct the flow patters of the nozzles, ventilation ducts, exhaust piping etc. The second main pitfall is the system documentation which classification society requires to be submitted on a case-by-case basis. This documentation is normally done by the experienced Marioff project team who has knowledge of what is required by different classification societies. Not all classification society requirements are mentioned in rules and
regulations, some requirements can only be known if there is previous experience from the same classification society. Further, these requirements are not the same for all classification societies, so creating a standard documentation would be difficult, or then a different standard should be created for each classification society. Also parts of the electrical design must still be made project specific, mainly the cabling diagram and connections diagram as these depend on the amount of protected sections and location of section valves.

These two main pitfalls could be countered with extensive training of the distributors and agents, but with extensive training we would risk that the valuable know how that Marioff Corporation Oy has gathered during the years would end up outside the company or, in worst case, to our main competitors.

8 Conclusion

The distributor and agent survey showed that there was no immediate interest for commoditization of MLPU system, but that there was a need for a pre-engineered package of KAU system. However, the requirements for the KAU system are not the same for all distributor and agents. Some prefer to provide some of the components by themselves and only purchase the minimum equipment from Marioff, e.g. Jeitek Corporation's reply to the survey. As the requirements for the packages vary between the distributor and agents, a decision should be taken if Marioff Corporation Oy intends to sell only complete packages or also parts of packages as per distributor and agent request. This work has not taken into consideration the pricing policy of the packages, but it is one issue that must be considered.

For Marioff Corporation Oy to be able to fully utilize distributor or agent sold pre-engineered packages it is evident that there is a need for extensive training of the distributor and agents. The training should include design aspects of the system (piping diagram design, system documentation with needed calculations etc.), training for the approval process with classification societies and training for commissioning, service and maintenance. Further it must be ensured that the distributor or agent has the needed resources available to complete the design, approval, commissioning and service of the systems, otherwise there is a risk that the commitment which distributor or agents has...
made will become the responsibility of Marioff Corporation Oy, but without the economical benefits, as the good reputation of the HI-FOG brand must be ensured.

The commoditization of the example systems seems, according to this study, not to be easily achieved. There are many issues which need firm decisions and many aspects of the commoditized systems would be outside any control from Marioff Corporation Oy. This poses a risk of Marioff Corporation Oy having distributor or agent sold equipment installed on vessels which we do not have any information about. The control of sales to sanctioned countries can be difficult as well as the control of the no bribes policy which Marioff Corporation Oy and UTC apply.

The investigations done for this study show that preparing a pre-engineered package for the MLPU system might be extremely difficult, or even impossible, to achieve. This is due to the several variables in regard to the design of the system, e.g. differences in piping diagram, electrical cabling and connections diagrams which need to be made project specific and the sometimes complicated classification society approval process.

For the KAU system, a pre-engineered package might be possible as there are not so many variables in the design and installation of the system. However, if the KAU unit is equipped with electrical release capability and control cabinet, the same problem exists as for the MLPU system, i.e. project specific cabling and connections diagrams should be produced. If a KAU would be commoditized, it should preferably be in its simplest form, i.e. with manual release of the system either directly from nitrogen cylinder or with a simple ball valve. It is suggested that the commoditization of KAU system is investigated further, taking into consideration if there is a need for a KAU system in its simplest form.
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