船用压载水处理系统指南

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轮机技术部

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前言

随着世界贸易和交通量迅速扩大，在最近几十年，由于船舶压载水处理不当造成了恶性物种入侵及环境恶化。在许多地区都有关于这方面的报道，我们的生态系统正在以惊人的速度恶化。由于海生贸易额不断增加，生物入侵率也将不断增加。

1988年，加拿大和澳大利亚首次报到了有关压载水入侵的海洋物种。作为回应，国际海事组织大会于1993年通过Res.A.774（18）“为防止有害水生物和病原体从船舶压载水和沉积物排放的指南”。经过超过14年海事组织中各会员国之间的探讨，于2004年2月3日在伦敦国际海事组织总部举行的外交会议上通过了有关船上压载水及沉淀物控制考核处理办法（压载水处理公约）。本公约生效后12个月内对超过30个国家，及合并后的商船队，不低于全世界总吨数35%的商船发挥了作用。

就压载水处理系统的安装要求（BWM）从压载水公约于2004年生效起，船东及船厂提出了很多意见。作为回应，韩国船级社根据船舶种类提供了有关BWTS安装的参考信息。

本指南是根据世界海事组织及船级协会的最新讨论决议编制的。

我们真心的希望本指南对船主，船厂，及现场的验船师有所帮助，同时，我们也欢迎大家提出

自己的宝贵意见。

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第一章 船舶压载水管理协定的介绍

1. 压载水管理协定的概要

压载水管理协约(Ballast Water Management Convention : BWM Convention)由前言，正文及附录构成。其中正文有22个条目，附录由规范及附录等24个部分构成。另外，附录主要有船舶压载水管理证书和船舶压载水管理记录簿构成。（表1－1－A为船舶压载水管理协定构成图，请参考）

为了压载水管理协定的执行，要以这些复杂的技术内容及程序为依据，若各个国家相互间应用不同基准的话，会变得混乱。IMO为了统一，为了国际化，特制定了14种指南。(请参照表1－1－B及 图1－1－A)

与政府密切相关的指南的种类有港湾内的石油开采（G2），处理装置的型式认可（G8）,活性化物质的认证资源（G9）,样机程序认可等（G10）,为了免除而做出的评价（G7），交换指定海域的设定（G14）以及紧急时刻要追加的措施（G13）
另外，与船主及船厂密切相关的指南的种类有小型船应用（G3）,压载水管理计划书（G4）,船上压载水的交换（G6），交换设计及设备（G11），及船内沉淀物的管理（G12）等。

表 I-1-A 压载水管理协定构成图

压载水管理协定				
前言				
正文	第一条	术语的定义	第十二条	船舶不正当的迟延
	第二条	一般的义务事项	第十三条	技术支援，协助及地方的协助
	第三条	应用	第十四条	情报交换
	第四条	通过压载水及沉淀物而移动的有害水生物及病原菌移动的控制	第十五条	解决争端
	第五条	处理沉淀物所需设施	第十六条	国际法及其他法规的管系
	第六条	科学技术的研究和监视	第十七条	签名，批准，领取，认证及加入
	第七条	检查及证书	第十八条	生效
	第八条	违反行为	第十九条	改正
	第九条	船舶的检查	第二十条	废弃
	第十条	违反行为的发现及控制	第二十一条	委托
	第十一条	管制行为的通知	第二十二条	语言
附录	A节 一般规范		第A-1条规定	术语的定义
	B 节 有关船舶管理及控制的要求		第A-2条规定	一般应用
			第A-3条规定	应用以外
			第A-4条规定	免除
			第A-5条规定	同等水平
			第B-1条规定	压载水管理计划书
			第B-2条规定	压载水管理记录书
			第B-3条规定	船用压载水管理
			第B-4条规定	船用压载水的交换方法
			第B-5条规定	船舶沉淀物的管理
			第B-6条规定	士官及成员的职务
	C 节 特定海域的特别要求		第C-1条规定	附加措施
			第C-2条规定	特定海域内与压载水注入相关的警告及相关船旗国的相应措施

		第C－3条规定	情报的交换
	D 节 与压载水相关的基准	第D－1条规定	压载水的交换基准
		第D－2条规定	压载水性能的基准
		第D－3条规定	压载水处理系统的认可要求
		第D－4条规定	样机压载水的处理技术
		第D－5条规定	机构基准的检查
	E 节 与压载水管理有关的检查及证书要求	第E－1条规定	检查
		第E－2条规定	证书的发行及签名
		第E－3条规定	其他当事国证书的发行及签名
		第E－4条规定	证书的样式
		第E－5条规定	证书的有效时间及效力
附录		附录 I	国际船用压载水管理证书的样式
		附录 II	船用压载水管理附录的样式

表 I-1-B 压载水管理协定指南的种类

编号	压载水管理协定的指南	MEPC建议书
G1	有关沉淀物所用设备的指南	Res.MEPC.152(55)
G2	有关压载水石油开采的指南	Res.MEPC.173(58)
G3	压载水同等水平的指南	Res.MEPC.123(53)
G4	与压载水管理及管理计划书的开发相关的指南	Res.MEPC.127(53)
G5	与压载水所需设施相关的指南	Res.MEPC.153(55)
G6	与压载水交换相关的指南	Res.MEPC.124(53)
G7	压载水协定中第A－4条规定的相关评价有关的指南	Res.MEPC.162(56)
G8	与压载水系统认证相关的指南	Res.MEPC.174(58)
G9	与用活性化物质的压载水处理系统的认证相关程序的指南	Res.MEPC.169(57)
G10	样机压载水处理技术相关程序的认证及检验有关的指南	Res.MEPC.140(54)
G11	与压载水交换设备及构造基准相关的指南	Res.MEPC.149(55)
G12	有关船舶沉淀物的管理设计及建造基准的指南	Res.MEPC.150(55)
G13	为了紧急情况发生而在压载水管理上添加的格外的措施的相关指南	Res.MEPC.161(56)
G14	有关指定压载水交换区域的指南	Res.MEPC.151(55)

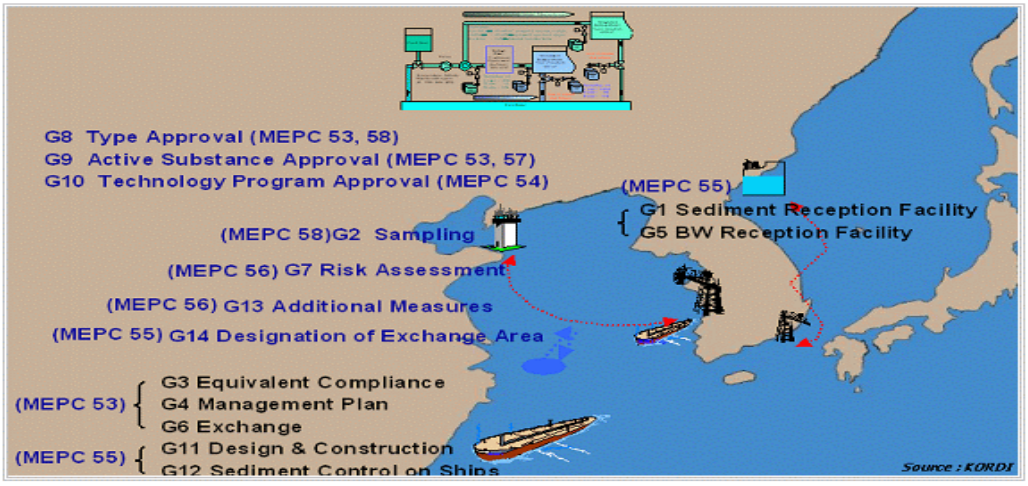

图1－1－A 压载水管理协定指南的种类

2. MEPC的主要会议

国际海事机构（IMO）的环境保护委员会（MEPC）上讨论并确定了与压载水管理协约实行相关的各种指南。这节中简略地记述了到2010年12月为止的MEPC主要会议的内容。

2.1 MEPC59（2009.7）会议

2.1.1 与压在水处理装置的活性化物质相关的IMO基本认证及最终认证的现状

1）MEPC 58次会议上，在BWM.2/Circ.16(2008.10.17)中登载了活性化物质的认证现状，今后，压载水处理系统的处理过程中产生活性化物质的毒性残留与否相关的IMO的Basic/Final Approval的目录以 BWM.2/Circ.**型式来发行。

国家	制造商	产品名称	认证	相关文件	状态
韩国	现代重工	EcoBallast	基本认证	MEPC59/2/4	许可
德国	Aquaworx	Aqua TriComb	基本认证	MEPC59/2/8	许可
中国	COSCO	Blue Ocean Shield	基本认证	MEPC59/2/2	许可
韩国	NK	NK-03 BlueBallast	最终认证	MEPC59/2/3	许可
德国	RWO	CleanBallast	最终认证	MEPC59/2	许可
日本	Hitachi	ClearBallast	最终认证	MEPC59/2/5	许可
荷兰	Greenship	Greenship Sedinox	最终认证	MEPC59/2/6	许可

Note: 韩国的Techross在 MEPC第59次会议以前就获得了认可

2.1.2 有关饮用水是否能应用作为压载水的讨论结果

1）如我们所知，饮用水中的化学物质是可以排出的，这种把饮用水作为压载水来使用时，必须符合压载水管理协约的应用。但要在现BLG正开发的“有关压载水其他方法的评价

程序”完成后，讨论的结果方可实施。

2.1.3 有关2010年所建造的压载舱容量在5000m3以下的新船的D-2(压载水系统的装载)应用的延期可能性的讨论结果

1）由于有关B-3.3的规定的日期延期的协约在履行的过程中没有预期的收获，并且也没有促进压载水处理系统开发，因此，在2010年所建造的船舶，仍然按照IMO Res.A.1005(25)1)来决定。

2.2 MEPC 2010年3月第六十次会议

2.2.1 GESAMP-BWWG与下列活泼性物质的基本认可，最终认可有关的劝告

国家	制造商	产品名称	认可	相关文件	状态
韩国	PANASIA	GloEn-Patrol	最终认可	MEPC59/2/7	认可
德国	Ecochlor	Ecochlor	最终认可	MEPC59/2/9	未认可
德国	Siemens	SiCURE	基本认可	MEPC59/2/11	认可
南非	Resource Ballast Tech.	Resource	最终认可	MEPC59/2/10	认可
丹麦	ATLAS-DANMARK	ATLAS-ANMARK	基本认可	MEPC60/2	未认可
日本	Toagosei	JEF	最终认可	MEPC60/2/2	认可
中国	Sunrui CFCC	Sunrui	基本认可	MEPC60/2/3	认可
丹麦	DESMI	Ocean Guard	基本认可	MEPC60/2/4	认可
韩国	21世纪造船	BlueOcean Guard	基本认可	MEPC60/2/5	认可
韩国	现代重工	HiBallast	基本认可	MEPC60/2/6	认可
韩国	KWANG SAN	En-Ballast	基本认可	MEPC60/2/7	认可
挪威	Qingdao Headway	OceanGuard	基本认可	MEPC60/2/8	认可
德国	Severn Trent DeNora	BalPure	基本认可	MEPC60/2/9	认可
韩国	现代重工	EcoBallast1)	最终认可	MEPC60/2/1	认可

1):虽然在GESAMP(海洋环保科学家联合小组)-BWWG没通过检查，但MEPC第59次会议上，具备基本认可权的公告，以书面评价型式在下届会议（即60次）上，将提交最终认可申请书，授予最终认可后便可实施。

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2.2.2 与 IMO Res.A.1005相关的后续措施

1）判断获得型式认可的压载水处理装置是否得以充分的开发， 在第25次IMD总会（2007.1

1）上决定的内容[IMO Res.A.1005(25)：2009年新造船舶的延期。除此之外，不需要其他的延期措施，在MEPC第59次会议上通过的决议，根据该决议，2010年及以后建造的船舶上的压载水处理系统没有必要延期设置。并且鼓励各国在压载水系统设置时，能尽可能快的实施。

2.3 MEPC 2010年9月第61次会议

2.3.1 GESAMP(海洋环保科学家联合小组)-BWTS对下列活泼性物质的基本认可及最终认可权的公告。

国家	制造商	产品名	认可	相关文件	状态
韩国	三星Techwin Echo	Purimar	基本认可	MEPC61/2	认可
韩国	Aquaeng	Aquastar	基本认可	MEPC60/2/1	认可
日本	Kuraray	Kuraray	基本认可	MEPC60/2/6	认可
日本	三井重工（Mitsui）	FineBallast1)			
韩国	21世纪造船	ARA Ballast	最终认可	MEPC61/2/5	认可
挪威	Qingdao headway	OceanGuard	最终认可	MEPC60/2/2	认可
德国	Severn Trent DeNora	BalPure	最终认可	MEPC61/2/9	认可
德国	Eka Chem	Ecochlor	最终认可	MEPC61/2/8	认可
日本	三井重工	SP-Hybrid	最终认可	MEPC61/2/2	认可
中国	Sunrui CFCC	BalClor	最终认可	MEPC61/2/4	认可

1) ：若无活泼性物质产生的话，根据 G8 的政府型式认可来执行。

2.3.2 从2010年 11月末到现在的压载水管理协约批准现况

1）批准国家：27个国家

2）商船的舱位数量合计：25.32%

3）压载水管理协约将在世界商船舱位数量35%以上的30个会员国的批准日起12个月后生效。

第二章 压载水处理系统的应用

1. BWTS的概要

由于船舶压载水处理装置的开发趋于商业化，为了在船上设置该系统，首先要根据IMO，对活性物质对海洋环境的影响作以评估，并应该获得活性物质相关的认可。活性物质是指含有病毒，病菌的物质以及作为有机体的有害水中有机体及对抗病原菌等一般的或者特殊的的物质。IMO的活性物质认可由基本认可和最终认可构成，该认可取得了MEPC的认证。

取得IMO的基本认证及最终认证的处理装置还要取得各国政府授予的消灭生物能力和各种操作性能以及能确定船舶应用的型式认可。由于型式认可的需要，压载水处理系统的型式认可实验要按照指南G8及国际协约D-2的性能基准来正确的实施实验，制造工厂，驳船及包含试验船在内的样品在工厂内要实行陆基实验。另外，为了确认压载水处理系统的型式认可指南及国际协约D-2性能基准是否适用，要在船上实行最大量的压载水处理系统的船上实验。

另外，为了确认压载水处理系统在船舶建造运行实施的过程中是否能适当的维持，以及是否能正确的操作等，要实施与其相关的震动，温度，湿度，防尘及船舶的倾斜，电源变动，电器电子装置的可靠性的实验。

2. 压在水处理系统的一般事项及应用

2.1 一般事项

2.1.1 术语的定义

1） 压载水：为了避免船舶的纵倾斜，横倾斜，吃水，平稳性及船体应力的影响而在船上装载的包括浮游物在内的物质。

2） 压载水处理系统：为了除去压载水及沉淀物中所含有的有害水生物及病原菌，防止有害物质流入及排出的机械性，物理性，化学性及生物性的单一或复杂的处理过程。

3） 总吨数（GT）:根据1969年船舶吨数测量有关的国际协约附录1，还有后续协约中所包含的吨数测量规则来计算的总吨数。

4） 船舶（Ship）:是指水上运行的所有形态的船舶，包括潜水船，浮油船,浮式平台，FSU（浮式储油平台），FPSO（浮式生产储存卸货装置）等。

5） 沉淀物：有船上的压载水中产生沉淀物质。

6） 压载水的容量：包括压载水可能装载的多用途的压载舱区域，为压载水的装载，搬运及排出所使用的压载舱的总体积容量。

7） 活性物质：由有害水生物及病原菌所产生的病毒，病菌类物质或生物。

2.1.2 有关建造及改造的定义

1）建造包括下列几个阶段

a.铺设龙骨；

b.可识别的特定船舶的建造过程开始；

c.船舶的装配至少已经形成了总重量的1%－50%的吨数中的最少量。

d.着手船舶主要改造

2）主要改造是指下列改造情况

a. 压载水的运载量有15%的变更的情况

b.船的种类变更的情况

c. 由主管部门认证的船龄可以延长10年以上的情况

d. 部件交换外导致的压载水处理装置变更的情况；为了满足D－1规定，以协约附录为目的的船舶改造不被看作是主要改造。

2.2 应用的船舶

2.2.1 所应用的船舶

1）对于所有为安装压载水而设计和建造的船舶都适用。（包括潜水船，浮油船,浮式平台，FSU（浮式储油平台），FPSO（浮式生产储存卸货装置）等）。

2.2.2 被检验船舶

1）除浮式平台，FSU（浮式储油平台），FPSO（浮式生产储存卸货装置）外，400总吨以上的所有协约中规定的需要接受检验并且需配有证书的船舶。

2.2.3应用的要求

1）没有根据协约设计和建造压载水的船舶或在船舶上装有永久性密封舱不向外排放载水的船舶

2）任何军舰，海军辅助舰或由其他国家拥有及经营，只用于政府非商业化服务的船舶。

3）未装载压载水的船舶

2.2.4 同等应用上的要求

1）全长不足50m,最大的压载水量是8立方米，但用于娱乐或竞技的游览船及主要搜索和救援船考虑附录书中要求的机关所发行的指南由主管部门来决定。

2.3 D－1及D－2规则所应用的时期

2.3.1 应用的时期

1）船舶压载水管理协约把2009年前后，及不同的压载水合计量分别为满足D－1和D－2要求的两种型式，如下表Π－2－A所示。 但是，这种要求的协约生效前没有任何法律约束力。

Keel Laying기준	BW Tank(m³)	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ships whose keel is laid before 2009										
< 2009	< 1500	D1 or D2								D2
< 2009	1500 ~ 5000	D1 or D2						D2		
< 2009	> 5000	D1 or D2								D2
Ships whose keel is laid after 2009										
≥ 2009	< 5000	D2								
2009 ~ 2011	≥ 5000	D1 or D2								D2
≥ 2012		–			D2					

表 II－2－A 船舶压载水管理协约应用的年度

Reg. D-1	Application of Ballast Water Management Plan according to the requirements for ballast water exchange (Res.MEPC.127(53))
Reg. D-2	Application of Ballast Water Management System which type approved according to the guidelines of Res.MEPC.174(58)-G8

2）阴影部分的年度过渡到周年日（IOPP证书的过渡日期基准）后的第一次IBWM中期检验及到 IBWM定期审查时间截止压载水处理系统应该根据D－2的要求来设置。

3）关于上述条款的例子A

a. 船舶建造日（K/L）：2008.9.25，船舶的过渡日期：2009.2.23（IOPP基准）

b. 压载水的合计容量： 3000m^3

c. 2014年后的第一次IBWM中期检验：2017.2.22

d. 2014年后IBWM的第一次定期检验：2019.2.22

☞ In this case, Reg. D-2 will enter into force on 2017. 2. 23(IBWM intermediate survey)

4） 上述条款的例子B

a. 船舶的建造日（K/L）:1991.8.24，船舶的引渡日： 1992年5月15日（IOPP

基准）

b. 压载水合计的容积：6000m^3

c. 2016年后第一次IBWM的中期检验： 2017年5月14日

d. 2016年后第一次IBWM的定期检验： 2020年5月14日

☞ In this case, Regulation D-1 or D-2 enters into force from the date of entry into force of the BWM Convention, and Regulation D-2 alone will enter into force on 2017.05.15

2.3.2 D-1规则中的压载水交换标准

1）压载水容积的95%以上做交换

2）依照Flow-Through Method来进行压载水交换的船舶，要判断各压载水舱的容积的3倍是否满足泵交换量95%以上这个标准，若做交换的容积达到95%以上的话，可以使用低于压载舱容积3倍的泵。

表 II-2-B D-1 规则的压载水交换基准

Exchange		Standard
Exchange Efficiency	Volumetric	at least 95%
	Flow-Through Method	3 times the volume
Area	Whenever possible..	200 miles from land, 200 metres depth
	In case unable..	200 miles from land, 50 metres depth
	Areas where does not meet..	Designated area by the port State

2.3.3 D-2 所规定的压载水性能基准

1）最小长度50微米以上的生存个体数为每m^3 有10个

2）最小长度10微米以上50微米以下的生存个体数为每ml有10个

3）微生物指标

a. 毒性霍乱菌每100ml，1cfu(菌体形成单位)以下

b. 大肠菌每100ml，250cfu以下

c. 分辨性大肠菌每100ml，100cfu以下

表 II-2-C D-2所规定的压载水交换基准

Organisms		Standard
Organisms	≥50㎛ Min. Dim.	less than 10 viable organisms per m^3
	10㎛ ~ <50㎛ Min. Dim.	less than 10 viable organisms per mℓ
Indicator Microbes	Vibrio Cholerea	1cfu/100mℓ 1cfu/1g (wet weight)
	Escherichia coli	250cfu/100mℓ
	Intestinal Enterococci	100cfu/100mℓ

2.3.4 与加利福尼亚及纽约州相关的要求，请参照本指南的附录A,B和C

3. 压载水处理系统的型式认证

3.1 一般事项

船舶压载水处理系统的活性物质的认可“ 使用活性物质压载水处理系统的认可程序G9”是根据IMO来实现的，提供上述的指南书G9的目的是为了确定是否有活性物质或含有其中的一种及使用包含上述活性物质的药品。以及，船的安全，人体的健康及水环境和相关船舶压载水处理系统内这些物质的应用方法的决定。

基本认可是指为了遵守活性物质和压载水管理协约而对压载水处理系统所做的一种预期的认可。以基本认可所提交的材料信息为基础，要确认不存在那些不允许产生的恶性影响，以及没有对人体，健康，财产或者资源可能造成无法预想危险的可能性。

最终认可（Final Approval）是指为了遵守协约，对使用活性物质或者其他产品的压载水处理系统的一种认可，其中还包括压载水处理系统的认可指南书G8中规定的型式认可实验的相关检验。活性物质认证技术审议是指在GESAMP上设置的BWWG，GESAMP-BWWG是指MEPC下GESAMP所属的技术小组，由各研究领域活动的专家所构成，使用活性物质压载水处理系统的船舶要向主管部门提交相关材料并接受检验。

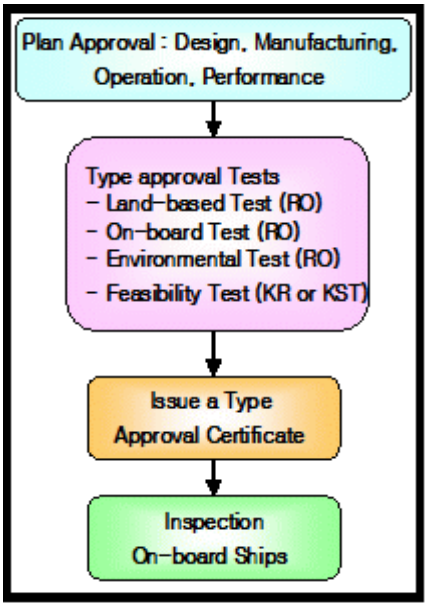
3.2 IMO型式认可程序

3.2.1 使用非活性物质的压载水处理系统型式认可的程序（协约指南的G8）

1）原则上看，使用非活性物质的压载水管理的型式认可没必要取得IMO的基本认可和最终认可，只要依照协约指南G8所规定的型式认可程序执行，获得主管机关的政府型式认证即可。

2）使用非活性物质的压载水处理系统，最具代表性的处理方式有UV Type。

3）根据协约中的指南G8进行的型式认证程序如下图II-3-A所示，各个实验的代理机关及实验标准如下表II-3-D所示。



根据协约中的指南 G8 进行的型式认证程序

表II－3－D 各个实验的代理机关及实验标准

Registered Organizations	Test Items	Test Standards
- KORDI (Korea Ocean Research and Development Institute) - KOMERI (Korea Marine Equipment Research Institute) - Busan Techno Park	On-board Test	- To comply with D-2 requirements after repeating ballast water suction → storage → discharge process 3 times - Test organism - Sampling
	Land-based Test	- Test cycle : more than 5 times per each cycle (PSU), minimum 2 cycles (total 10 times) - Capacity of control tank and ballast tank should be greater than 200 m3 - Time of sampling : 3 times shortly before/after ballast water treatment
- KTL (Korea Testing Laboratory) - KOMERI (Korea Marine Equipment Research Institute) - SGS Tesco	Environmental Test	- Vibration Test - Temperature Test - Moisture Test - IP Test - Power Variation Test - Incline Test - EMC Test
- KR (Korean Register of Shipping) - KSSTA (Korea Ship Safety Technology Authority)	Feasibility Test	- Feasibility for ship's operation - Performance of Alarm Device and Recording Equipment - Control and Monitoring System

3.2.2 使用活性物质的压载水处理系统的型式认可程序（协约的指南G9）

1）使用活性物质的压载水处理系统根据压载水处理系统公约的指南G9，首先要由IMO获得基本认可和最终认可。

2）获得基本认可和最终认可的程序如图 II－3－B及表 II－3－C所示进行，基本认可申请书内要包含活性物质有关的信息。

3）最终认可申请书是根据压载水处理系统认可而作成的指南书的要求在陆基实施的实验结果，排除水的残留物毒性物质与基本认可的评估结果是否一致，结果确认后要提交。

4）认证申请书如果以会员国的名字申请的话，所有内容都要由申请政府来提供保证。

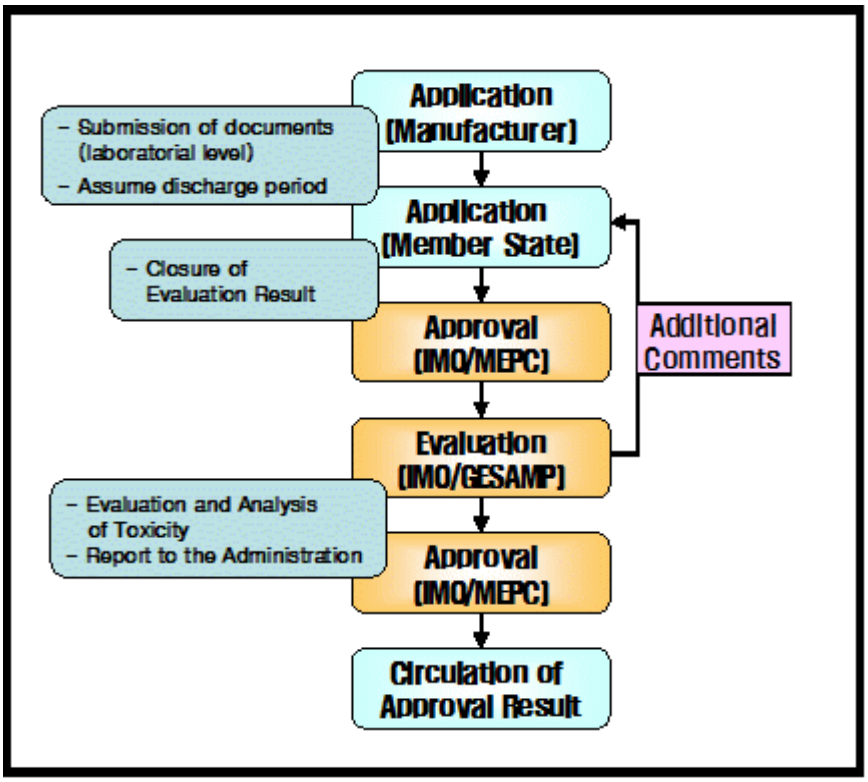


图 II-3-B获得基本认可的程序

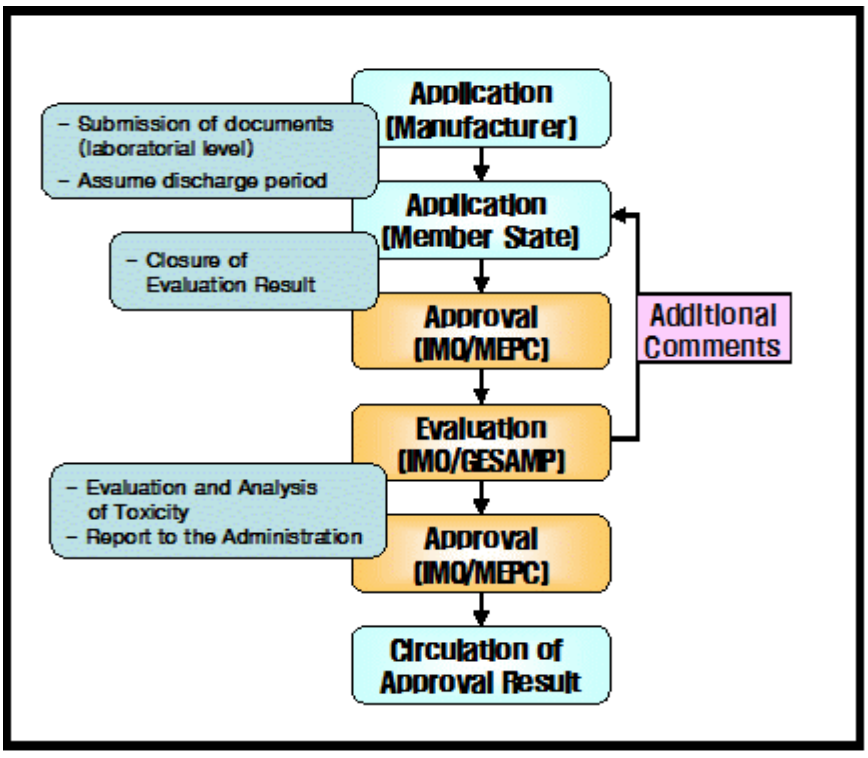
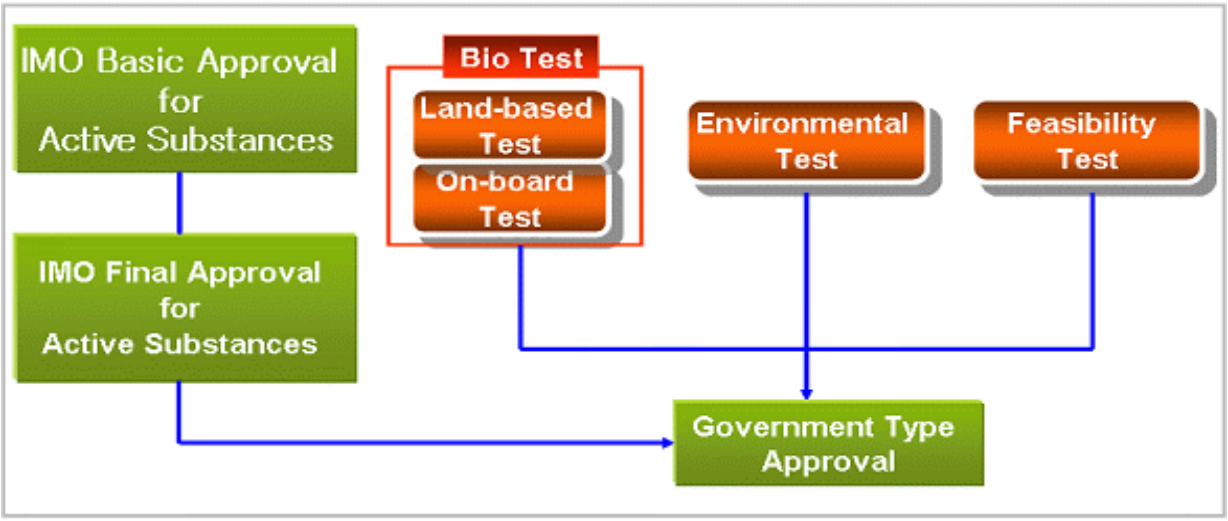


图 II-3-C获得最终认可的程序

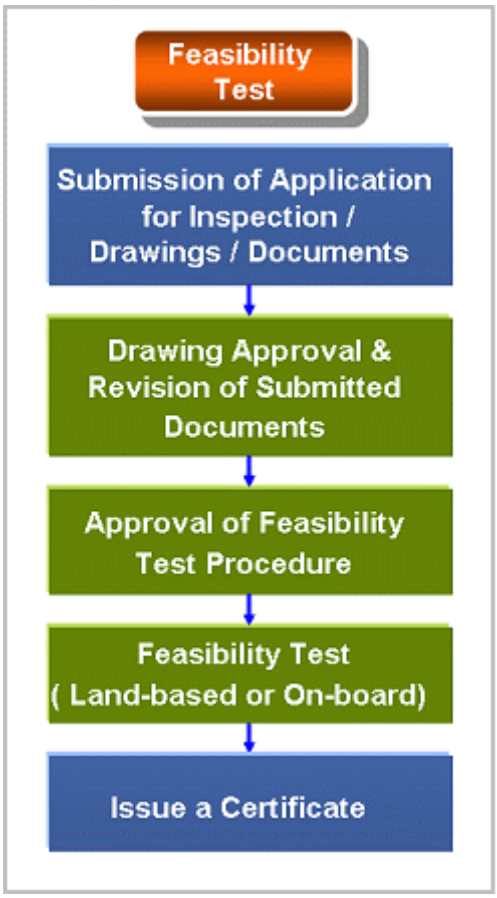
5）使用活性物质的压载水处理系统为了能获得IMO的最终认可，除了协约的指南书G8的要求以外，相关的实验要求及要提交的评估证书的相关的文件如下表II-3-E所示。

表II-3-E 根据协约的指南G9添加的试验要求

Additional Requirements	Item	Test Standard / Document
Test	Toxicity Test	- Toxicity Test of the treated ballast water - Persistence Tests, Bioaccumulation Tests, Toxicity Tests
	PSPC Corrosion Test	- Effect on corrosion of ballast tank.
Application Form		- Data on effects on aquatic plants, invertebrates, fish and other biota - Data on mammalian toxicity - Data on environmental fate and effect under aerobic and anaerobic conditions - Data specifying the name, dosage, and maintained period of each ingredient of active substances



图II-3-D 从政府得到型式认可证书的程序



图II－3－E适应性实验的程序

3.2.3 从政府获取型式认证的程序

1）不使用活性物质压载水处理系统时，根据协约指南G8的要求，基本认可及最终认可可免除，如图II－3－D所示经过陆基实验，船上实验，环境实验，适应性实验后，可从政府得到型式认可证书。

2）活性物质的压载水处理系统，由IMO获得基本认可毒性实验及PSPC腐蚀性实验评估书等其他资料提交，然后由IMO获得最终认可后，再进行上述 1）中的提及的4种实验后，方可从政府获得型式认可的证书。

3）适应性实验若由韩国政府代理，并由我韩国船级社主管的话，其过程要按照图II－3－E所示的过程来进行。

第三章 压载水处理系统的技术

1. 压载水处理系统的技术区分及比较

在IMO国际协约的性能基准确定之前，从2003年5月开始在IMO GloBallast全世界开发的压载水处理技术开发完成前杀灭效率低的技术也可以应用。在IMO国际协约的性能基准确定后，从2004年5月开始，在新加坡举行的第二次ICBWM表彰会上发表的压载水技术，使得综合系统和化学药品的使用得以解决。

2005年7月MEPC第53次会议上，为了能在2009年国际协约会上，在开发时间内可以看到具有必要元素的处理装置，实行技术检查时，综合了各国的开发技术。为了在IMO上型式认证指南和活性物质认可指南书完成后能综合提交的材料并强化活性物质规则，使活性物质根本就不产生的方式受到了广泛的关注。

现在世界各国关于压载水处理技术的开发及公开发表等，过多的费用及性能尚欠缺及现实性的技术不足等原因，现在关于技术检验方面仍然很困难。

其中，与为活性物质的认证而提交的装置具有商业化的计划一起而提交的计划书及活性物质的审议报告等可靠的材料，可以做出确切地判断。下表有典型的压载水处理装置技术的分类，各处理装置的特性如表III－1－A，有关使用活性物质的典型处理装置的记述是根据制造商的主页，宣传册等来记述。

表 III-A 处理装置技术区分及比较

编号	处理技术	代表的制造商	特性
1	电气化学+中和	Techcross	-不需要装载化学物
2	过滤+电气化学	EctoSys, RBT, GreenShip Meyer	-不需要装载化学品
3	过滤+电气的分解，氯+中和	Severn, Mitsubish, Electrichor	-不需要装载为化学药品
4	过滤+电气化学+无氧	OceanSaver, NEI	-不需要装载化学物质
5	过滤+AOT	PureBallast	-副产品的应用 -不需要装载化学物质
6	过滤+UV	Panasia, OptiMarin, Gauss, Marenco, Willand	-副产品的应用 -不需要装载化学物质
7	(过滤+)臭氧	Special Pipe, NK	-不需要装载化学物质
8	过滤+二氧化氯	EcoChlor	-性能良好
9	过滤+化学药品	Peraclean	-初期的设置费用最少
10	结晶体+过滤	Hitachi	-副产品少

1.1压载水处理装置的基本构成

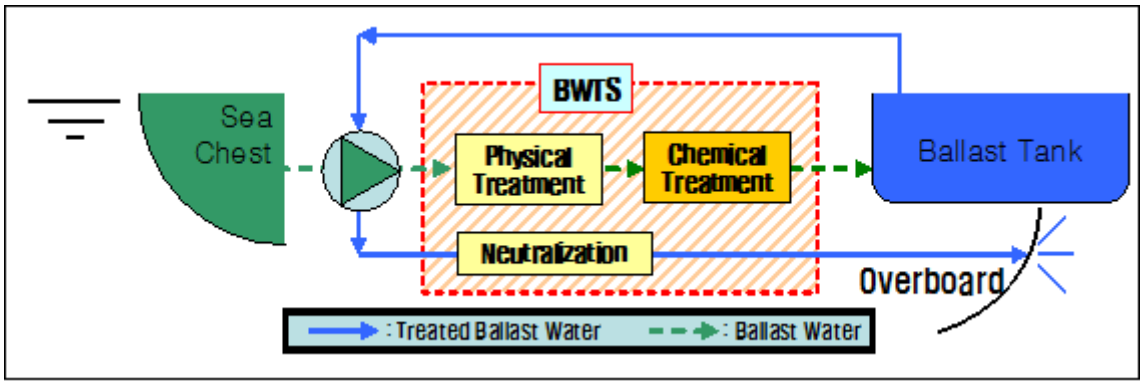


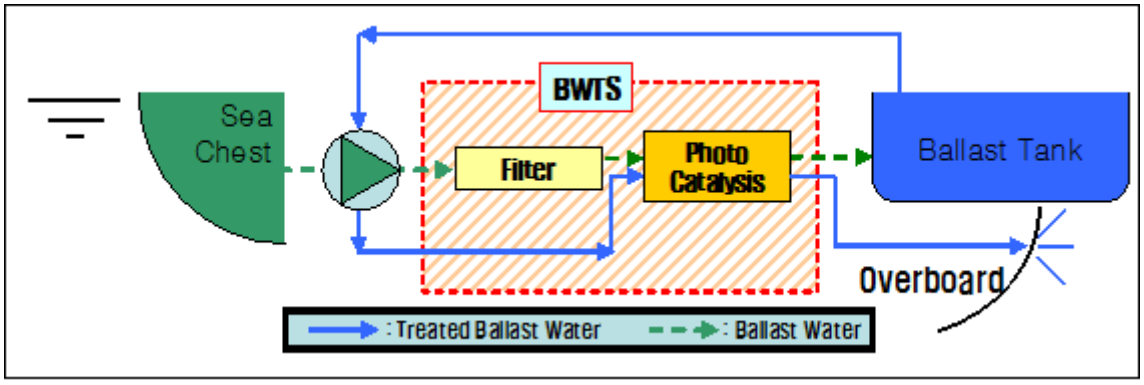
图 III-1.1-A 压载水处理系统的处理方法

一般情况，压载水处理系统如图III-1.1-A所示。压载水的物理性处理可通过过滤来实现，通常50㎛以上大小的生物及沉淀物可以被过滤出去。然后，药品等的化学性处理可以通过杀菌的方式来完成，然后把处理过的水注入压载舱内。此后，在向船外排水进行压载水再处理或者需要中和处理系统的情况，在这些处理结束后，即可向船外排出。 在很多系统中的生物或沉淀物的大

小超过50㎛的情况，为了分离可以用过滤或者气穴（ cavitation）等物理性处理方式导入系统中，并且可以帮助抑制沉淀物通过。

微生物或细菌等杀菌处理的主要化学性方法来实现的。该方法主要有使用紫外线（UV）的方法，使水中氧的量减少的方法，还有掺杂具有较强的杀菌力的臭氧等化学物质的方法。

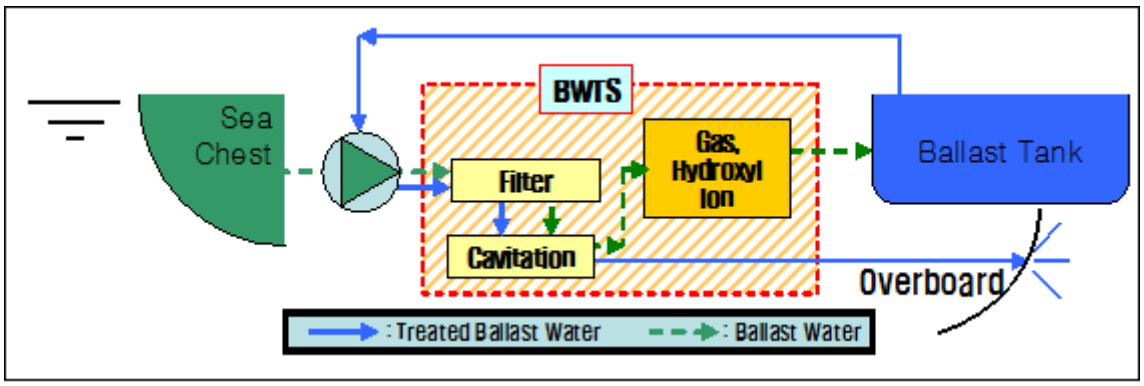
1.2 过滤处理+ 光媒触



图III-1.2-A 过滤处理+ 光媒触处理方法的概要图

上述的方法具有不使用化学药品的优点。图III-1.2-A所示为处理方法的概要图。首先，通过过滤的方法处理水中大的水中生物，然后，通过自由基方式用二氧化钛来处理水中生物及进行杀菌处理。自由基是指具有不成对电子的分子或者原子。二氧化钛在白色颜料，食品添加物，牙膏等的原材料中广泛应用，二氧化光触媒通过特征波长放射，活性氧或羟基等的相互作用来消毒或杀菌，比起被广泛使用的氯，次氯酸，过氧化氢及臭氧等是具有更强的氧化能力的物质。在压载水进行排水处理时，需要通过压载水处理系统来再次处理。

1.3 过滤+ 空穴+ 氮气

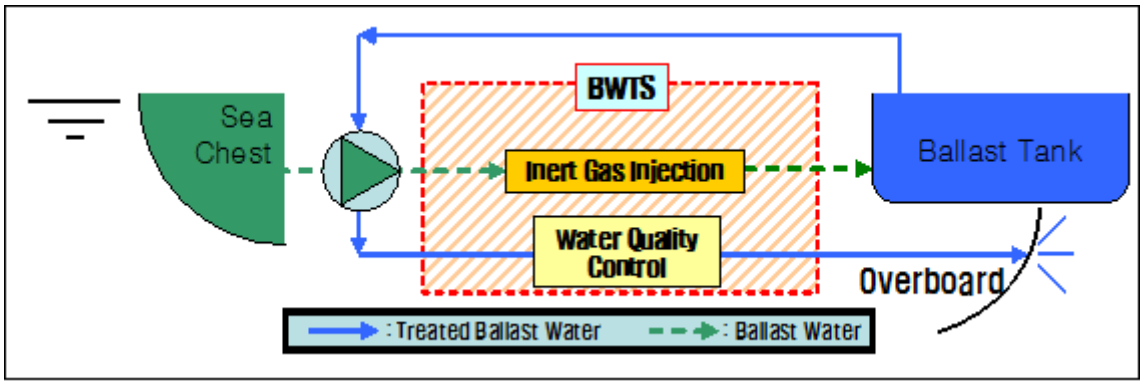


图III－1.3－A 过滤+ 空穴+ 氮气

图III－1.3－A所示为不使用化学药品的处理方法的概要图。注入的压载水通过过滤来除去50㎛以上的大的水生物及沉淀物。然后通过气穴（ cavitation）装置来杀菌，在船内产生的氮气通

过电解产生的羟基离子来实现水中生物及菌类的杀菌。

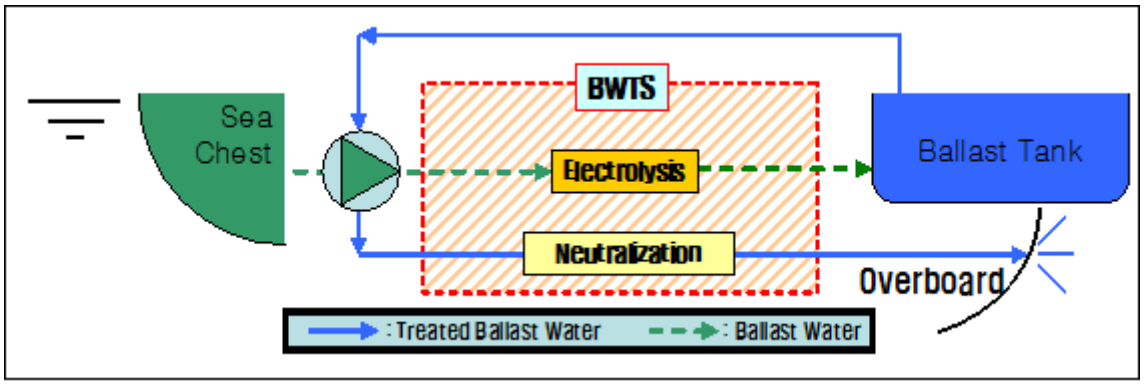
1.4 惰性气体处理法



图III－1.4－A 使用惰性气体的处理方法

压载水注入时，由于使用文曲利管（venturi pipe），压载水中注入了惰性气体，通过使压载水中的氧气浓度下降来进行杀菌处理。航海过程中，通过压载舱堕化来防止水中生物的繁殖。由于压载水的氧浓度下降，生物无法繁殖，因此，排出的时候要通过注入大气中的气体排出测量器再排出来。

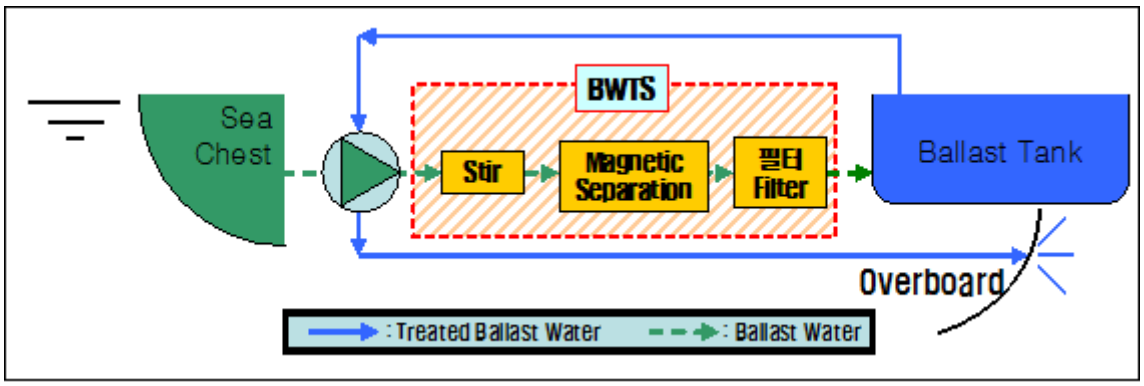
1.5 电解处理法



图III－1.5－A 电解处理法

通过电解装置放出的次氯酸根离子来破坏细胞核，碳化还原后，通过ORP(氧化还原电位)来破坏细胞膜，从而实现杀菌处理。为了防止压载水舱内微生物的再生，要使压载水中残留一些次氯酸根。由于这个原因，压载水在排出时，残留的次氯酸与硫酸钠需中和后排出。

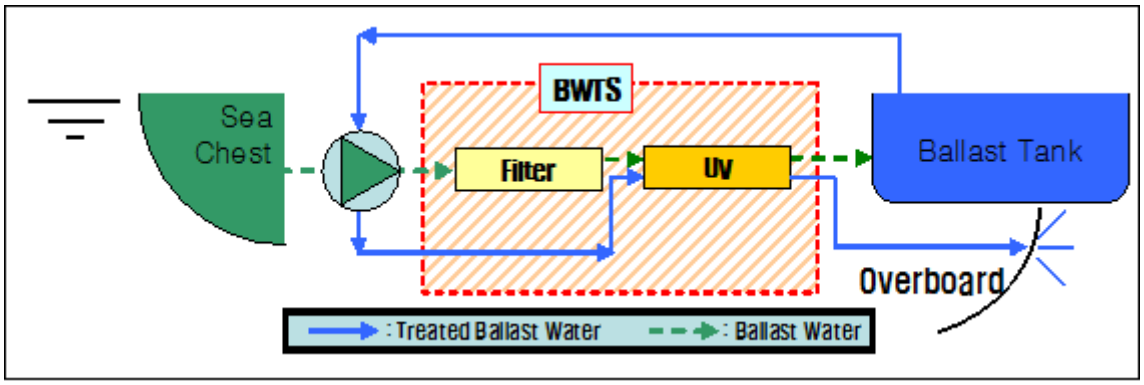
1.6 过滤+磁极分离法



图III－1.6－A 磁极处理法

压载水注入时，加入磁成分搅拌分离后处理水中的生物，微生物及细菌的系统。为了杀菌而不使用化学药品， 排水时水的成分也不致变化，这样的话，就没有必要再处理和中和了。

1.7 过滤+紫外线处理法



图III－1.7－A 紫外线处理法

水中生物在杀菌处理时，不要使用外部带入的化学药品，而要首先通过过滤来滤去水中大的生物及沉淀物，然后再通过紫外线杀去微生物及细菌等。排水时，再次通过紫外线放射装置来对压载舱内生存的微生物及细菌进行杀菌处理。

2. 生产厂商的压载水处理装置的特征

下面是与各压载水处理装置的处理技术相关的根据各生产厂商的主页，宣传册中的技术，结合各产品厂商的情况，要考虑性能的提高，防爆型的应用，个别部分设计的改变等要素。各生产商详细的特征信息请参见附录 E 及 F。

2.1 PureBallast System(挪威/56届MEPC最终审批)

2..1.1 一般事项

1）该技术作为PureBallast处理装置，在MEPC的第55次会议上，以瑞典的名义提出了关于活性物质的基本审批申请。该审议在接下来的一次会议，即为2007年7月的第56次MEPC会议中，以挪威的名义同时获得了基本认证和最终认证。由过滤和 Benrad AOT(高氧化技术)构成。

2.1.2 技术要求

1）过滤（50㎛）的沉淀物，水位下降后为了除去大的颗粒及微生物，使用自动过滤洗涤的方法。

2）AOT 是一种由特殊离子（氢氧根离子）通过对中间生成物产生的水中污染有机物和有毒物质进行消毒的氧化处理的压载水处理技术，最近压载水处理系统中被广泛应用的是通过调整臭氧（O3）的pH值，或掺杂过氧化氢，紫外线能源等来增强其氧化能力的技术。Benrad AOTZ装置是由自由基直接作用的影响及紫外线灯，或通过氧化钛等作为催化剂来增强氧化能力，从而实现微生物杀菌消毒的装置。

3）AOT是不产生毒性的杀菌剂，典型的氧化剂，与氯气，二氧化氯，高锰酸钾等相比，不仅具有更强的氧化性，而且与单独使用臭氧的设备相比，不但没有毒性或残留物质而且反应速度快。下图III-2.1-C及 III-2.1-D为压载水处理时的管道流程图。

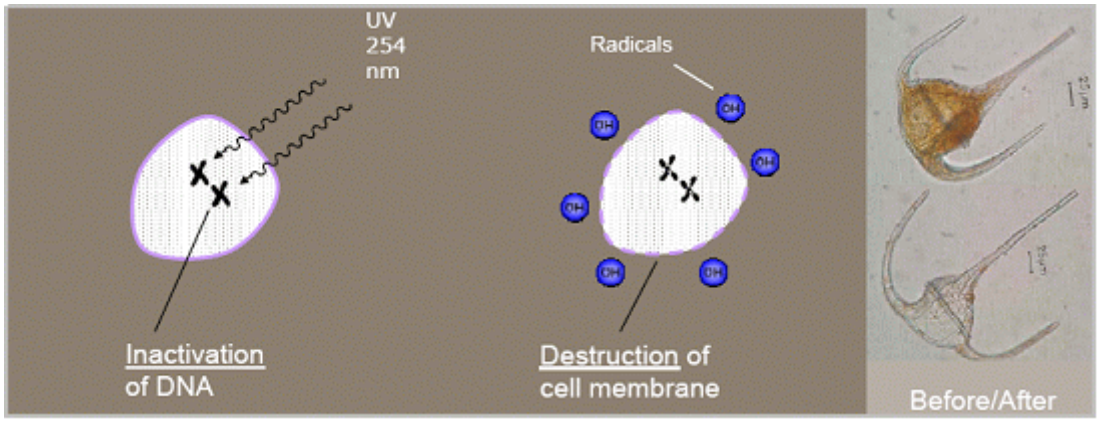


图 III-2.1-A PureBallast的应用原理

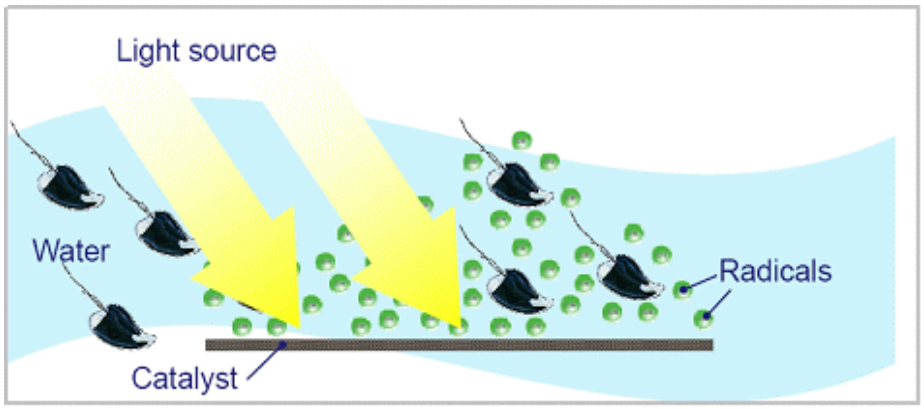


图 III-2.1-B PureBallast的应用原理

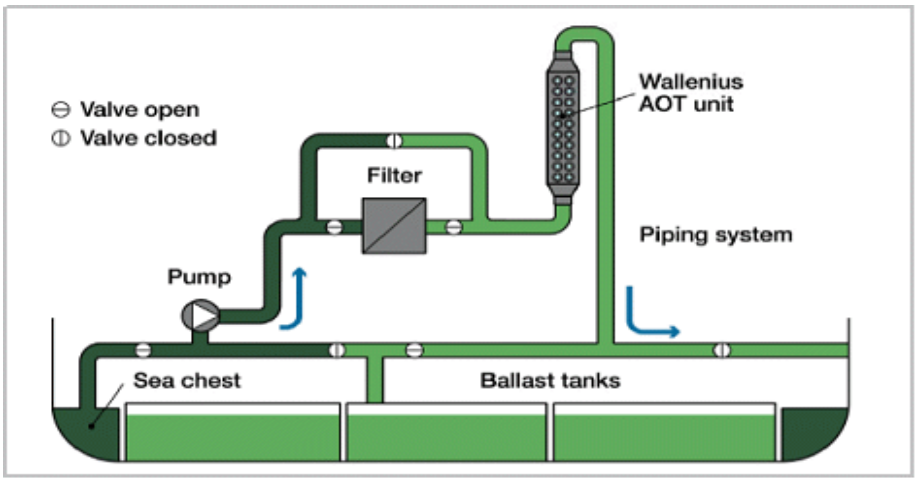


图 III-2.1-C Ballasting 过程

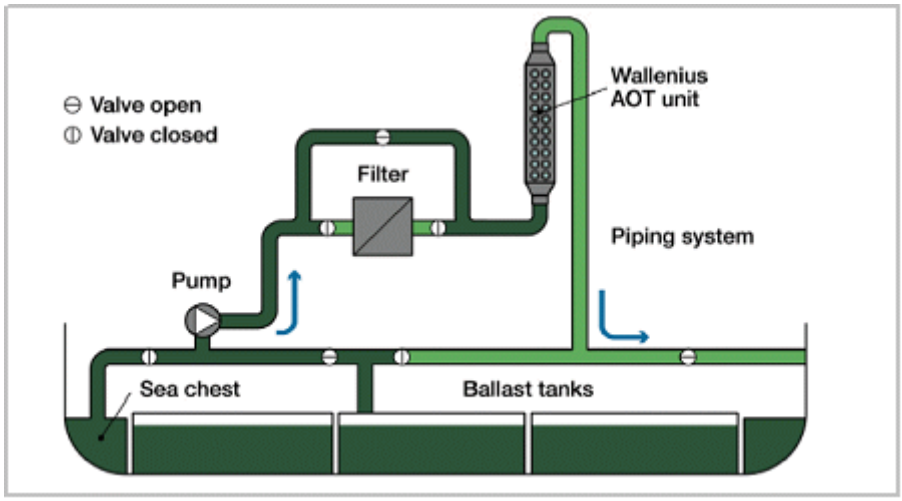
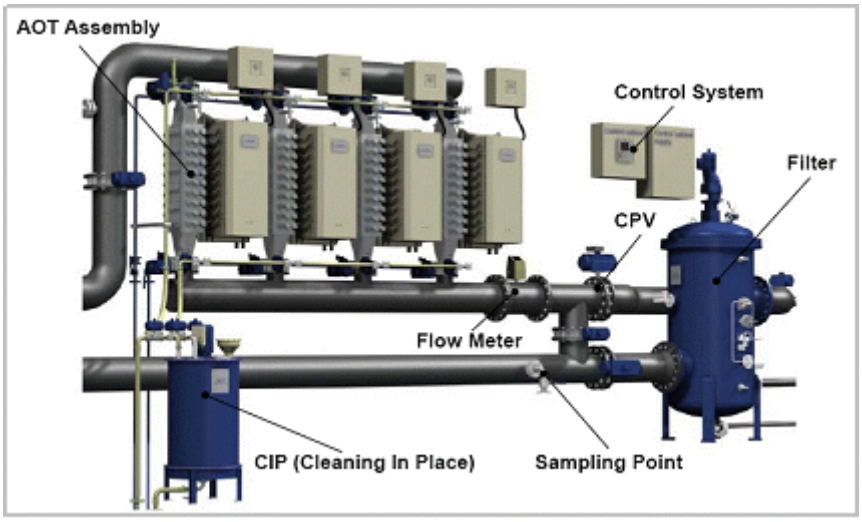


图 III-2.1-D Deballasting过程

图III-2.1-E 所示为由过滤及AOT等构成的 PureBallast处理装置的设置图。



<图 III-2.1-E 为 PureBallast处理装置概略图>

图 III-2.1-F AOT的配置图

图 III-2.1-G 过滤器

Model	Power Consumption (kW)	Size of AOT unit(s)(H X W X L)
PureBallast 250	60	2 X 0.8 X 1(m)
PureBallast 500	120	2 X 0.8 X 2(m)
PureBallast 1000	240	2 X 0.8 X 4(m)
PureBallast 1500	360	2 X 0.8 X 6(m)
PureBallast 2000	480	2 X 0.8 X 8(m)
PureBallast 2500	600	2 X 0.8 X 10(m)

表 III-2.1-F 电力消耗比较

2.2 Electro-cleen(韩国/MEPC 58次会议（最终认证））

2.2.1 一般事项

1)Techcross公司所正开发的电化学处理装置Electro-Cleen相当于一个电解装置，Electro-Cleen在2006年3月的第54次MEPC会议上获得了活性物质的基本认证，在2008年57次MEPC会议上获得了最终的认证。

2.2.2 技术要求

1）该技术应用了电解技术,单一的工程也配备了复合的消毒器。在电解过程中，从阳极和阴极分别放出正离子和负离子。能形成杀死两极附近生物的充分的电压，特别是阴极产生的阴离子具有卓越的能使有机物分解的能力。 水电解的话，会产生氢氧根，过氢化物酶，碳酸氢根，过氧根，过氧化氢，臭氧，次氯酸盐等多样化的离子，这样就会产生较高的电位差，几乎所有的有机物都有在这种情况下快速反应。

2）离子是在水草中数亿分之一秒的瞬间存在的不稳定的物质，通过离子交换，生物可能在瞬间就被杀死。另外，通过生成的次氯酸盐可以持续的杀灭压载水舱内的生物。 在排出之前，应该设置氯的中和装置，来保证排出水中氯的浓度几近为0。

2.2.3 构成要素

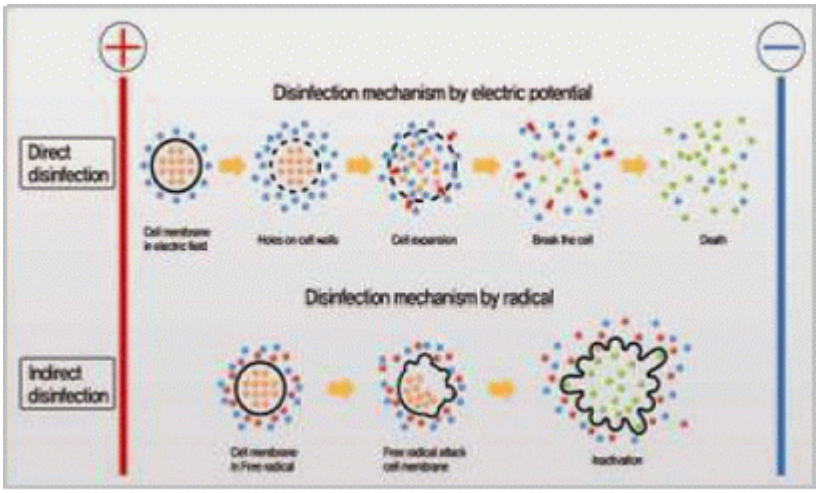
1）中央控制装置（ControlPC）：控制压载水处理系统。

2）中和装置: De-ballasting 时，在压载水中残存的氯气的浓度在TSU中感应后自动从中和装置中排出。

3）电源适配器：压载水处理系统电源的分配

4）整流器：由电源适配器输出的电源转化为高压电流提供给ECU.

5） 电解室单元（ ECU ： Eletro-Chamber Unit）:由整流器提供的高压电流中实现电解的部分将成为压载水处理的核心部分。



<图 III-2.2-A Peraclean Ocean 样品的构成图 >

MODEL	Capacity (m^3/h)	Power Consumption (kWh)	Size (W X D X H)(mm)
ECS-600	600	36~60	2200 X 100 X 1800
ECS-1200	1,200	72~120	2000 X 1400 X 1900
ECS-1800	1,800	108~180	2000 X 2200 X 1900
ECS-2400	2,400	144~240	2400 X 2350 X 1900
ECS-3000	3,000	180~300	2600 X 2500 X 1900
ECS-3600	3,600	216~360	2700 X 2500 X 1900
ECS-4200	4,200	252~420	3050 X 2500 X 1900

表 III-2.2-B 产品规格表

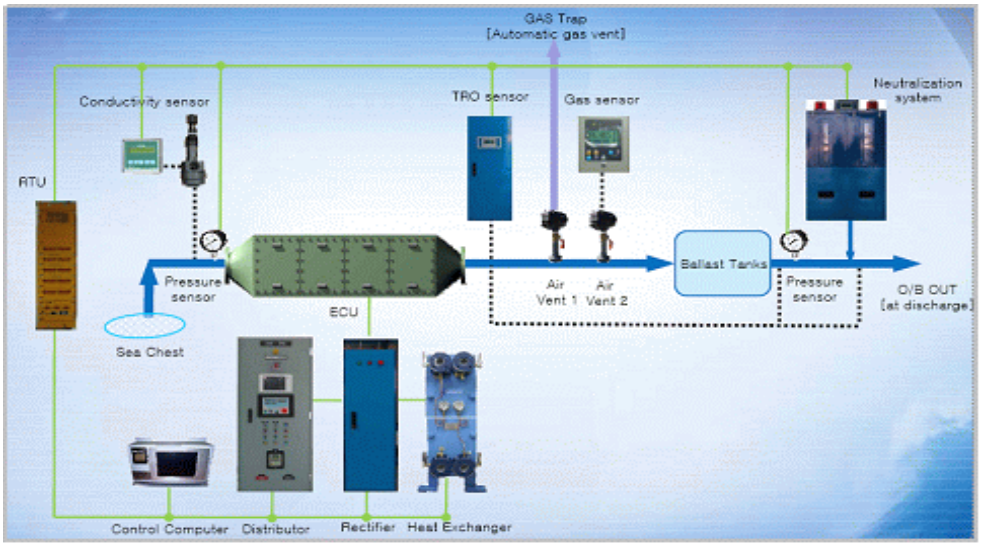


图 III-2.2-C Electro-Cleen 原理图

2.3 OceanSave（挪威/MEPC 58次会议（最终认证））

2.3.1 一般事项

1） 挪威的 OceanSaver公司开发的处理装置在2008年3月第57次MEPC会议上获得了基本的认可，在2008年10月的58次MEPC会议上获得了活性物质的最终认证

2.3.2 技术要求

1）2007年时，发表了在全部的过滤处理后，通过气穴（cavitation）的冲击来杀灭生物，通过充入氮气来除去氧气的技术。

2）可是，如果向IMO申请活性物质的基本认证的话，需要附加电解装置。附加的组成元素如下：

a. Mechanical Filteration Unit

b. C3T Unit ： Hydrodynamic cavitation

c. C2E Unit ： Activated water

d. Nitrogen(N2) Supersaturation unit

3) 在2006年之前， 没有C2D电解装置，主要用C3T做为处理装置。C3T通过应用流体力学的空穴液压冲击原理，来杀灭生物，如图III-2.3-A所示。

4）如果生物的杀灭效果小，船舶的压载水舱内生物的繁殖速度快的话，在排出时，仍要有可处理的设备构成。下图 III-2.3-B及III-2.3-C所示为 Ballasting 和 Deballasting的过程。

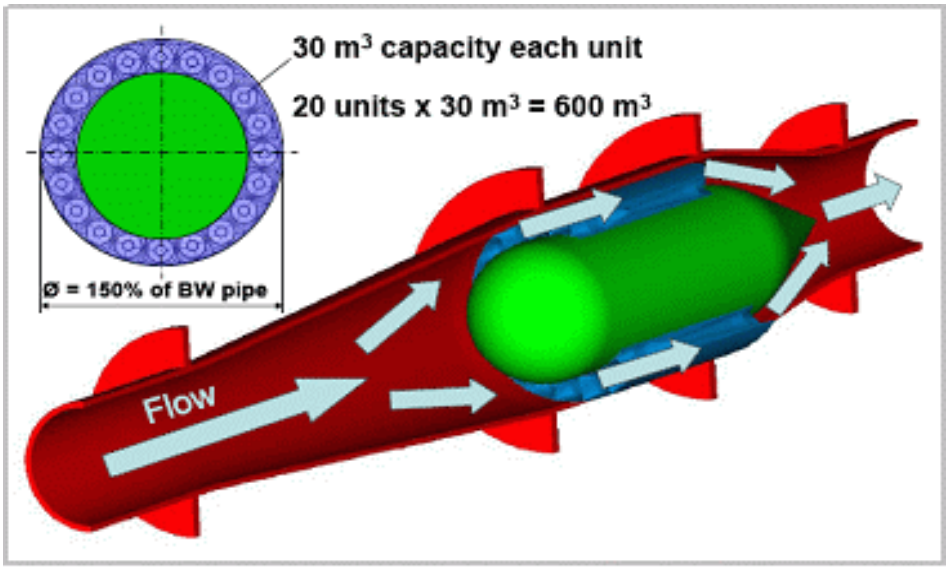


图 III-2.3-A OceanSaver C3T(600m3/h) 空穴装置

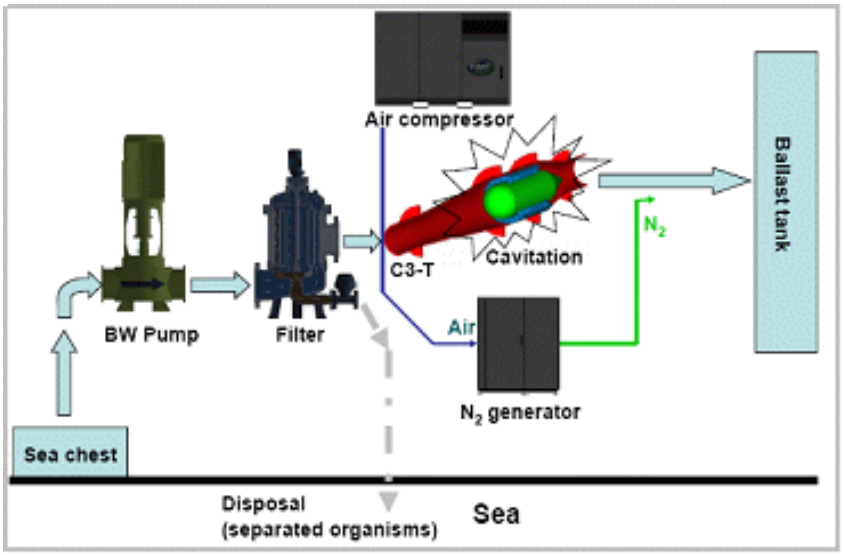


图 III-2.3-B OceanSaver 压载水的 Ballasting过程

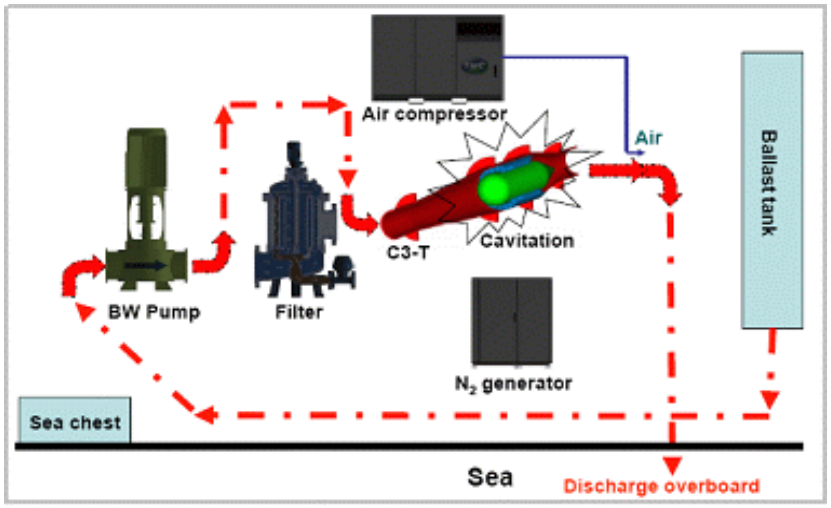


图 III-2.3-C OceanSaver 压载水的 Deballasting过程

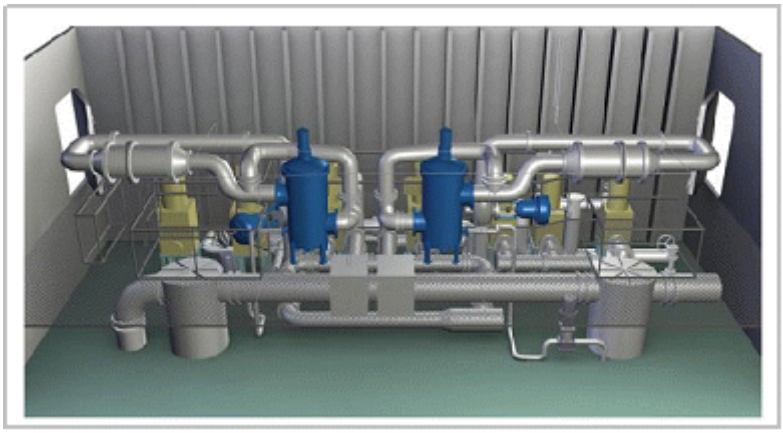


图 III-2.3-D OceanSaver 的安装配置图

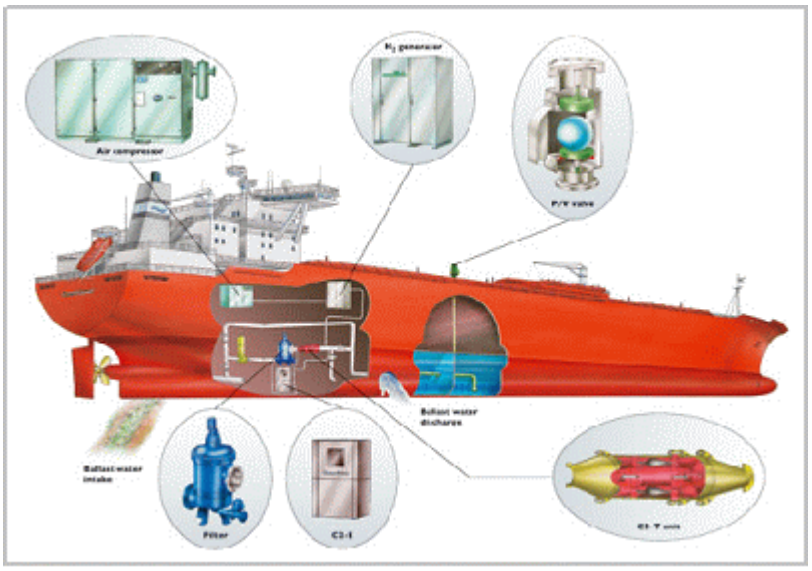


图 III-2.3-E OceanSaver 处理装置的内部设备分解图示

2.4 RWO（德国/MEPC 59次会议（最终认证））

2.4.1 一般事项

1） RWO公司开发的 CleanBallast 处理装置是在MEPC第59次会议上获得最终认证的，该处理装置，在处理压载水的过程中可以实现两个主要的过程。

2.4.2 技术要求

1)压载水在注水的时候，由固体物质及残留物首次通过过滤装置DiskFilter分离及微生物通过二次电解杀菌装置EctoSys构成。De-ballasting时，处理过的压载水再次通过EctoSys（电解装置），对压载水舱内生成或未杀灭的生物 ，再次进行杀灭的过程。

2)图III-2.4-A所示为Ballasting过程，沉淀物及50㎛以上的生物通过DiskFilter来过滤，50㎛以下的微生物则通过使用 EctoSys电解装置来杀灭。图III-2.4-B所示为 De-ballasting的过程，处理过的压载水通过EctoSys后排向船外。图 III-2.4-C，图 III-2.4-D及图III-2.4-E为各个Monitor, DiskFilter 及 EctoSys的照片，关于该处理装置的Spec，如下：

a. Power Consumption （耗电量）: Min. 0.008kWh/m3 ~ Max. 0.1kWh/m3

b. Pressure Drop 压力差（压力）: 0.6 ~ 1.3bar

c. System Capacities （系统容量）: 100 ~ 7,000m3/h

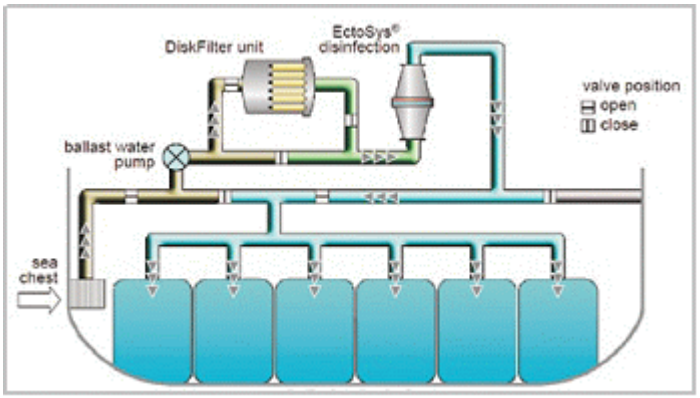


图 III-2.4-A Ballasting过程

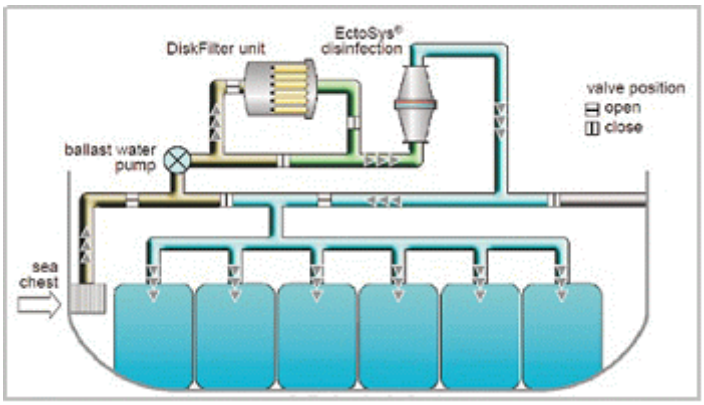


图 III-2.5-B De-ballasting过程

图 III-2.4-C Monitor

图 III-2.4-D EctoSys

图 III-2.4-E DiskFilter

2.5 NK-O3(韩国/MEPC 59次会议（最终认证））

2.5.1 一般事项

1） NK公司使用臭氧的处理技术在2007年的MEPC 56次会议上取得了活性物质的基本认证，2009年8月 MEPC的59次会议上获得了最终的认证。

2.5.2 技术要求

1）主要部件是由能使空气压缩的空气压缩机以及在压缩空气中制造纯氧的氧气再生器，99%的氧气用作制造臭氧的臭氧投入器构成。

2）图 III-2.5-C 的表所示为NK-O3模型在 III-2.5-C从（ 015(300m3/h)到 400(8,000 m3/h)范围的关于多种类尺寸类型的技术比较。

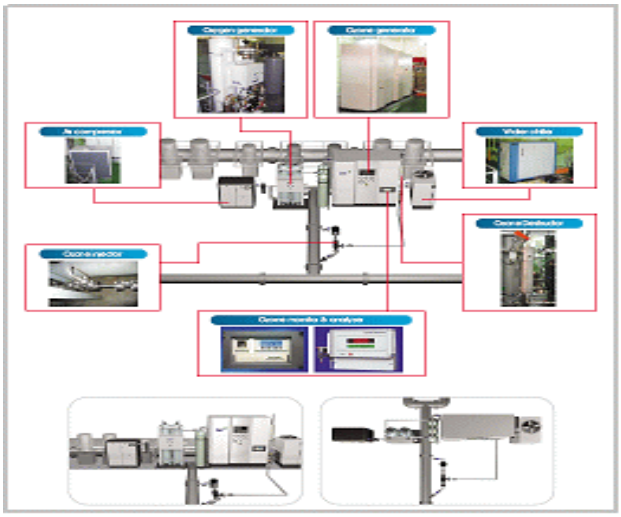


图 III-2.5-C NK-O3系统模型

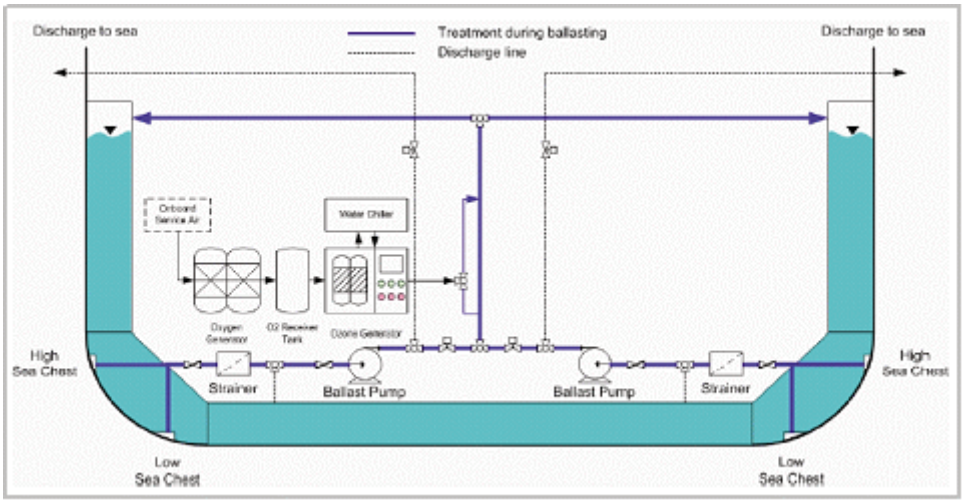


图 III-2.5-B 为 NK-O3 的管系配置图

Model/Type	Flow Rate (m^3/h)	Ozone Production (g/hr)	Power Consumption (kWh)	Foot Print (m^2)
NK-03 015	150X2	750	25.7	3.7
NK-03 030	300X2	1,500	46.6	5.8
NK-03 050	500X2	2,500	69.4	8.3
NK-03 075	750X2	3,750	95.8	9.5
NK-03 100	1,000X2	5,000	150.2	11.5
NK-03 150	1,500X2	7,500	199.9	15.9
NK-03 200	2,000X2	10,000	264.9	16.6
NK-03 250	2,500X2	12,500	319.2	23.7
NK-03 300	3,000X2	15,000	384.2	26.0
NK-03 400	4,000X2	20,000	486.6	33.1

表 III-2.5-C 产品规格表

2.6 Hitachi-ClearBallast（日本、MEPC 59次会议（最终认证））

2.6.1 一般事项

1）日本Hitachi所开发的 ClearBallast(Ballast Water Purication System在2008年3月的57次 MEPC会议上，获得了活性物质的基本认证，在MEPC 的59次会议上 获得了最终的认证。

2.6.2 技术要求

1） 该处理装置如图III-2.6-A所示，该装置是通过使用磁性物质的凝聚分离技术，通过注

入凝聚剂，磁性分离，过滤等过程来实现的。然后通过把凝聚剂及四氧化三铁添加到海水中如图III-2.6-B所示的程序，把沉淀物，浮游生物，细菌及沙石等聚集成团后除去。

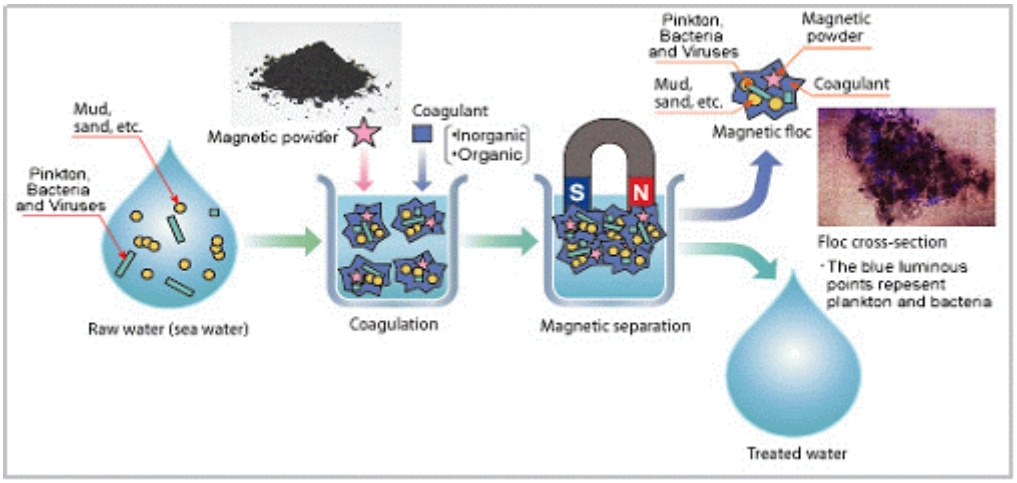
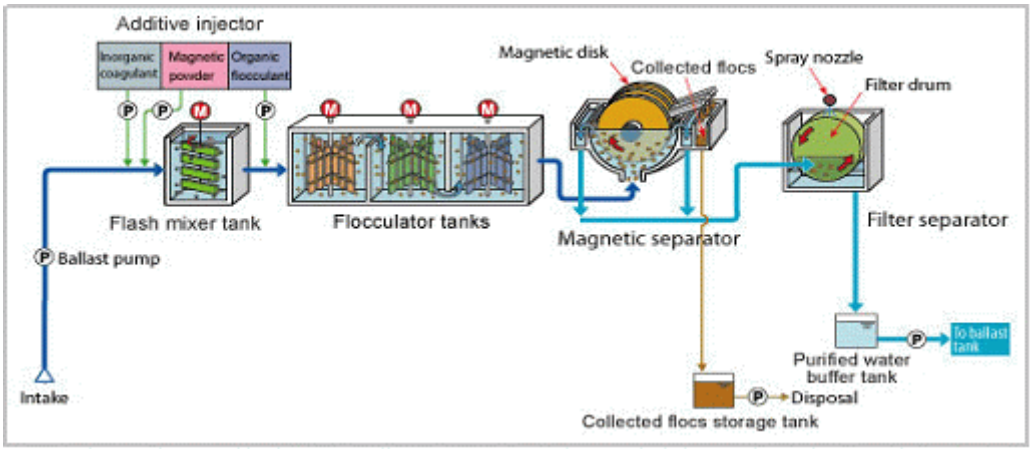


图 III-2.6-A ClearBallast的凝聚原理



图III-2.6-B ClearBallast装置的处理过程

表 III-2.6-C 耗电量比较表

Ballast Pump Capacity (m^3/h)	Types	Area	Electric Power (kW)
200	Modular Type Purification System	20 Foot Container	13
400		20 Foot Container x 2 (40 Foot Container x 1)	23
		L8.4m x W2.7m x H3.5m	
800	Unit Assembling Purification System - Coagulation tank - Flocculation tank - Magnetic separator - Filter separator - Coagulant supply device - Control panel	40m^2Foot Print Note 3	38
1,200		58m^2Foot Print Note 3	68
1,600		77m^2Foot Print Note 3	76

* Note 3:Foot Print:Floor space

2.7 Greenship Sedinox （荷兰/MEPC 59次会议（最终认证））

2.7.1 一般事项

1）在荷兰GreenShip公司开发的处理装置是由离心分离机形式的沉淀物分离装置及电解分离装置构成的。不需要添加化学药品，通过电解可以产生2.6ppm的次氯酸钠。

2.7.2 技术要求

1）船舶压载水处理是除去沉淀物的过滤沉淀法 Sedimentor（图 III-2.7-A参照）及 电解装置 Termanox（图 III-2.7-B 参照）的兼用。关于各构成品的细节，请参考图 III-2.7-E及图III-2.7-F。

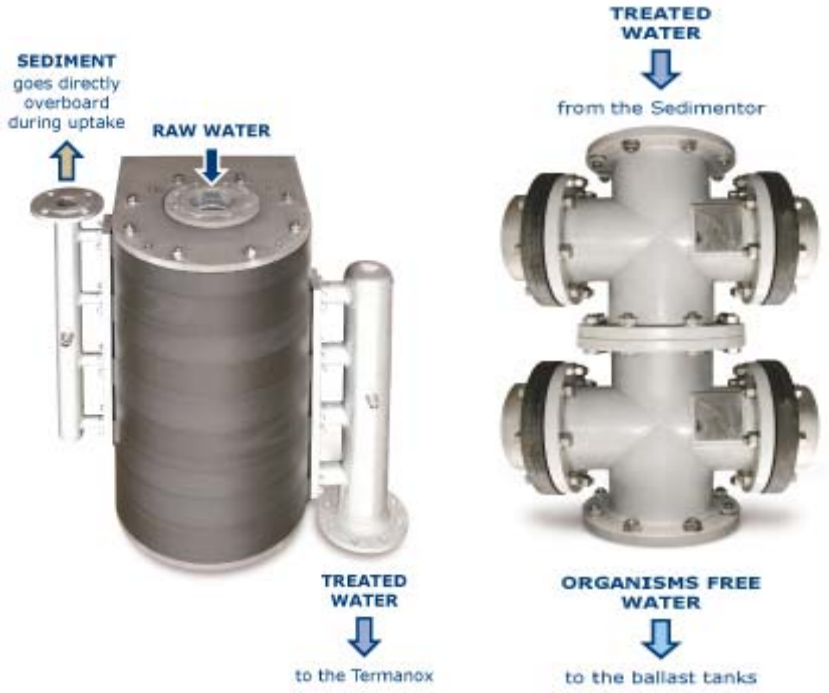


图 III-2.7-A 沉淀分离器（Sedimentor(100m3/hr) 图 III-2.7-B Termanox(100m3/hr)

2）图III-2.7-C所示为实际船舶上设置的处理装置图，图III-2.7-D所示为处理装置的概略图。

图 III-2.7-C实际设置图

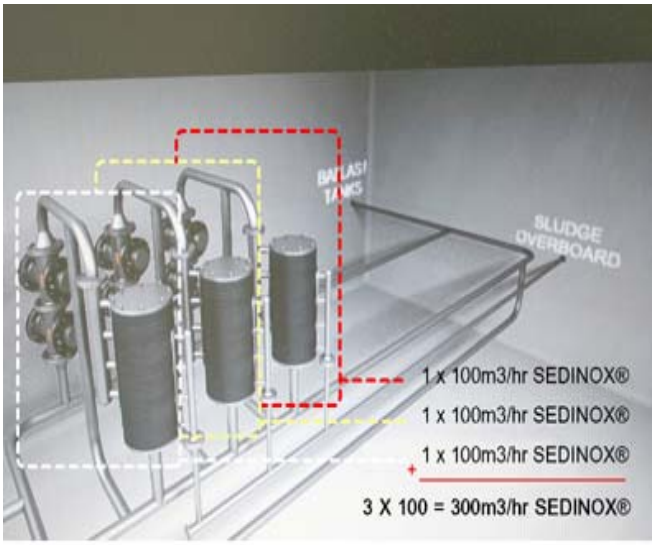
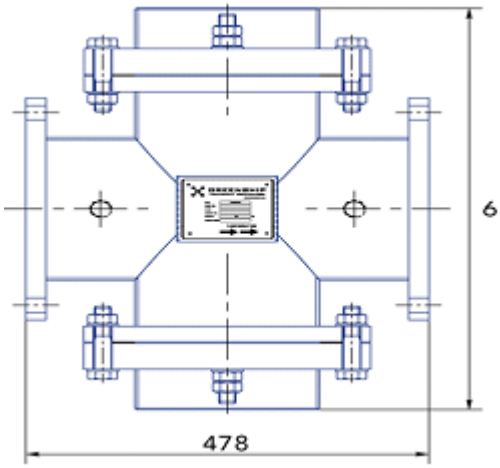
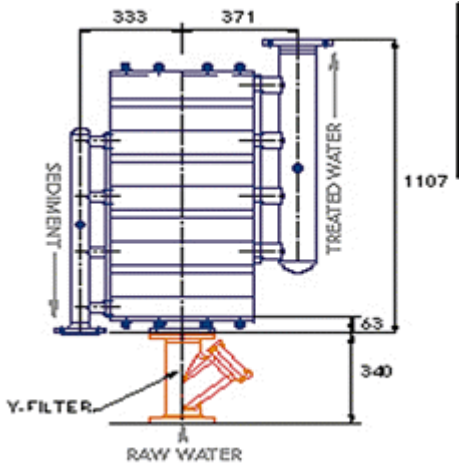


图 III-2.7-D 300m3/h容量的处理装置



Name	Termanox (전기분해)
Capacity (m^3/h)	100
Power Consumption(kW)	2kW/ 100m^3/h
Pressure drop(bar)	0.8bar

图 III-2.7-E Termanox(100m3/h)的尺寸



Name	Sedimentor(Filter)
Capacity (m^3/h)	100
20㎛ above	100% filtering
10㎛ above	80% filtering
Pressure drop(@ 4bar)	2bar

图 III-2.7-F 沉淀分离器（Sedimentor）(100m3/h)的尺寸

2.8 GloEn-Patrol(韩国/MEPC 60次会议（最终认证）

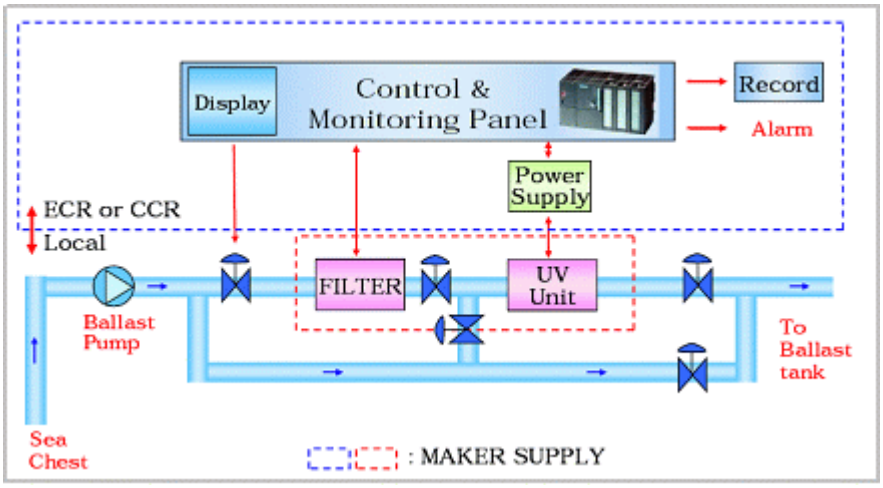
2.8.1 一般事项

1） 该处理装置是在 Panasia开发的使用紫外线来杀菌的系统MEPC的57次会议上获得了活性物质的基本认证，在MEPC 60次会议上获得了最终认证。

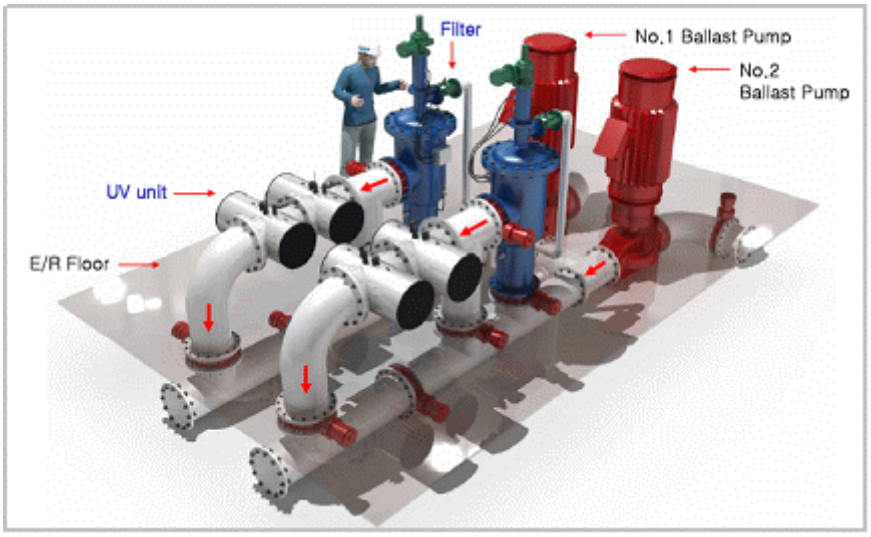
2）250m3/h容量的过滤器使用尺寸为50㎛的过滤网，工作压力为2.5bar，最大工作压力为10.0bar。

2.8.2 技术要求

1）该系统具有自动洗涤装置和各种传感器及模拟系统。由于是使用紫外线UV的方式，不使用其他化学剂及活性物质，因此，不必担心有毒性及腐蚀性等，与其他技术相比，更具有保护环境的意义。



图III-2.8-A GloEn-Patrol处理装置的流程图



图III-2.8-B GloEn-Patrol处理装置的整体装配图

Model	Capacity (m^3/hr)	Power Consumption (kW)	Foot Print (m^2)	Application
GloEn-P500	500-600	80	2.7	23K, 29K, 35K
GloEn-P750	750	120	4.2	45K – 51K
GloEn-P1500	1,500	240	9.8	71K, 97K
GloEn-P2000	2,000	320	9.5 (14.9)	158K
GloEn-P3000	3,000	480	13.3(20.5)	300K

图 III-2.8-C列出了根据类型容量分类的耗电量及大小

2.9 Resource Ballast Tech. Sys.（南非/ MEPC 60次会议（最终的认证））

2.9.1 一般事项

1）南非的 Resource Ballast Technology开发的处理装置在2008年3月份MEPC 57次会议上获得了活性物的基本认证，在MEPC 60次会议上获得了最终的认证。

2.9.2 技术要求

1）RBT在处理装置中使用了空穴原理（Cavitation），并且伴随使用少量的臭氧及次氯酸钠来过滤。效应器是依靠电控板来控制的，效应器通过ECP来供给0.001mg/liter的臭氧，PH值及盐度来实现电源的供给。这样通过电解就会生成次氯酸盐。

2） 图III-2.9-A所示为整体的工作流程图，图III-2.9 –B列出了处理装置根据类型分类的容量大小及耗电量。

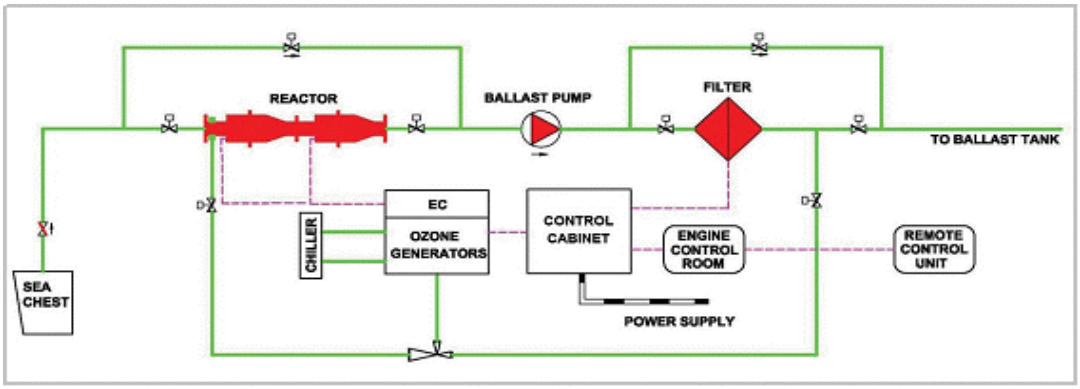


图 III-2.9-A工程流程图

DN size	mm	150	200	250	300	350	400	450	500	600
Flow rate	m³/h	150-200	201-400	401-600	601-1000	1001-1200	1201-1500	1501-2000	2001-2500	2501-4000
Reactor dimensions [L x Ø]*	mm	3000 x 595	3000 x 658	3000 x 703	3200 x 765	3200 x 820	3200 x 873	3580 x 1018	3680 x 1083	3800 x 1253
Filter dimensions [H x Ø]	mm	2075 x 650	2330 x 900	2330 x 900	2415 x 1100	2615 x 1250	2650 x 1500	2650 x 1500	4110 x 1900	4560 x 2010
System weight	kg	1700	2100	2500	3200	4200	4600	5100	6100	9400
Energy consumption	kW	4	7	9	12	15	18	22	30	45
Pressure drop over reactors**	bar	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6
Pressure drop over filter	bar	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

* Length for two reactors end-to-end. Max diameter including junction box.
** Maximum projected pressure drop.
Note: 1 Reactors and filter on suction and pressure sides of ballast pump respectively
2 Data based on configuration with one reactor set, one ballast pump and one filter

图 III-2.9-B 按类型分类的容量，耗电量及大小的比较

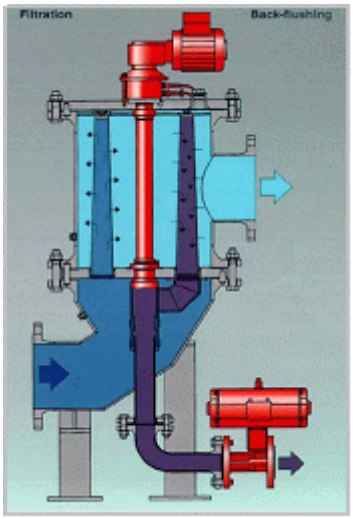


图 III-2.9-C 过滤器

图 III-2.9-D 电化学反应

2.10 JFE(日本/MEPC60次会议（最终认可）

2.10.1 一般事项

1）日本JEF公司开发的是一种过滤装置，空穴，次氯酸钠一并使用的技术。该装置在2008年MEPC的58次会议上获得了基本认可，在MEPC60次会议上获得最终认可。

2.10.2 技术要求

1）在设有压载水的船上，通过稀释次氯酸钠的方式，把30ppm的次氯酸钠注入。如图III-2.10-A 及图 III-2.10-B所示为Ballasting mode和 De-ballasting mode的过程。

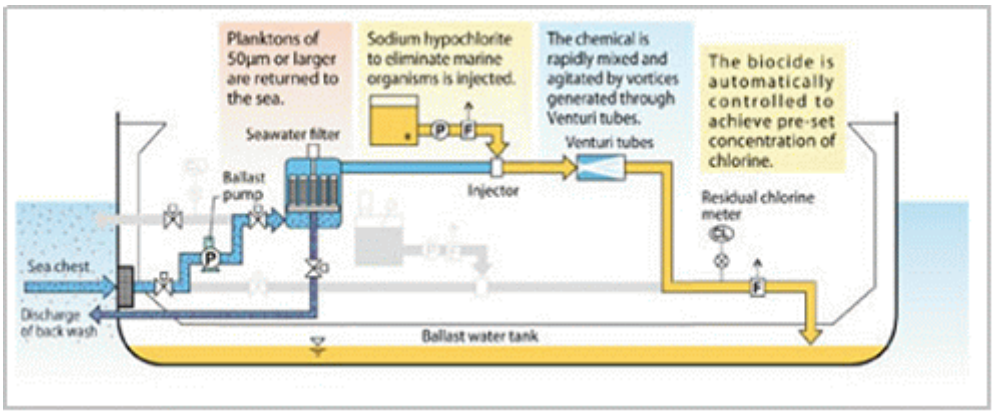


图 III-2.10-A Ballasting 处理过程

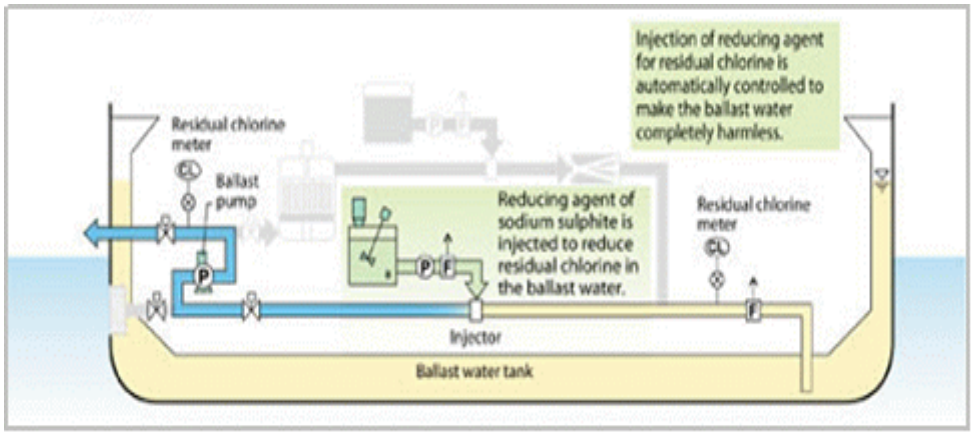


图 III-2.10-B De-ballasting处理过程

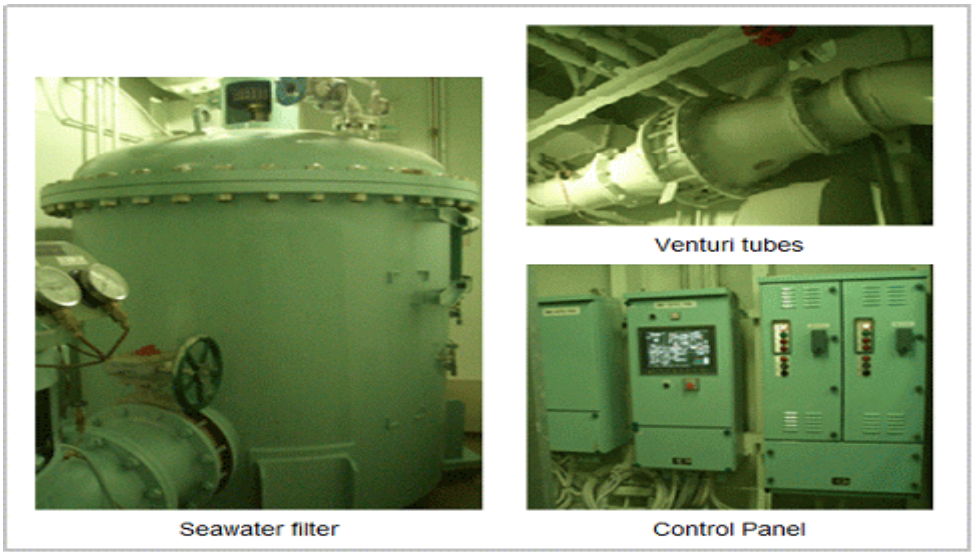


图 III-2.10-C处理装置的主要构件

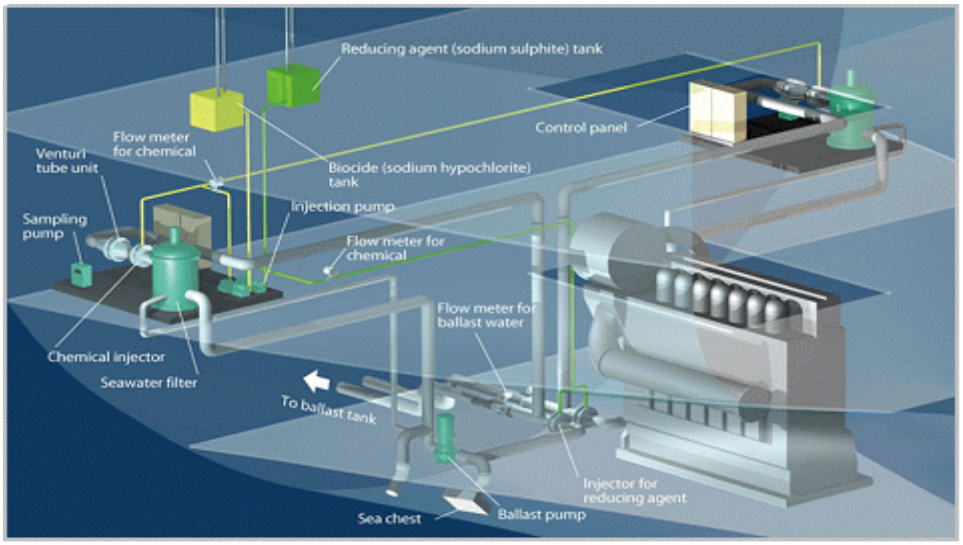


图 III-2.10-D处理装置的整体流程图

2.11 EcoBallast（韩国/MEPC 60次会议（最终认证））

2.12.1 一般事项

1）现代重工开发的EcoBallast在MEPC 60次会议上获得最终认可。EcoBallast System是通过过滤及紫外线杀菌这两种主要构件来实现的，该系统是依靠电脑的基本程序来控制的，并且采用了可使压载水中沉淀物有效减少的过滤的方式。该处理装置是由于使用了非化学性过滤及紫外线的方式，因此，是极具环保意义的产品。

2.12.2 系统的构成

1）包括系统阀及测量仪在内的控制单元
2）自动反冲过滤（依靠差压来驱动的反冲泵）
3）紫外线反应器
4）紫外线清洁单元
5）自动反冲过滤及紫外线反应器的旁通线

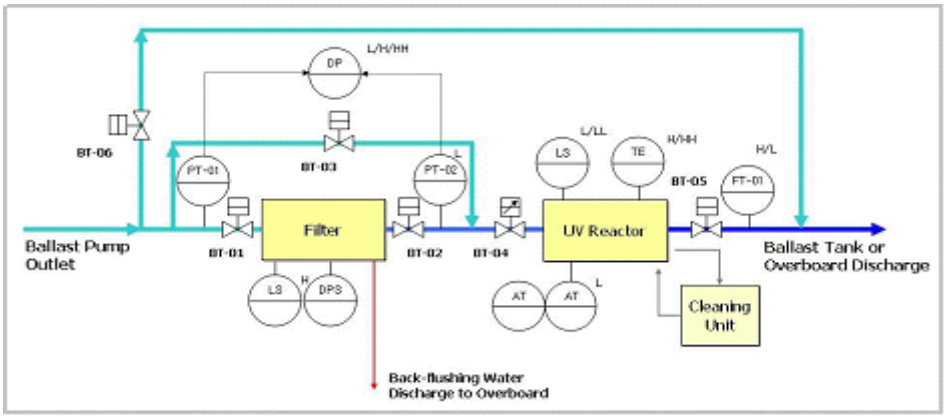


图 III-2.11.-A过程流程概略图

2.11.3 自动反冲过滤

1）自动反冲过滤是通过过滤器前后端的差压反冲泵及电动机的回转来驱动的。自动反冲过滤的构成如下表III-2.12-B所列出的。而图III-2.11-C所示为过滤器的参数及概略图。

Parameter	Unit	Value
Total height	mm	2950
Housing inside diameter	mm	700
Inlet flanges	DN	450
Outlet flanges	DN	450
Max. operating pressure	bar	Max. 6 bar
Approx. operating weight (Empty)	kg	1,655(1,020)
Protection class	IP	55
Power supply	V	440(3 p/60Hz)

表 III-2.11-B过滤器式样

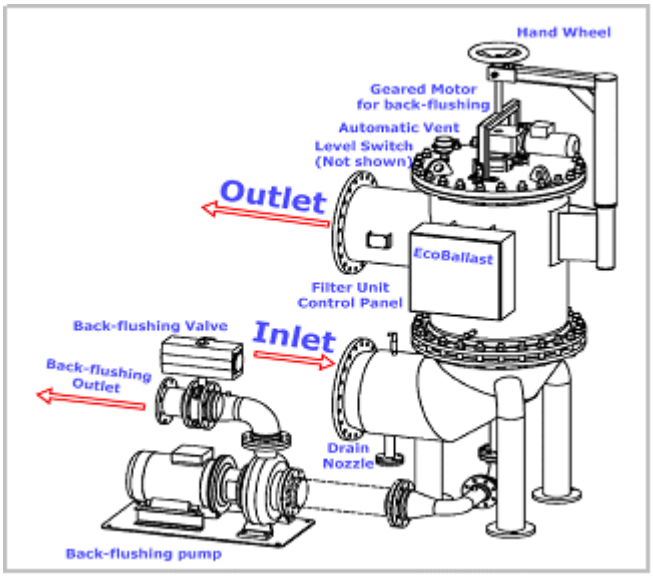


图 III-2.11-C自动反冲阀门的概略图

2.11.4 UV Reactor 紫外线反应器

1）紫外线反应器的管路如下图III-2.11-D所示插入，紫外线反应器和相关的主要参数如表III-2.11-E所列

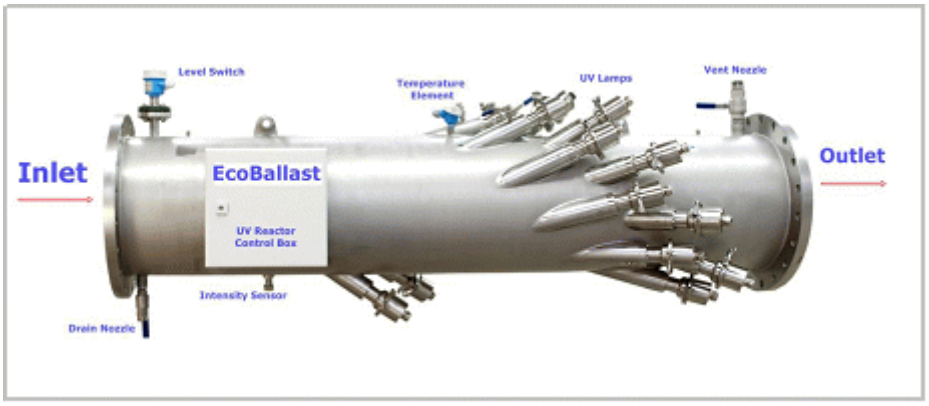


图 III-2.11-D紫外线反应器

Parameter	Unit	Value
Max. power consumption of each lamp	kW	9
Min. UV Transmission (T_{1cm})	%	70
Way of installation	-	Horizontal or Vertical
Total length	mm	2355
Inlet flanges	DN	500
Outlet flanges	DN	500
Max. Operating Pressure	bar	7
Water Temperature	°C	+5 - 32
Approx. Volume	m³	0.5
Approx. Weight (Empty)	kg	400
Protection class	IP	54

表 III-2.11-E紫外线反应器的参数

2.12 ARA Ballast(韩国/ MEPC61次会议（最终认可）

2.12.1 一般事项

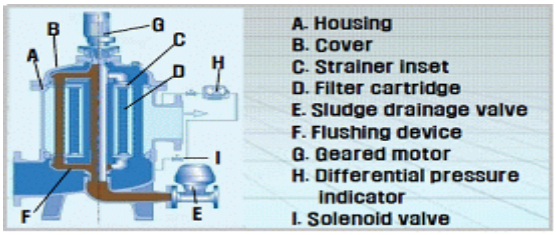
1）21世纪造船厂所开发的 ARA Ballast处理系统在MEPC 60次会议上获得了基本认证，在MEPC 61次会议上获得了最终的认证。

2.12.2 系统的构成

1）过滤： 船上的压载水注入时，除去海水中含有的50㎛以上的浮游生物的过程。（请参照 III-2.12-A）

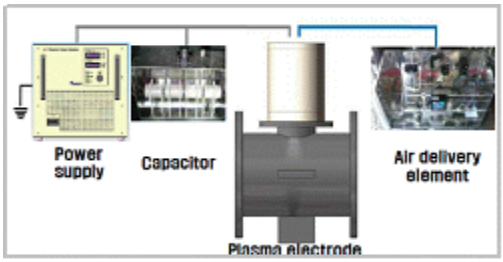
2）Plasma Electrode：船上压载水注入时，电源在水中产生了离子，依靠离子发出的冲击波可以产生激烈的压力变化，通过这个可以破坏细胞壁。（参见图 III-2.12-B）

3） MPCU Module： 用紫外线来杀灭细菌和病毒，不需要参加化学物质。Ballasting和De-ballasting时，驱动装置。（请参照图 III-2.12-C）



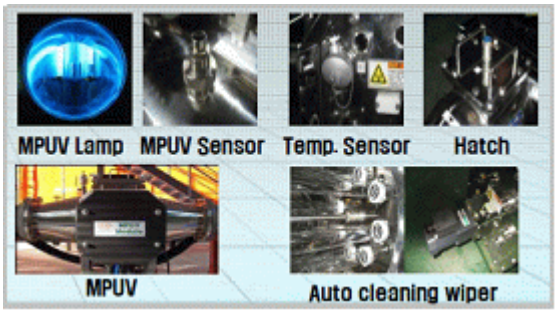
No.	Items	Specification
1	Service	Ballast water Filter
2	Type	Type 6.18.2 size 300
3	Filter element	Candle type
4	No. of candle	28pcs. Per chamber
5	No. of chamber	1
6	Mesh size	34microns
7	Connections	DIN flange NP 10
8	Back-flushing medium	Medium itself permanent
9	Nominal diameter	250㎜

图 III-2.12-A 为过滤器的细节图



No.	Items	Function	Specification
1	Plasma Electrode	플라즈마 발생부	Electrode I.D. : 250A
2	Power Supply	플라즈마 발생을 위해 전원 인가	입력 : 3상, 440V ± 10% 출력 : 0 ~ 30 kV(가변) (0-10 kV(Interlock))
3	Capacitor	전원 인가→ 펄스	용량:0.75㎌, 내전압:12 kV
4	Air Delivery Element	Air 유량 제어	Max. flow rate : 200 slm

图 III-2.12-B离子反应器的细节图



No.	Items	Function	Sepecification
1	MPUV Lamp	UV 조사	3.0㎾/ea(default setting), 12ea
2	MPUV Sensor(Intensity)	UV 조사 강도 측정	220-300㎚, 2ea
3	Temp. Sensor	챔버 내 온도 측정	PT-100, 1ea
4	MPUV Chamber	UV Casing	STS 316L, 1ea
5	Auto Cleaning Wiper	석영관 자동 세척	Teflon, 1unit
6	Quartz sleeve	MPUV 보호 및 MPUV 투과도 결정	Quartz, 12ea

图 III-2.12-C MPCU 模块的细节图

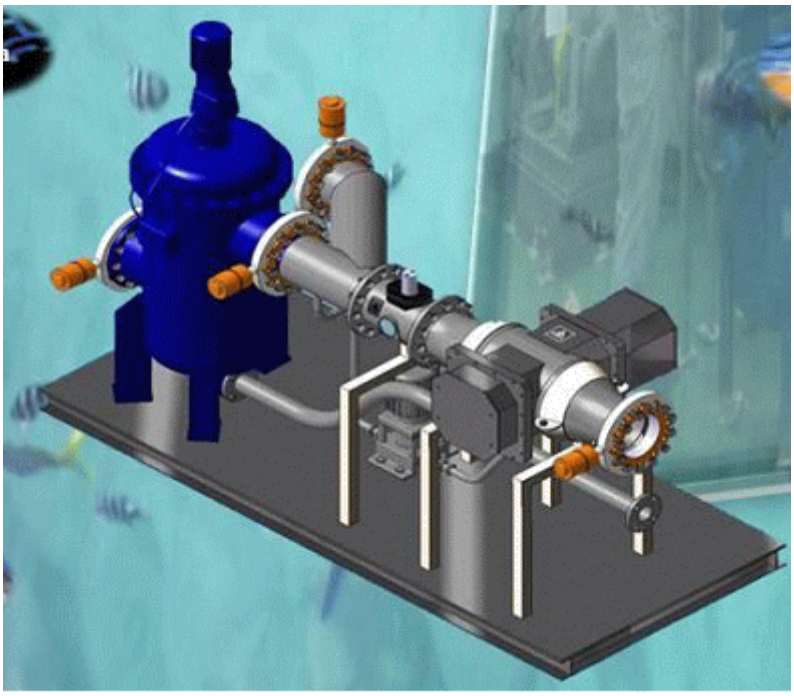


图 III-2.12-D装置的整体构成图

Model/Type	Flow Rate(m^3/h)	Power Consumption(kWh)	Foot Print (m^2)
ARA-250	250	30	1.79
ARA-500	500	60	2.74
ARA-700	700	85	2.78
ARA-1000	1,000	125	5.06
ARA-1500	1,500	170	5.19
ARA-2000	2,000	250	10.12
ARA-3000	3,000	350	10.38

表 III-2.12-E根据型号容量列出的耗电量及大小

2.13 Ecochlor（德国/MEPC 61次会议（最终认证））

2.13.1 一般事项

1）德国 Ecochlor公司的处理装置是应用二氧化氯技术的装置。起初，在美国开始研发，在IMO上以德国的名义申请了基本认证，2008年10月的MEPC58次会议上获得了基本的认证，在MEPC的61次会议上获得了最终的认证。

2） 以前没有处理方法，所谓的Purate就是指把氯酸钠与过氧化氢的混合物与硫酸反应来产生二氧化氯注入压载水的管路中来实现杀菌的过程。在认证的审查过程中要添加过滤的程序。

2.13.2 技术要求

1）图III-2.13-A为处理装置的整体结构图，表III-2.13-C所示是各型号容量及设置面积。对于所有型号的耗电量都与容量无关，统一为6kW，只在Ballasting过程处理压载水。

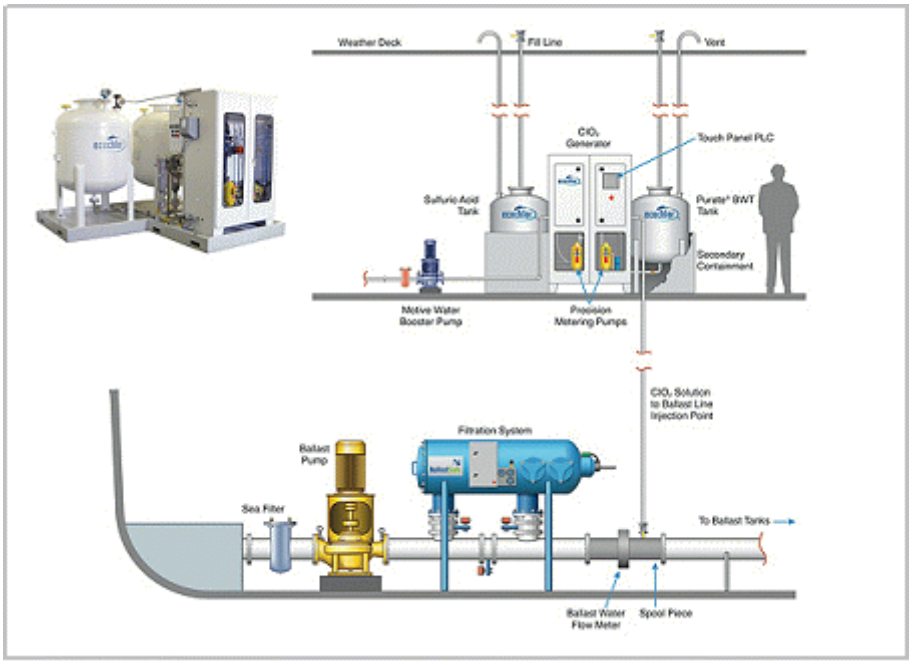


图 III-2.13-A处理装置的设置及流程图

图 III-2.13-B 二氧化氯活性物质反应器的照片

MODEL	CAPACITY (m³/hr)	TANK SIZE (Liters)	FOOTPRINT m²		MOTIVE WATER (L/min.)[b]
			Prefiltration	Treatment[a]	
250 ST	250	500	0.4	4.5	20
400 ST	400	500	0.5	4.5	30
800 LT	800	1,500	1.0	7.4	40
1600 LT	1,600	1,500	2.4	7.4	45
2400 LT	2,400	1,500	3.2	7.4	50
2400 VLT	2,400	2,500	3.2	10.0	50
3400 VLT	3,400	2,500	5.0	10.0	75
4600 ELT	4,600	5,000	7.6	16.0	100

Power requirements for all systems: 6 kW
[a] Installed in any convenient ship location. [b] During ballasting only.

图 III-2.13-C 各类型的容量及设置面积

2.14 BalPure(德国/ MEPC 61次会议（最终的认证）)

2.14.1 一般事项

1）BalPure是德国 Severn Trent De Nora公司的处理装置由过滤器，电解装置及中和装置构成。

2.14.2 技术要求

1）压载水在注水时，海水的一部分通过电解可以获得高浓度的次氯酸，该次氯酸与压载舱中生物混合后可以杀灭生物。次氯酸和海水被注入压载舱的同时氢气的浓度降低。电解的过程中，海水中的溴变成了次溴酸盐及次溴酸。

2）经历这样的过程后，船上的压载水一部分被处理，其余的压载水根据掺杂的生物杀灭基准进行适当的处理。船舶压载水排出时，要使用中和装置，从中和装置排出后，船上的压载水中的氯成份的浓度相对较高时，船舶的压载水中要添加适量浓度的亚硫酸钠中和后再排出。

图 III-2.14-A BalPure处理装置的产品

3）图III-2.14-A 所示为BalPure系统的概要及产品。图III-2.14-B为船舶压载水摄入水时的处理过程。图III-2.14-C所示为排出时的处理过程。

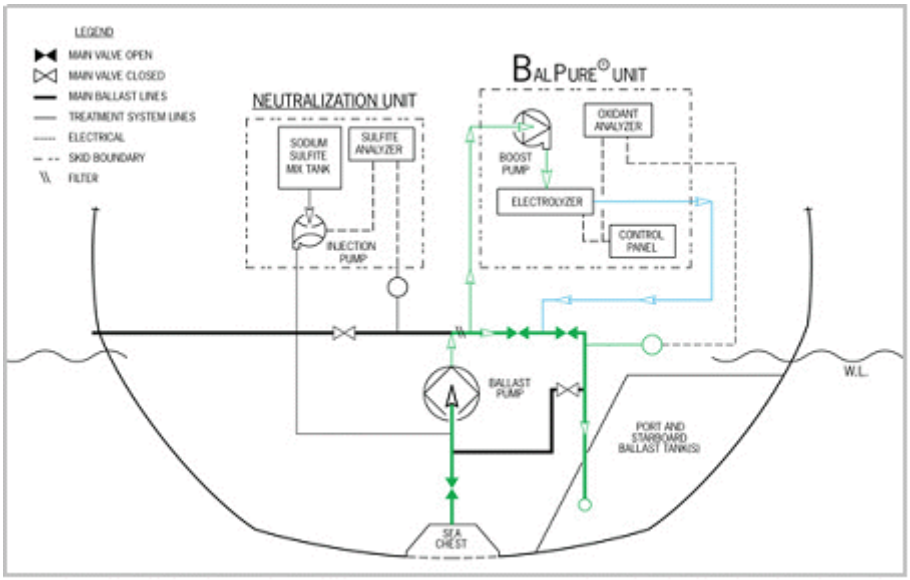


图 III-2.14-B BalPure处理装置的 Ballasting过程

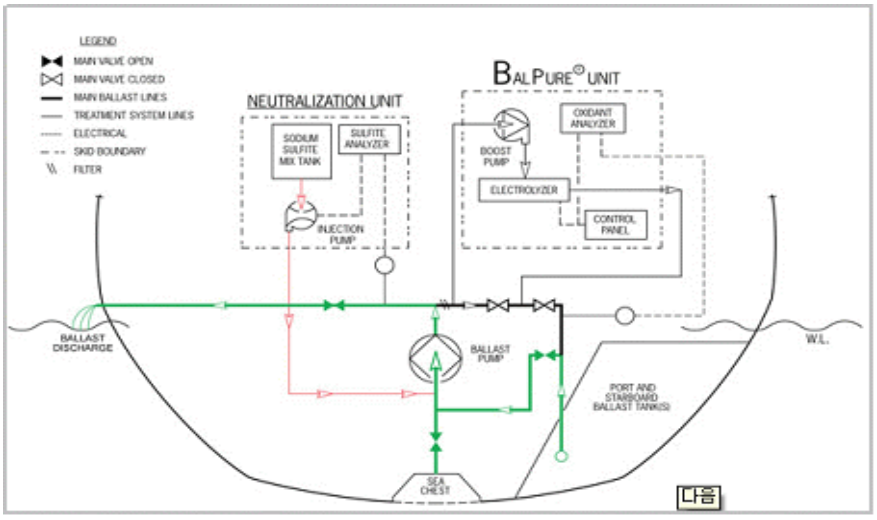


图 III-2.14-C BalPure处理装置的 De-ballasting处理过程

表 III-2.14-D各类型的容量，耗电量及大小

MODEL	SEAWATER TO BE TREATED (m^3/h)	FLOW TO GENERATOR (m^3/h)	REQUIRED POWER (AC KVA)	REQUIRED POWER (AC KW)	AMPS (DC)	VOLTS (DC)	FOOTPRINT (m^2)		PRESSURE DROP (BAR)	BISULFITE PER HOUR OF DEBALLAST (Liters)
							System	Filter		
BP-500	250 - 750	6	64	41	500	60	9.6	1.2	0.5	3.9
BP-1000	751 - 1150	12	113	73	600	90	9.6	1.7	0.5	7.7
BP-1500	1150 - 1550	18	163	104	675	120	9.6	2.7	0.5	11.5
BP-2000	1551 - 2500	24	294	189	1200	120	12.6	3.2	0.5	15.4
BP-3000	2501 - 3500	24	360	231	1200	150	13.2	5.7	0.5	23.1
BP-4000	3501 - 4500	32	429	275	1800	120	13.2	6.4	1	30.8
BP-5000	4501 - 5800	40	534	343	1800	150	13.2	9.4	1	38.5

2.15 OceanGuard （挪威/ MEPC 61次会议（最终认证））

2.15.1 一般事项

1）上面所提到的处理装置在MEPC 60次会议上获得了基本的认证，在MEPC61次会议上获得了产品的最终认证。

2）上述装置是中国Headway Technology公司与哈尔滨工业大学一起合作开发的。

2.16.2 技术要求

1）上述装置使用了 AOP(Advanced Oxidation Process)高级氧化技术，该技术把电解及超声波兼用，大大地提高了对微生物和细菌的杀灭能力。

2）海水电解会产生大量的氢氧根，氢化氢化物酶，HCO,过氧根，过氧化氢，臭氧，次氯

酸等多样化的离子，这些离子可保持高电位差，具有能与所有的有机物快速反应的特性。离子与水草中存在的数亿分之一秒的瞬间产生的不稳定物质通过离子交换可以对生物实现瞬间的杀菌。另外，通过所生成的次氯酸，可以持续杀灭压载舱中的生物。

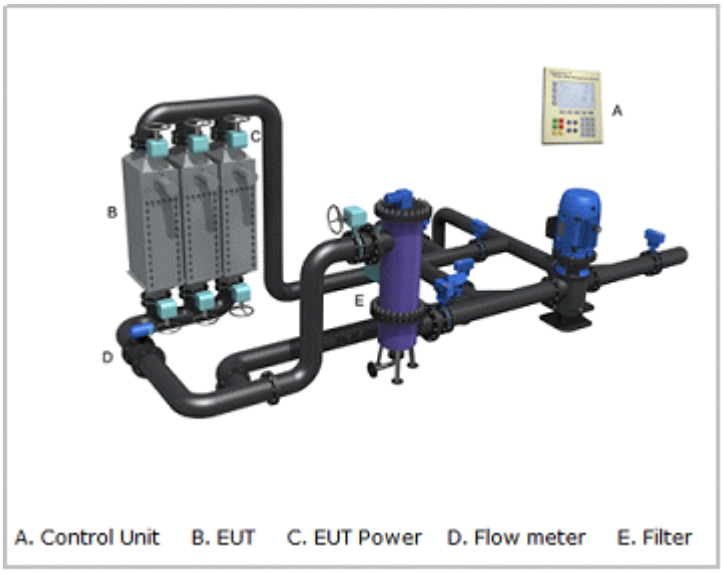


图 III-2.16-A 海洋卫士等距视图

3）是超声波发出的高频波的冲击可以杀灭剩余的微生物及细菌。图III-2.16-A是该装置的实际管路配置图，各构件的说明如下。另外各类别的处理容量及电力消耗量请参照表III-2.16-E.

2.16.3 系统的构成

1）控制单元： 控制单元石油多种传感器信号的检测及警报信号还有自动控制系统来全面的管理的。管理着系统的启动及关闭。另外，控制系统是由各种传感器来实时记录状态并且包含根据作业状态的运行条件变化来监视并记录。（请参照图 III-2.16-B）

2）过滤器：自动反冲过滤器的规格尺寸为50㎛，50㎛以上的固体物质，沉淀物及大于该尺寸的浮游动物在过滤器中筛除。请参照图 III-2.16-C

3）EUT：该处理装置中最核心的技术是由电解装置及超声波装置构成的，依靠各种氢离子使得微生物及细菌杀灭，同时由于超声波具有冲击性使得杀菌效果大大增加。（请参照图 III-2.16-D）

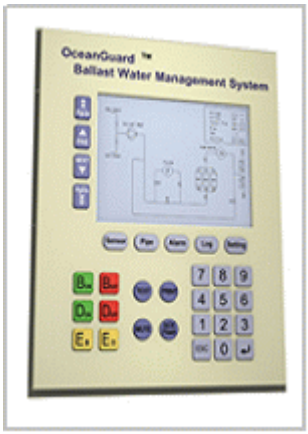


图 III-2.16-B 控制单元　图 III-2.16-C 过滤器　图 III-2.16-D EUT 装置

Model	Capacity Range (m^3/h)	Rated Capacity (m^3/h)	Power (kW)	Dimension (mm x mm x mm)	Weight (Kg)
HMT-100	50-120	100	1.5	455 x 300 x 950	150
HMT-200	120-250	200	2.5	612 x 391 x 1333	300
HMT-300	250-350	300	3.5	612 x 391 x 1655	400
HMT-600	350-750	600	7	698 x 406 x 1797	450
HMT-1000	650-1105	1000	12	636 x 496 x 1890	500
HMT-1500	1250-1650	1500	18	801 x 610 x1952	600
...	...	...	...	...	...
HMT-3000	2550-3250	3000	36	1350 x 810 x1952	1300
...	...	...	...	...	...
HMT-6000	5250-6350	6000	72	2400 x 810 x1952	2600
...	...	...	...	...	...
HMT-9000	8250-9350	9000	108	3750 x 810 x1952	3900

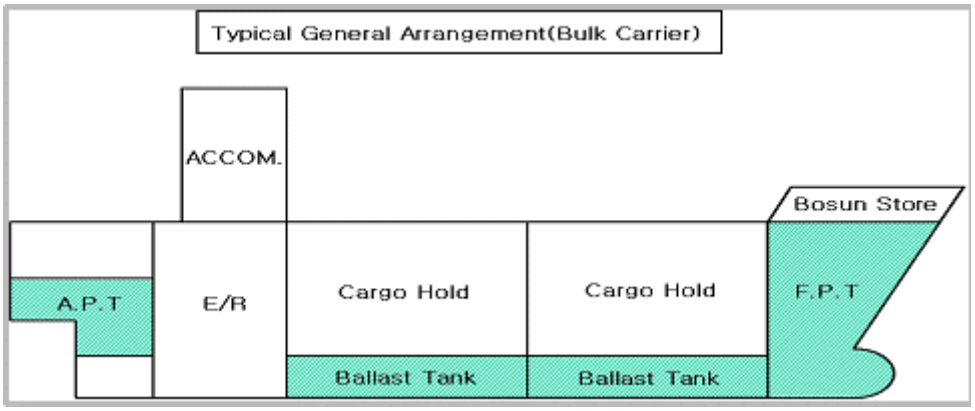
表 III-2.16-E各类型的处理容量，大小及耗电量的比较

第四章 压载水处理系统在船舶中的应用

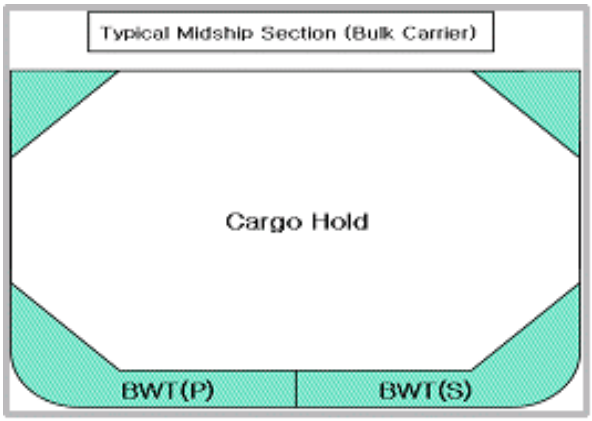
1. 油船以外的船舶

1. 一般事项

图IV-1-A呈现的是典型的散装货船或一般货船的总布置图，而图IV-1-B所呈现的却是典型的散装货船的舯横剖面图。正如下面的船舶的总布置图和舯横剖面图所示，压载水舱一般设在船体货舱周围的双重船壳或双重船底的空间里，以及船艏F.P.T及船艉A.P.T的尖舱处等。像一般货船、集装箱船等种类的船舶要配置与散装船结构类似的压载水舱，而Ro-Ro车辆船，客船，拖船，驳船等特殊功能的船舶为了调节吃水，要另设其他型式的压载水舱。



图IV-1-A散装货船总布置图



图IV-1-A散装货船舯横剖面图

一般来说压载水舱的注排水，是根据船舶的运行目的来决定轮机舱内要配置舱底消防总用泵还是消防压载泵。但是，散装货船和集装箱船等大型船舶除了要配备舱底消防总用泵和消防压载泵外，为了能迅速注排水还要在轮机舱内配备两台以上专用的压载泵。

2.相关的规范

2.1 KR 钢船建造规范 第 5 篇 第 6 章 402.2（2）

所有的压载水舱至少要联接两台提供动力驱动的压载泵。其中一台用于实现主机舱的驱动。当船舭，卫生水，杂用水泵妥善连接时，该泵可视为是独立的动力压载泵。但若在顶边舱上用重力排水的话，在跟干舷甲板很容易接近的地方可以使用装有可操作气闭指针的螺丝截止阀。另外，油船上为了能向紧急货油泵中吸入压载水，货油泵也视为是一台独立动力的压载泵。

2.2 KR 钢船建造规范 第5篇 第6章 406.7

2.2.1 为了防止海水意外进入压载水舱或压载水从一个压载海水舱进入另一个压载水舱，在注水排水以外的时间，为使压载水舱能经常保持关闭状态，需要配备具有开关标识的止回阀或者截止阀等适当的设备。在使用蝶阀（不包括远程控制阀）时，为防止由于振动或液体流动而引起的阀盘晃动，需要配备压紧装置或采取其他类似的措施。

2.2.2 设有远程控制阀的情况，由于控制而使动力源丧失时，要保证阀门可关闭或者一直保持在关闭状态。大体来说，动力丧失的时候，为封锁阀门，应采用易接近的手动方式。远程控制阀应该停留在动力源丧失的位置。使用远程控制阀的舱类别要分明，并且在控制压载水的场所应设置开关指示装置。

2.3 KR钢船建造规范 应用说明 第5篇 第6章 406.1.（2）

在专用的压载水舱内需配置海底门（sea chest），在实行自然注排水的情况下，要设置两层截止阀以便在干舷甲板上就可以实现操作。

2.4 浮动式海上结构物的规范 10章104.7

2.4.1 海上钻井的压载抽水装置应符合下列要求：

1）压载抽水装置需设置2组以上，其中一组装置即便不能使用，其中所有区域的压载水也要没有任何问题并保证装置可以实现排水。

2）压载抽水装置要具有在3小时内从水平状态正常最深的吃水线处到最大载重吃水线处或具有能使更高的结构物（我社指定的）上浮的能力。（请参见KR钢船建造规范浮动式海上构造物的规范10章104.7 2）内容）

3）在压载舱中央控制处，需设置可实现压载泵及相关阀远程控制的设施。

3.危险区域

3.1 一般货船，散装货船，集装箱船

在装载IMSBC Code 及 IMDG Code 中所定义的具有易燃性危险货物（SOLAS Reg. Ⅱ-2/19规范）时，根据IEC 60092-506 要求，装载危险品的货舱及相关的通风管都被指定为危险区域。如果是与Class 2.1.3(闪点≤23° C)，6.1（闪点≤23° C）8中相符的货物或散装形态下装载Class4.3的情形，通风口3米以内的区域被划分为危险区域。

3.2 Ro-Ro船，汽车搬运船

密闭的RO-RO区域或密闭的汽车区域都被划分为危险区域。即便密闭区域每小时可以实现机械通风10次，浮桥上也设置了通风能力丧失的警报装置，从各平台到甲板上450mm以下的区域仍要被划分为危险区域。在450mm以上高度设置的情况，为了防止火花喷溅要采用加封保护形式（IP55以上），并且允许设置表面温度不超过200° C的电气设备。

3.3 特殊分类区域

根据3.2行要求中所添加的特殊区域，即舱壁甲板下面的所有区域都被划分为与通风次数无关的危险区域。

3.4 货物区域外的危险区域

大部分船舶上所设置的蓄电池储藏室，调和漆储藏室，乙炔气储藏室等都被划分为危险区域。

3.5 危险区域内压载水处理系统(BWTS)的设置

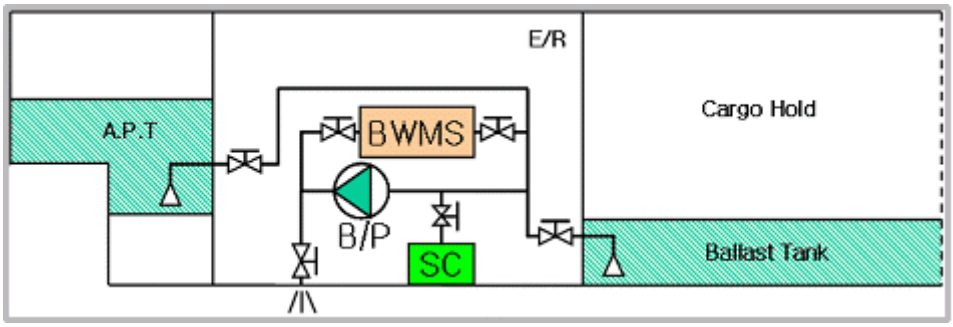
在上面3.1-3.4中所提及的危险场所中应避免设置与BWTS相关的电气设施。若不可避免的话，至少要设置适当防爆等级的防爆型电气设施。但是，若要在满足通风要求的密闭RO-RO区域或汽车区域内安装BWTS电气的话，除 IIB T3等级以上的防爆型外，若在平台上超过450mm的高度设置的话，必须保证是满足IP55以上，表面温度不超过200° C的电气设备。

3.6 与船舶种类及个别货物种类的防爆等级以及电气设备的保护形式相关的内容，请参见附录 A。

4. BWTS的设置

4.1 在机舱内部设置的情形

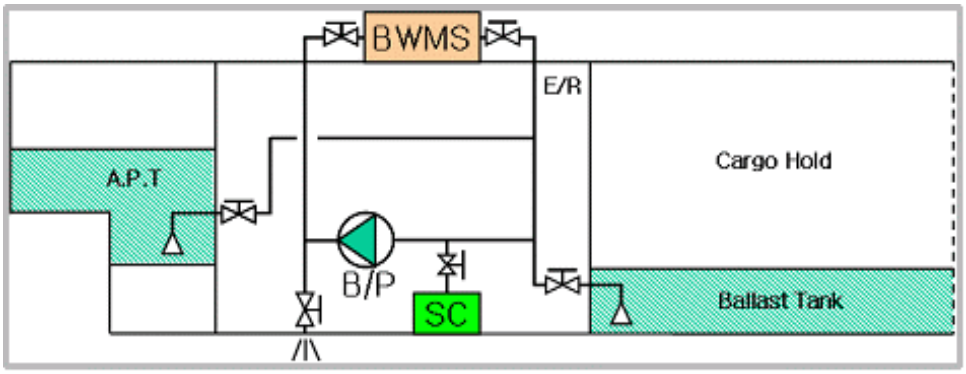
图IV－1－C是在机舱内部设置BWTS的简略图。由于除油船以外的大部分船的压载水舱被划分为安全区域，BWTS设在机舱内可使压载水处理处不存在任何问题。但是，为了处理压载水，在产生臭氧的设备处应该安装臭氧感应器以便臭氧放出时发出警报。或者，在臭氧的排管中使用双层管或完全焊接管SUS Pipe等特殊的导出措施。若在BWTS处理后，有氢气等危险气体产生，要以危险气体不在机舱内放出的原则来设置，有害气体应由机舱外的安全场所引出。



图IV－1－C机舱内部设置BWTS的简略图

4.2 在机舱外设置的情形

为了在机舱内设置BWTS所需装置，依照各种装置的类型，使用最小的设置空间。但如果有机舱空间狭小，或者配管比较困难等原因的话，在机舱外配置BWTS的情况也存在。按各厂商分类的BWTS的最小设置空间请参见附录E和F。下面的图IV－1－D就是在机舱外设置BWTS的简略图。



图IV－1－D 机舱外设置BWTS的简略图

若在甲板上面的机舱外部设置BWTS，还要考虑下列事项。

4.2.1 若在与甲板上部等高度的位置设置BWTS，压载管可以引到甲板的上面处理压载水，这时要考虑压载泵的水头（或称扬程）的减少，还有压载水从高处流向低处的时候，所产生的过多的增空压力，为了采取适当措施来保护管道，需要安装合适的防止该情况发生的真空阀装置。

4.2.2 在设置BWTS时，应尽可能的设置在上面3.1－3.4中所提到的危险区域外。如果不得已必须考虑设置在汽车区域，RO－RO货物区域，或者货物舱等危险区域内时，根据3.5－3.6的要求要特别考虑电气装置的防爆类型。此外，由于是在容易受到物理性冲击的场所内设置， 其他的保护措施也很必要。

4.2.3 在处理压载水产生臭氧的设备所在处应该安装臭氧感应器以便臭氧放出时发出警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊设施。

4.2.4 在处理BWTS后，若使用的是会产生氢气等危险气体的类型，若流出的危险气体储存在密闭区域内的话，危险气体排出管应该引向外面的安全场所。

4.2.5 在露天甲板上个别的密闭区域上设置BWTS时，个别的密闭区域有可能造成船舶总吨数的增加。尤其是当船舶总吨数变化时，也会造成船舶设备的明显变化，总吨数如果有变化的话，需要跟总部的基本技术部协商。（例：500吨，1，000吨，2，000吨，10，000吨等）

4.2.6 如果在露天甲板上设置BWTS的话，在选择设备时要考虑选择适当的IP等级，并且为防止货物受到物理性的损伤，应设置在受保护的区域内。

4.3 管及电缆的穿透处采取的措施

设置BWTS中使用穿过舱壁及甲板的管或电缆时，穿透处的舱壁和甲板要使用统一的防火构造及水密构造来建造。特别是电缆和管穿过安全区域与危险区域之间的舱壁时，一定要满足气密构造的要求。下面Ⅳ－1－E和Ⅳ－1－F所示为全船穿透处的细节图例。关于穿透处的详细内容请参见我船级规范第8篇附录8－2节中“穿透处的划分”。

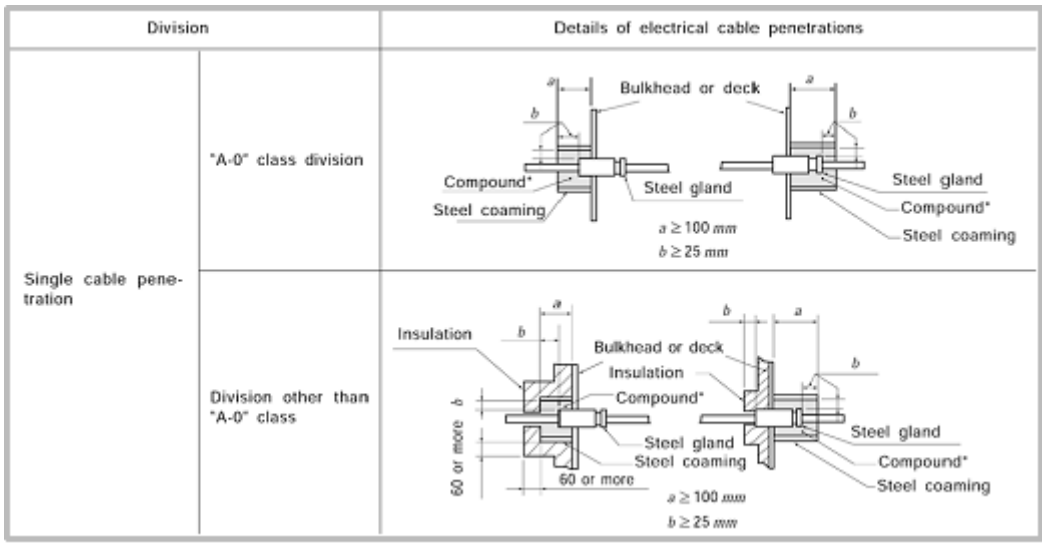


图 IV－1－E Example of Single Cable Penetration Parts

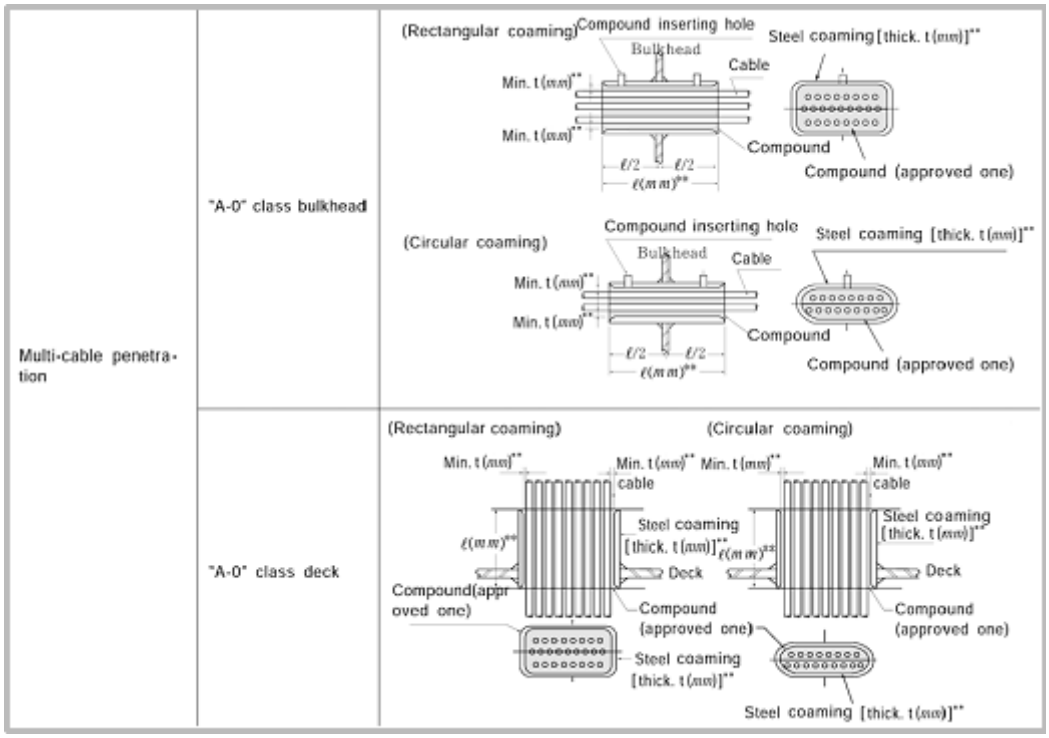


图 IV－1－F Example of Cables' Penetration Parts

5. 特殊事项

5.1 By-pass的警报及记录

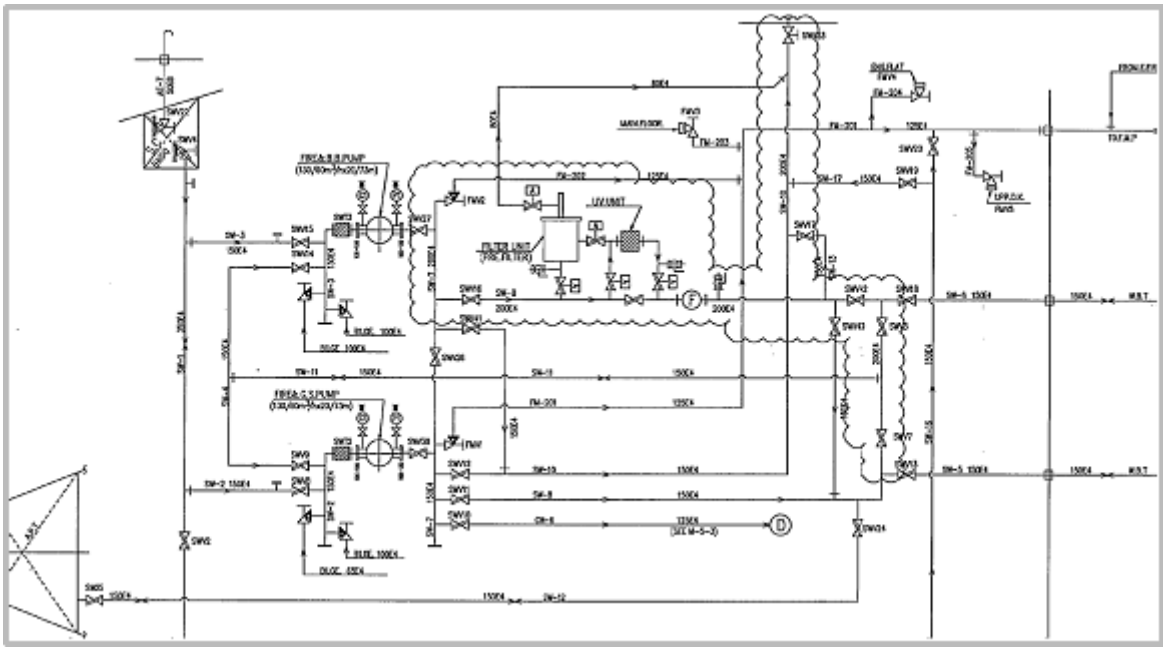
在国际压载水管理公约中规定的WM的旁通功能（bypass），在发出警报时都要记录在控制设备中。”使用bypass的BWTS，为了能使未处理的压载水向压载舱内注入或从中排除，就要使bypass能自动接受可视可听警报后并能记录在控制装置中。旁通功能和相关的所有阀门要变为远程控制阀，另外，每个阀要设开关指示装置，并且在BWTS的控制设备中有能可以自动探测警报的bypass构成。

5.1.1 设置场所狭窄

大部分的船舶都设有2台以上的压载水泵，而且一般是通过泵的出口侧的两个主排水管向压载水舱内注水或由压载水舱向外排水。如果是小型船的话，可能由于安设处窄小等原因只在压载泵的出口处设置一个主排水管，这样的话在设计时要考虑下列事项。下图IV-1-G即为在BWTS上只设置一个主排水管的船舶。

1） 拆除不通过BWTS来注水和排水的所有管或者可能实现旁通的所有阀，该系统由可自动发出可视可听的警报构成，另外，在控制装置中要能记录。

2） 大部分使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超设计流速的速度通过BWTS时，一般来说，配管要按约为2~3m/s的速度来设计。



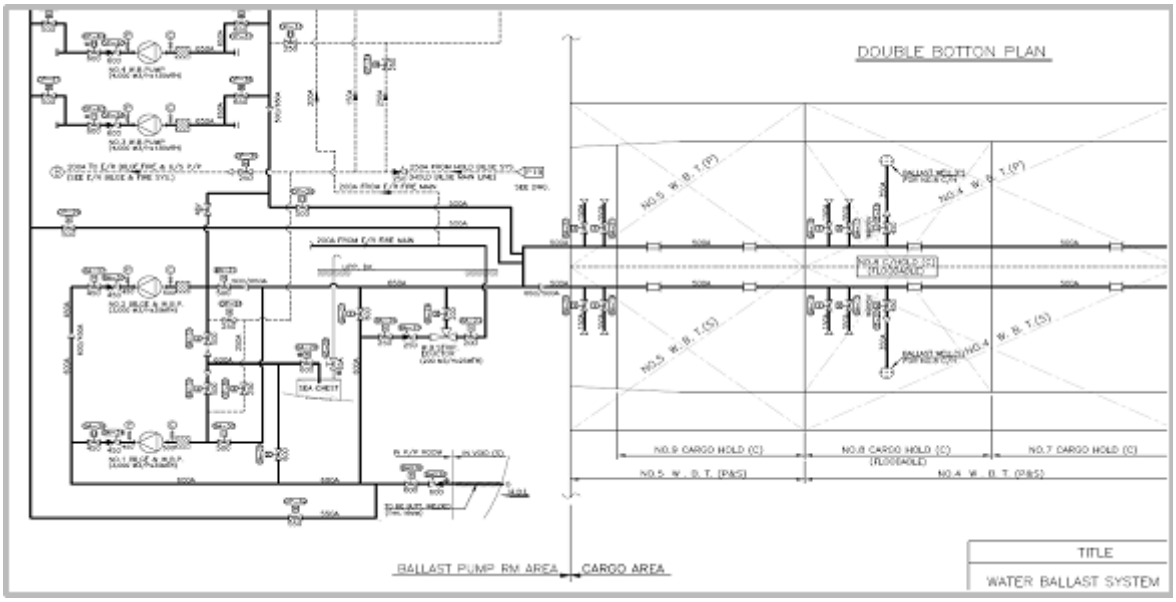
图IV-1-G 在BWTS上只设置一个主排水管的船舶。

5.1.2 BWTS的初期运转

初期，加压载及减压载时，在一定的时间内，要求bypass及再循环型式的BWTS，在设计时，与压载水的注水和排水所涉及到的阀可以自动联锁使得未经处理的压载水无法注入或排出。若有类似的情况，请参考型式认可的条件及型式认可图纸上的明确记载。特别是现有船若设有具有该特性的BWTS的装置的话，要确认所配置的自动控制阀及联锁阀的型式是否符合要求，使用液压驱动阀来操作的，还要考虑液压动力源的（Hyd. Power Pack）用量是否充分。另外，该船配有的BWTS作业说明书中一定要包括初期作业过程的说明。

5.1.3 压载卸载用喷射泵

具有大容积的压载舱的散货船等类似的船舶为了压载舱内的卸载（抽水），配备专用喷射泵的情况很多。采用这种配置的船舶，选择排水时压载水能另做处理的BWTS类型，设计时就要使卸载用(stripping)管中排出的所有压载水可用BWTS来处理。或者拆除所有不经过BWTS的注水和排水管，或者，在卸载管上安装的阀要有可识别警报的系统构成，并且该警报要记录在控制装置里。下面图V－1－H呈现的是装有卸载用喷水泵的压载管装置图例。



图IV－1－H 装有卸载用喷水泵的压载管装置图

5.1.4 现有船舶中的应用

大部分的现有船舶都配有2台以上的压载泵，通过泵出口侧的两个主排水管可以实现压载水的注入和排出。但是，在现有船舶中，如果是新设置的情况，设置空间狭窄或者管道改造等很复杂原因可能会导致在压载泵的出口侧只设置了一个主排水管的情形，设计时则须考虑下列的事项。

1） 不通过BWTS来注水和排水的管都拆除，另外管上附着的与bypass有关的所有阀系统请按照上文5.1中的要求执行。

2） 大部分使用2台泵，一台用于压载水的注水，另一台则是为了向主排水管中运送压载水。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或超设计流速的速度通过BWTS的情行。

5.2 重力注水和排水

像超大型的散装货船，压载舱内部配有海底门，通过重力来实现注水和排水，这时要在海底门上配置双重的截止阀，并且要求在干舷甲板上可以实现操作。下面IV－1－I及IV－1－J所示为通过重力来实现注排水的船舶的例子。

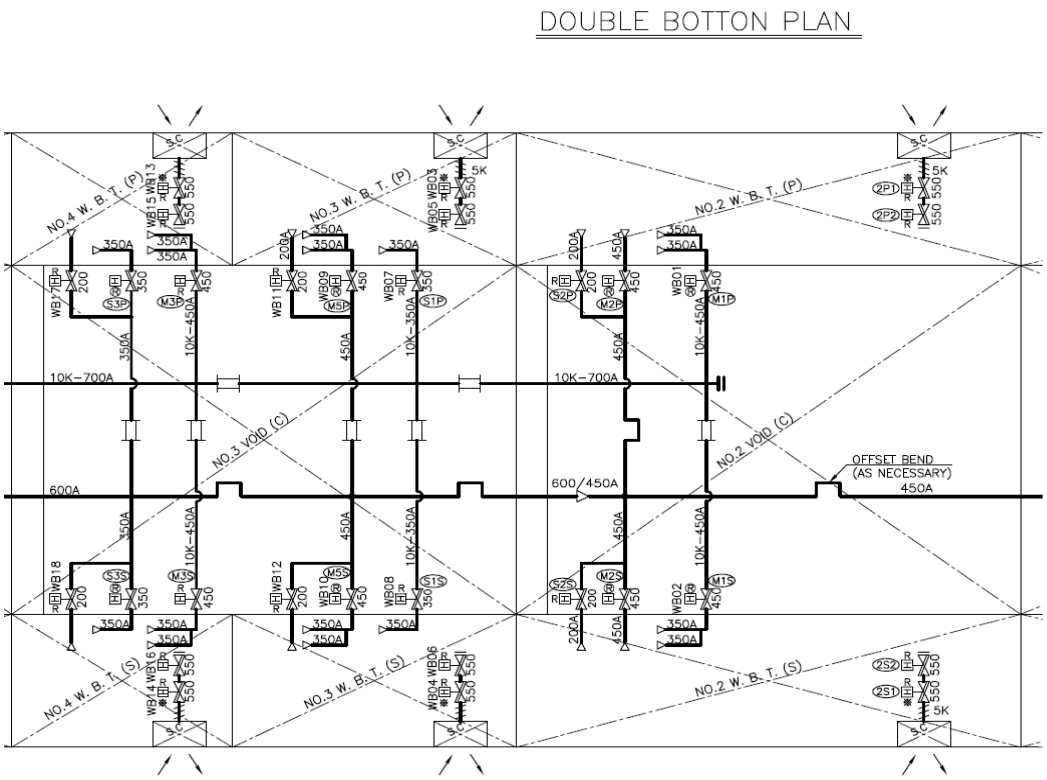
5.2.1 只在注水时使用的处理方式

1）在设有只能处理向压载舱中注水问题的BWTS的船舶上，压载水注水时，安装有海底门的铜阀一定要关闭。另外，若该阀门是可以实现bypass功能的阀的话，一定要满足上文5.1中的要求。

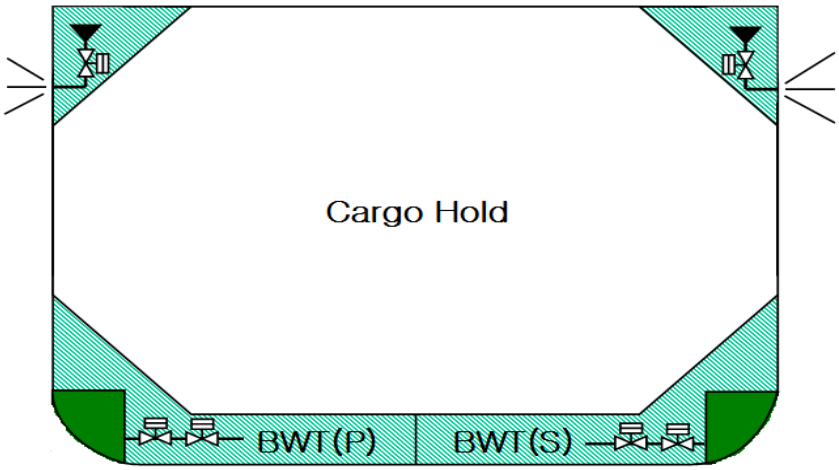
2）可以通过重力来排水。

5.2.2 排水时其他的处理方式

设有其他的压载水处理方式BWTS的船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果是具有bypass功能的话，要满足上文中5.1的要求。



图IV－1－F 用重力来实现压载水的注排水



图IV－1－J用重力来实现压载水的注排水

5.3 重力排水

5.3.1只处理注水的方式

1）与散装货船的顶边舱类似，通过重力从压载水舱内排水的船舶，在设有只处理压载水的BWTS的船舶上，压载水的排水也是通过重力来实现的。

2）注水时，无论什么情况，压载舱内未处理的海水都不得进入。并且，重力排水用的排水管上配备的阀门是止回阀（check valve）。但如果设有可以用于bypass的截止阀(stop valve)的话，要满足前文5.1的要求。

5.3.2 排水时其他的处理方式

1）设有其他压载水处理方式的BWTS船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

2）特别是为了满足有关现有船舶压载水管理公约D1（压载水交换方法）的要求而设置的交换压载水，如果使用溢出管（overflow）的话，请考虑上述要求。

5.4 紧急时用压载水舱作为货物舱

散货船等类似的船舶吃水调节及天气十分恶劣时，为了维持船舶适当的稳性，如果要在货舱内设置可以注入压载水的管装置，这种船舶需要考虑下列事项。

5.4.1 设有其他压载水处理方式的BWTS船舶，排水时压载水要另做处理。

5.4.2 货物舱内存在很多货物残渣及不纯的物质，这些不纯物质会使BWTS的性能降低，在配置时需要充分考虑这些问题。

5.4.3 设有可向压载舱内注入惰性气体的BWTS船舶，在向货舱内注入惰性气体时，要考虑维持非惰性气体的浓度。

5.5 具有其他使用目的的兼用泵

在把消防泵作为压载水泵来使用的船上,BWTS要采用远程控制。 为了使用消防泵的固有功能，在消防泵的消防主管道入口和出口处配置的阀要可实现远程操作。另外，BWTS和舱底泵兼用的情况，要统一考虑后再设计该系统。

5.6 KR簿记符号（船级符号）UMA以上的等级

我船级社的自动化设备簿记符号UMA（UMA,UMA1,UMA2,UMA3）以上等级的船舶，根据我船级钢船建造规范中第9篇第3章的内容，要求消防泵远程启动。因此，压载水泵和消防泵兼

用的船舶，在配置BWTS时也需考虑以上的事项来设计该系统。

5.7 KR簿记符号（船级符号）UMA1以上的等级

我们船级自动化设备的簿记符号UMA1以上等级的船舶，根据我船级钢船建造规范第9篇第3章的内容，要设置可远程控制压载的系统。因此，在具有UMA1以上等级的船舶上设置BWTS时，与压载水的注排水及BWTS相关的阀要以具有远程控制功能的原则来设计。

5.8 国际航线的客船

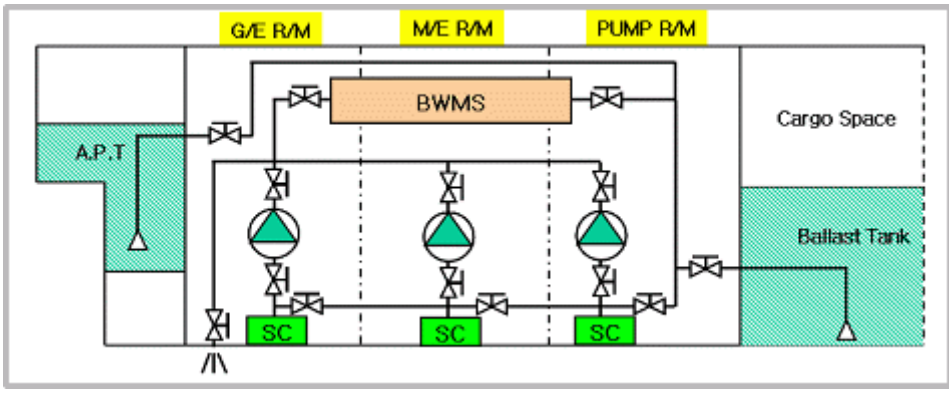
国际航线行驶的客船，机舱被划分为主机舱，辅机舱，泵舱等区域。另外，这种船一般来说，消防泵和舱底泵由可压载的装置构成。该种船要考虑下面的要求，下图IV－1－K即为客船上设置BWTS的例子。

5.8.1 使用压载泵作为消防泵或舱底泵在各个区域分散设置时，首先要考虑BWTS在什么区域设置。另外，BWTS的所有装置都要通过远程来控制时，须参照上文中5.5中的要求。

5.8.2 消防泵与压载泵兼用时，要参照上文中5.5和5.6的要求。另外，自动驱动的消防泵需与压载泵兼用时，该系统同时要由有自动驱动来提供消防水的结构构成。

5.8.3 当舱底泵和压载泵兼用时，请参照上文5.1和5.5的内容。另外，舱底泵及舱底管上配阀的区域浸水等情况， 在设计远程控制阀的远程操作系统时也是该考虑的因素。

5.8.4 在其他的区域设置消防泵以及舱底泵通过额外的海底门来吸入海水的配管型式很多。这种情况下，不通过BWTS来实现压载水的注排水而是所有阀都具有旁通（bypass）功能，那么，这时要设计为可发出警报并能在控制装置上记录的系统。应参照上文5.1中提到的内容。



图IV－1－K客船上设置BWTS

5.9 设有 BWTS 区域的耐火完整性（Fire Integrity）

BWTS及相关的设施设置在甲板舱室居住区域内的情况也是存在的。这种情况要根据SOLAS Reg. Ⅱ-2/3 中关于其他机舱区域和工作区域来定义。与其他区域或工作区域相邻的居住区域的舱壁和甲板要考虑SOLAS.Ⅱ-2/3规则中关于舱壁的耐火完整性要达到A-0以上的要求。

5.10 驳船等大容量压载舱的情况

驳船等具有大容量的压载舱的船舶，在设置BWTS时，要确定BWTS所需要的总的电力使用量。大部分的驳船中都设置了相对容量较小的发电机。因此，在选择BWTS产品时，首先要确认该船的发电机的容量，并且要把电负载分析（ Electric Load Analysis ）材料交给船级社接受审查。

5.11 从单壳油船向散装运输船改造的船舶

近来，由于单壳船体的禁航，很多单壳船都改造为散装运输船。改造前的大部分油船都有货舱泵室并且在此区域内设有专用的海水吸入口及压载水泵。但是，大部分情况是，船艉的货舱泵室内设置的压载泵不予使用，而是通过使用舱底消防总泵和消防压载泵来实现压载水的注水和排水。由单壳油船向散装货船改造时，船上所设置的BWTS应该考虑下列事项。

5.11.1 泵机室内所有设置的压载舱，甚至船尾的压载水要用BWTS来处理，关于这点在BWTS的设置上应该予以考虑。

5.11.2 在泵机室内设置，但由于设置场所的狭小或设置上的一些问题，不通过BWTS的旁通管线（bypass line）也会有很多，这些在设计时也应该予以考虑，这种情况下，需要参照上文5.1的要求。

5.11.4 排水时通过BWTS来处理压载水型的镇流器溶出泵，或者使用喷射泵系统时，在BWTS设置时，要考虑后再设计。这种情况下，需要参照上文中5.1.3的内容。

5.12 压载水舱的改造

现有的船舶按压载水国际管理公约附录A-1,Reg.5的要求改造为新船时请考虑下列事项

-压载水的运输量有15%以上的变化，或者
-船的种类有所改变，或者
-经政府认定，船龄可以继续延长10年以上，或者
-配件的替换，导致BWTS变化的情形

5.13 淡水舱

如果饮用水舱作为压载水舱来使用时，饮用水中所含有的化学物质可以排出，请考虑在国际压载水管理公约中与IMO相关的内容。

5.14 用电量和回路的构成

对用于BWTS设置所增加的用电量进行分析时，针对该船的电气用量是否充分要进行审核，因此，电载荷的分析材料要向我船级社提交后接受审查。另外，对于电气设备的过载和短路，要采取适当的保护。（请参照附录中用电量及回路结构的内容）

5.15 关于电气分解方式的特别考虑

5.15.1 线路电压的下降

1）使用电气分解式的BWTS时，通过使用整流器来把440V的交流电（或220V）变为36V以下的直流电，从而实现压载水处理装置的电供给，并且这时会有很大的电流流经供给线路中。

2）因此，由于输送电的距离长会使电压下降，为了能使处理设备正常启动，应该把电缆设置成小于制造商所限定的长度。

5.15.2使用导电条（母线）构成的线路

1）电气分解时，由于输送较大的电流，当处理设备容量很大的时候，电缆的尺寸和售价都会有相当大的增加。由于这个原因，为了使设备小型化，就有了由导电条（母线）构成的线路。导电条（母线）要选择我船级社型式认可的产品，并且一定要在后备箱内配置等级号在IP54以上的该产品。

2）导电条（母线）尽可能避开在危险区域或露天甲板上设置，万一设置在了危险区域的话，一定要使用防爆型，特别是在从安全区域到危险区域的穿透处设置时， 还要满足关于舱壁穿透处的防火构造和气密构造的要求。另外，关于船内及舱壁穿透处的设置，一定要使用我船级社认可的方式。

5.16 BWTS的控制，监视及警报

在国际压载水管理公约指南8的第4节中，有关于BWTS的控制装置，监视及警报装置要求的规定。

5.16.1 控制，监视及警报装置

1）BWTS处理时所需的投入量及强度可以自动控制。控制装置在运行过程中要一直具备自我监视的性能，并且运行时必须要能自动监视和调节。

2）监视系统是否出现故障或者不运行情况，如果发生而妨碍正常运行的话，要求在所有的作业区域内能收到可视可听的警报。

5.16.2 运转及控制

1） BWTS的运转及控制方面，单纯从效果上来看，要做到在远程控制场所内容易实现控制。但这里面所说的不是与BWTS有关的所有阀自动化的意思，不包括导致处理装置不运转的阀，是指手动控制阀可以很容易的控制的意思。在这种情况下，BWTS运行时，对于使用手动阀来注水和排水的过程相关的指南及相关管装置的图纸，最好在所有的控制场所内贴示出来。

2）配有我船级社簿记符号，UMA1级以上的船舶，BWTS运转时， 相关的所有阀的操作及压载泵的驱动控制场所中都要有远程控制。

5.16.3 旁通功能（bypass）及覆盖（override）

1）在设有BWTS的船舶上，紧急时期，为了保护船及船员的安全，要设置bypass 和override装置。另外，在旁通(bypass)时，控制和监视设备中可以自动接收到可视可听的警报，并且能记录在控制装置上。

2） 现有的船舶中，大部分在一侧设置压载线，对于剩余的压载线任意使用的情况，要追加可以实现监视功能的设计。与此相关的厂商在审图时要考虑所有与船舶的压载相关的设施。所有的旁通情况（bypass）的目录都要提交并接受审查。

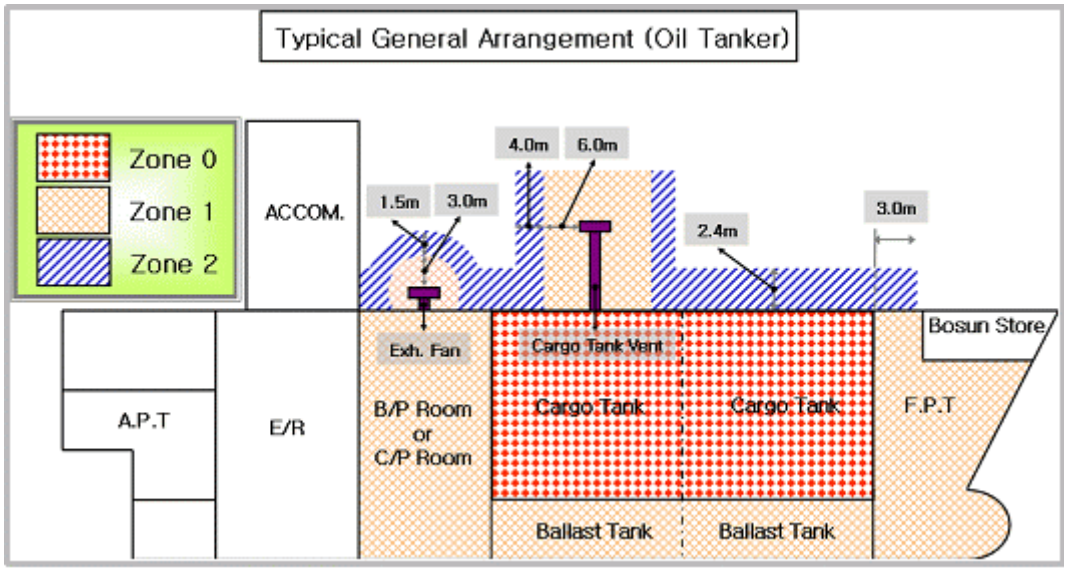
2.油船

1.一般事项

图 IV-2-A~IV-2-C 呈现的是一般油船的总布置图的例子，而图 IV-2-D 呈现的是油船舯横剖面图的例子。

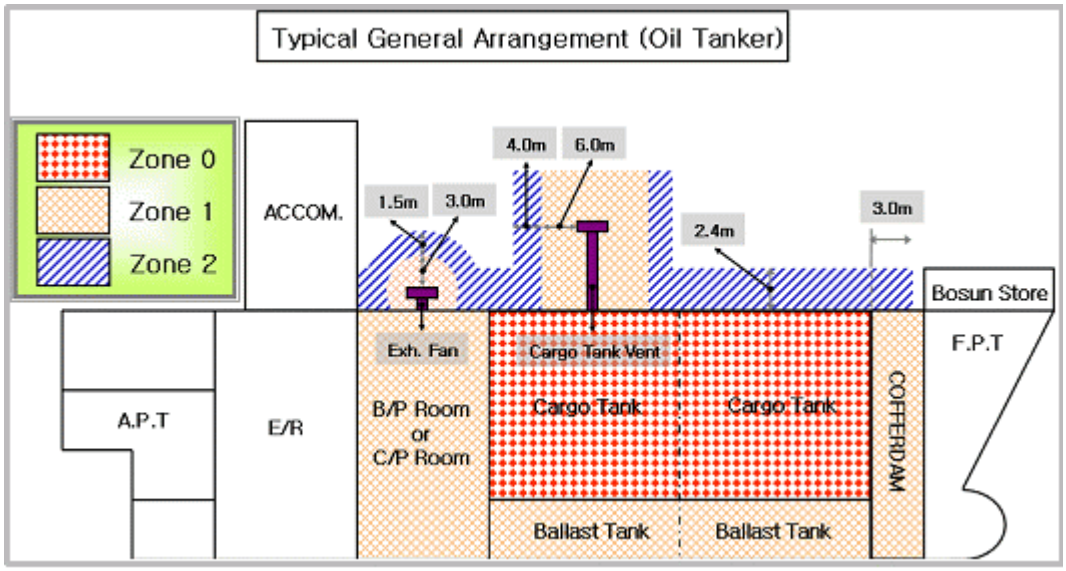
1.1 IV-2-A呈现的是具有货泵舱及压载泵舱，并且货舱与船艏相相邻的油船的总布置图。

大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相相邻的压载舱就被划分为危险区域。因此，压载舱的注排水可以依靠泵舱内的压载泵来进行。除此之外，大型的油船一般还设置喷射泵(eductor)和扫油泵（stripping pump）。但是，大部分船艉的注排水还是通过使用船机舱内的消防压载泵和舱底消防总用泵来进行的。

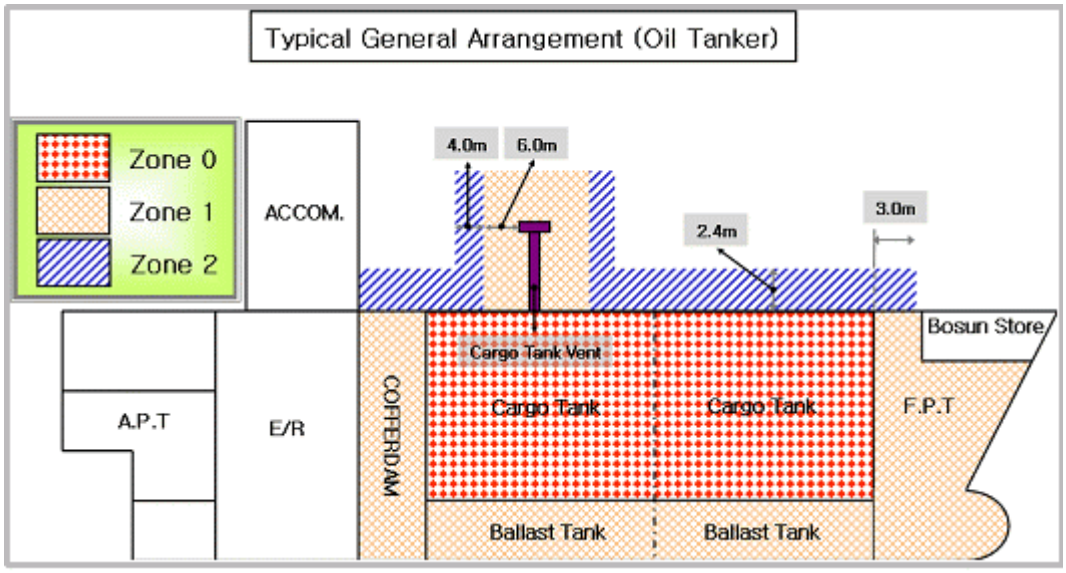


IV-2-A一般油船的总布置图

1.2 图IV－2－B呈现的是具有货泵舱或压载泵舱，船舶艏尖舱通过防撞舱壁（cofferdam），燃油舱或淡水舱等结构，无法与货舱相邻的油船的总布置图。大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相相邻的压载舱被划分为危险区域。 除此之外，大型的油船一般还设置喷射泵(eductor)和扫油泵（stripping pump）。不过，大部分船艉的注排水还是通过使用船机舱内的消防压载泵和舱底消防总用泵来进行的。另外，还有为替代船艏注水所用的泵舱内所设置的压载泵而设置的消防压载泵和舱底消防总用泵的情行，而排水则是通过泵舱内所设置的压载泵来进行的。

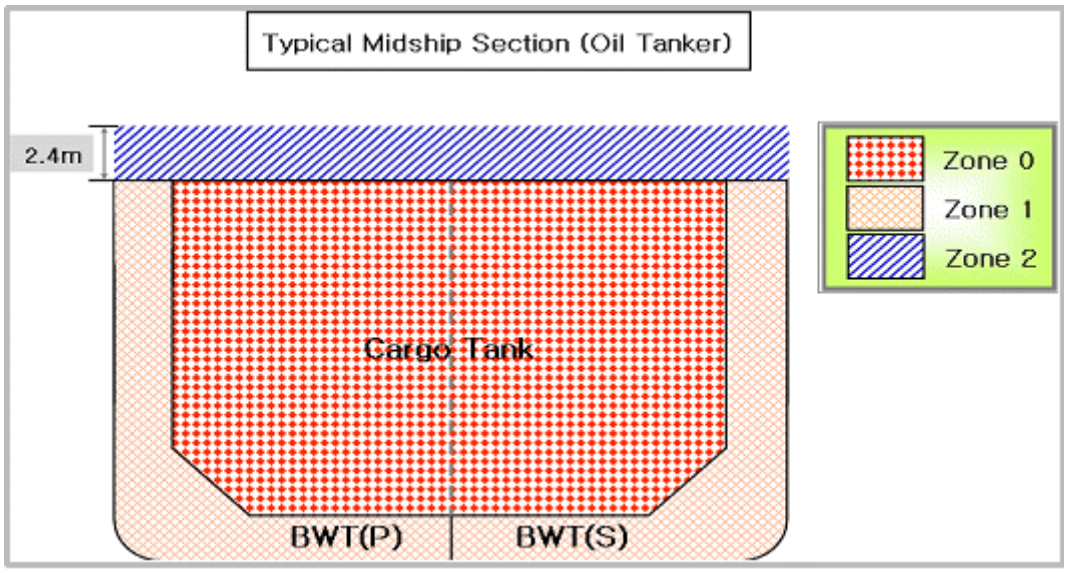


IV-2-B般油船的总布置图



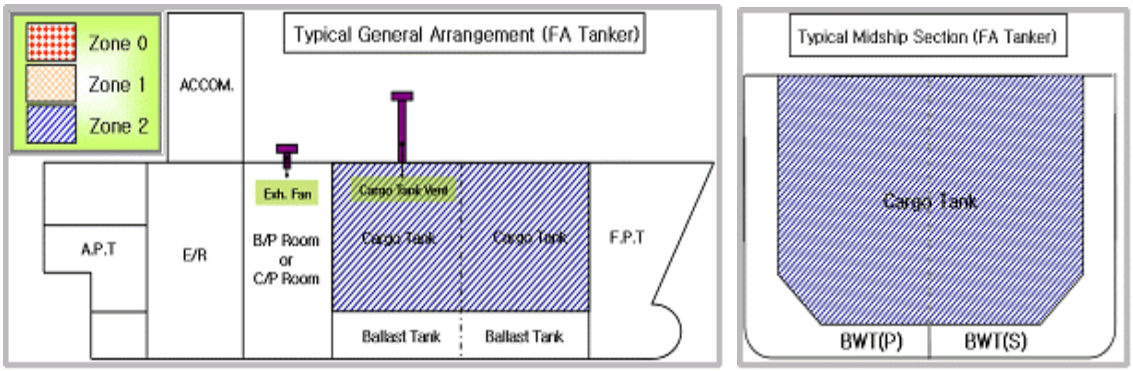
IV-2-C油船的总布置图

1.3 图IV-2-C呈现的是没有货舱或压载舱的油船的总布置图的例子。大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相相邻的压载舱就被划分为危险区域。没有泵舱的油船的压载泵及海水吸入口要设置在压载舱内，一般使用潜水泵，并且压载管上配置的阀要由远程操作来控制。因此，各压载水舱的注排水一般通过设置在舱内的潜水型压载泵来实现。 不过，大部分船艉的注排水还是通过使用船轮机舱内的消防压载泵和舱底消防总用泵来进行的。另外，还有在为替代船艏注水所使用的泵舱内的潜水型压载泵而设置的消防压载泵和舱底消防总用泵， 排水需通过潜水泵来进行。



IV-2-D油船的舯横剖面图

1.4 图IV－2－E所示为只运送闪点超过60°C的货物的油船（FA Tanker）的总布置图及舯横剖面图的例子。这种情况，大部分的压载舱在货舱周围设置了L型或U型的双壳结构，根据IEC60092－502 Reg. 4.3的规定，除了装有可加热到闪点的15°C以内的货物的情况外，其他相邻的压载舱均可做为安全区域考虑。各压载舱的注排水通过使用船机舱内的消防压载泵和舱底消防总用泵来实现。



图IV－2－E FA油船的总装配图和舯横剖面图

2.相关的规范

2.1 KR钢船建造规范第7篇第1章 1003.2

与货油舱相相邻的压载舱要符合下列的要求。

2.1.1 这则规范对于与货油舱前后的防撞舱壁（cofferdam)兼用的压载舱也适用。

2.1.2 与货油舱连接的压载舱的压载水管跟其他管要分开配置，并且不能引入。因此，机舱以外的泵舱内压载水的注排水或排水泵设置时要根据一定的原则来设置。但是，如果为我船级社特别认定的情况下，为了紧急时压载水的吸入而要设置货油泵，根据我社的其他规定，可把货油舱不相邻的气体安全区域看作是压载舱。

2.1.3 在跟货油舱相邻的压载水舱的空气管的开口处，必要时，可以附着一层可调换的防火网（Flame screen）。

2.1.4 与货油舱连接的压载舱内设置的测深管（sounding pipe）除我社特别认定外，均应引向露天甲板。

2.2 KR钢船建造规范应用指南的第7篇第1章 1003.2

下面谈及的是符合上述2.1要求的与货油舱相邻的压载水舱中压载水管装置。

2.2.1 定义为气体安全区域的压载舱要通过气体安全区域内设置的泵来实现注水和排水。但是，在专用排水管上设置的单向阀（止回阀）连接，根据条件可以通过危险区域设置的泵来实现排水。

2.2.2 与货舱相邻的压载舱的压载水通过货油泵吸入时，货油管的连接处要设置接口（spoolpiece）及螺丝调整止回阀。另外，除了紧急时期以外，要把spoolpiece(接口)拆下来保管，并且要贴出警示牌。

2.3 KR的钢船建造规范的第7篇第1章1003.3

对于货物区域内其他的压载舱所使用的管装置，压载水可注入的船艏压载舱要满足下面的条件。（请参加IACS UR F44 ）

2.3.1 通风口管的开口处与着火点的距离大于 IEC60092-502 中的要求，在开放甲板上设置。

2.3.2 在开放甲板上要求具备适当的便携式可测定压载舱内可燃性气体浓度的测量工具。

2.3.3 船艏压载舱要求从开放甲板上可以直接探测。

2.3.4 船艏的压载舱与开放甲板相邻。但是，如果可以满足以下条件的话，就允许通过开放甲板与压载舱连接的密闭区域与压载舱相邻。

1）通过防撞舱壁（cofferdam)把密闭区域从货油舱中分离时，在密闭区域内要设置由螺栓联结的气密窨井，在采取下一个措施后，船艏的压载舱可开放的相关内容以警告牌的形式张贴出来。

a. 不含气的论证，或

b. 确定密闭区域内不安全的电气设备的电源被切断。

2）把密闭区域划分为具有货油舱和共同境界的危险区域的话，密闭区域内要保证通风顺畅。

2.4 KR 钢船建造规范指南第7篇第1章1003.2

上文2.3的要求所适用的跟货油舱相邻的压载舱中的压载水管应满足下列规定。

2.4.1 被定义为气体安全区域的压载水舱要通过气体安全区域内所设置的泵来实现注排水。

2.4.2 当与货油舱相邻的压载舱的压载水有货油泵吸入时，在货油管系的连接部位要设置接口（spoolpiece）及螺丝止回阀。另外，除了紧急时期以外，要把spoolpiece(接口)拆下来保管，并且要贴出警示牌。

3. 危险区域及电气设备的保护形式

3.1 运送闪点在60° 以下货物油的油船的危险区域

运送闪点在60° C以下货物油的油船，根据IEC60092-502 Reg.4.2中的规定，根据可燃性油蒸汽存在的概率和危险性把其划分为Zone 0, Zone 1和Zone2，由于Zone等级的不同，要设置的电气设备的型式也有所不同。其中BWTS及相关的压载舱被定义为危险区域Zone1, BWTS的设置可能性比较高的货物泵舱被定义为Zone1,货物甲板上2.4m处到最高处被定义为Zone2区域。因此，在这些危险区域内所设置的电气设备，要特别考虑防爆的要求。图IV-2-A~D为油船内危险区域划分的图例。危险区域及电气设备的保护型式有关的详细内容请参考附录“ 根据船种类划分的危险区域及电气设备的型式”中第二行的内容。

3.2 运送闪点超过60° C的货物油的油船的危险区域

运送闪点超过60° C 的货物油的油船时，根据IEC 60092-502 Reg.4.3 的规定把货油舱，货油舱的通风管，货油管的内部都划分为Zone2。图IV-2-E所示为FA Tanker中危险区域划分的图例。

4. BWTS的设置

4.1 运送闪点在60°C以下货物油的油船上BWTS的设置

图IV-2-A，B 及 C为运送闪点在60°C以下的货物油的危险区域的划分图例。根据国际压载水公约/指南/G8 .4.9行的规定，与BWTS相关的所有电气设备要设置在危险区域外。如无法避免的话，要安装通过型式认可的防爆性装置，并且应该避开所有可能形成静电驱动的位置。

4.1.1 关于BWTS所设置的位置

在运送60°C以下货物油的油船中，除了要应用防爆型的型式认可的电气设备外，还要满足3.1中所提及的在危险区域外部设置的要求。然而，由于压载舱本身被定为危险区域，与其有关的所有压载管道都被定为危险区域Zone1。另外，在压载管上应该直接设置，有型式认可的BWTS处理装置及传感器等电气装置。

1）在货泵舱或压载舱内设置时

在有货泵舱或压载泵舱的油船上设有压载水的处理装置的情况也存在。图IV-2-F为设有货舱泵的船舶的概略图。考虑在危险区域设置的与BWTS相关的电气设备，必须为通过型式认可的防爆型。

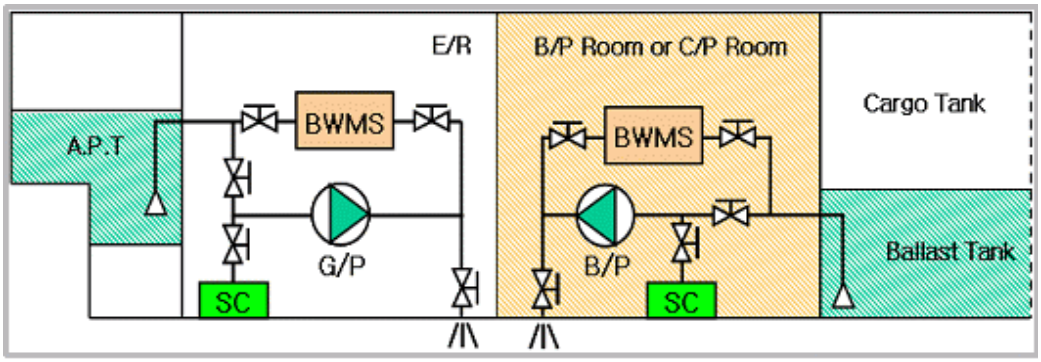


图 IV-2-F 在货泵室内设置压载水

2）在船机舱/泵舱以外场所设置时

没有货泵舱或者压载泵舱的油船，由于在机舱区域和居住区域内不可能设置，所以很难找到设置的位置。这种情况下，在甲板上面设置BWTS的情况也是存在的。图IV-2-G就是在甲板上设置BWTS的概略图。在甲板上设置BWTS时，请考虑下列事项。

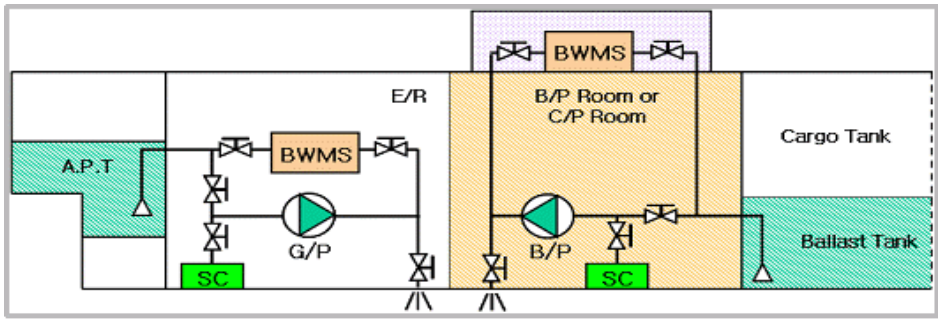


图 V-2-G 在船机舱/泵舱以外场所设置压载水

a. 与甲板上的等高处设置BWTS，要把压载水管引到甲板上，压载水处理方式，要考虑关于压载泵的水头减少，还有压载水由高处向低处移动时，压载管会发生过度的振动。为了防止过度振动的发生，应该采取相应的措施。

b. 货物甲板上设置防撞舱壁（cofferdam），在开口及进出口的高度2.4米以上被看作安全区域的位置设置非防爆型BWTS时，跟前面说明过的相同，由于压载管本身属于危险区域Zone1，在该区域内的法兰，阀等会出现漏水等原因，而BWTS作为危险区域Zone2时，在该区域内设置的电气设备要采用适当的防爆型式。但是，如果BWTS处理装置区根据IEC60092-502的要求采取了适当的安全措施的话，通过我船级社检验后可被认定为安全区域。

c. 在露天甲板上的其他密闭区域设置BWTS时，密闭区域会使船舶的总吨数增加。特别是船舶总吨数的变化使得设备有所变化时，需同基本技术部协商。（例：500吨，1600吨，2000吨，10000吨等）

d. 在处理压载水而产生臭氧的设备处应该安装臭氧感应器以便臭氧放出时发出警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊的引出措施。

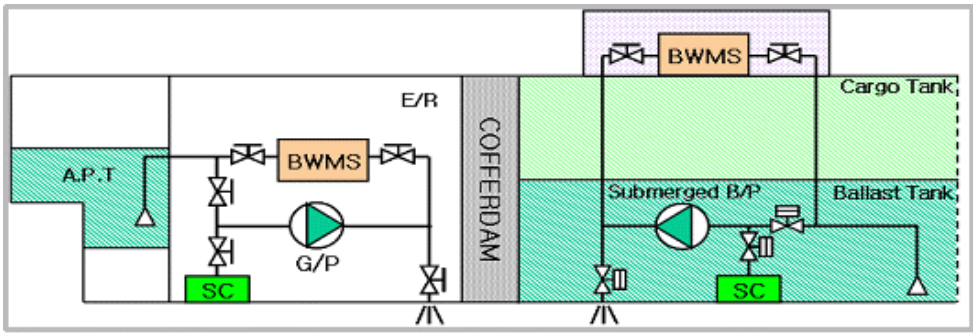


图 IV-2-H 在没有泵室的油船上设置压载水

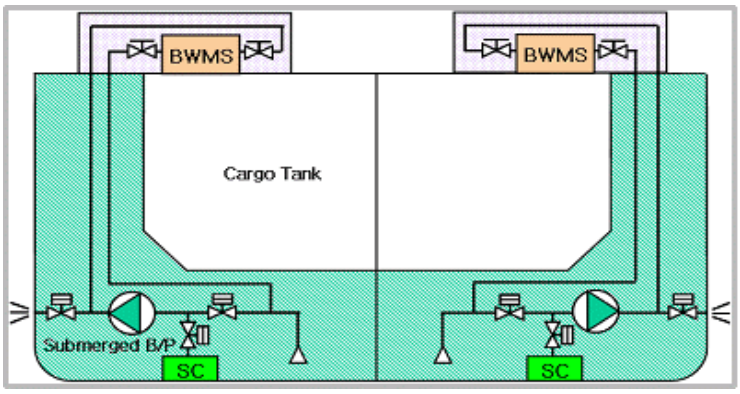


图 Ⅳ-2-1 在没有泵室的油船上设置压载水-1

e. 在BWTS处理后， 在使用会产生氢气等危险气体的型式时，如果流出的危险气体可以储存在密闭区域内的话，危险气体排出管应该引向外面的安全场所。

f. 如果在露天甲板上设置BWTS的话，在选择设备时要考虑选择适当的IP等级，并且为防止货物受到物理性的损伤，要设置在受保护的区域内。

3）在轮机室内部设置的情况

在除装载闪点在60°C以上的货物以外的油船的轮机舱内不能设置压载水处理装置和压载水取样设备。但是，大部分的油船船艉A.P.T的注排水是通过轮机舱内的消防压载泵和舱底消防总用泵来进行的。另外，在很多被看作是安全区域的船艏F.P.F处，注水是通过轮机舱内代替压载泵而设置的消防总用泵和消防压载泵来进行，而排水则是由轮机舱内的压载泵来进行的。这类船舶需要考虑以下事项。

a. 为了处理安全区域的A.P.T 或F.P.T的压载水，须把专用的BWTS设置在机舱等安全的区域内。但是，在排水时，需要其他排水处理方式的BWTS的话，主要是在泵舱内设置压载泵来排水，但如果在轮机舱内设置的BWTS不能使用时，要考虑以上的事项。

b. 为处理压载水而产生臭氧的设备所在处应该安装臭氧感应器以便臭氧放出时发出警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊的引出措施。

c.在BWTS处理后，若使用的是会产生氢气等危险气体的型式时，流出的危险气体可以储存在密闭区域的话，危险气体排出管则应该引向外面的安全场所。

d. 轮机舱内与BWTS相关的设备在向压载泵内设置的与BWTS相关的设备中注入处理物质时，要遵守下列要求。

- 一定，只在注入时使用。
- 不能使用穿透轮机舱室货泵室内舱壁的甲板来注入
- 一定要使用小口径管
- 为了防止注入管内的逆流现象应该在货舱内设置正确的切断方法。下图IV-2-J所示为类似的切断方法的例子。

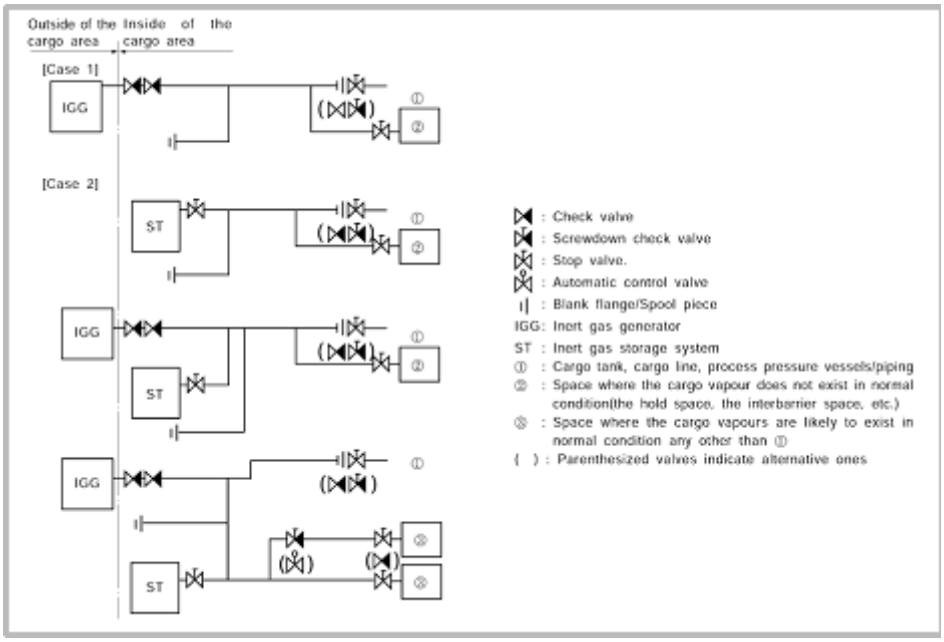


Fig. IV-2-J Example of Blocking Up Method

4.1.2 压载抽样式电气设备

（TRO）总残余氧化剂气体传感器，气体传感器单元的压载管直接设置在抽样型式的危险区域外，并且要使用认可的防爆产品。在安全区域内设置时，也要设置适当的型式。

4.1.3 关于电气分解方式要特别考虑的事项

1）线路的电压下降

使用电气分解式BWTS时，通过使用整流器来把440V的交流电（或220V）变为36V以下的直流电，从而实现压载水处理装置的电供给，并且这时会有很大的电流流经供给线路中。因此，由于输送电的距离长会使电压下降，为了能使处理设备正常地运转，应该把电缆设置成小于制造商所限定的长度。

2）导电条（母线）的线路构成

电气分解时，由于输送较大的电流，当处理设备容量很大的时候，电缆的尺寸和售价都会有相当大的增加。由于这个原因，为了使设备小型化，就有了由导电条（母线）构成的线路。导电条（母线）要选择我船级社型式认可的产品，并且一定要在后备箱内配置等级号在IP54以上的该产品。导电条（母线）尽可能避开在危险区域或露天甲板上设置，万一设置在了危险区域的话，一定要使用防爆型，特别是在从安全区域到危险区域的穿透处设置时， 还要满足有关舱壁穿透处防火构造和气密构造的要求。另外，关于船内及舱壁穿透处的设置，一定要使用我船级社认可的方式。

4.1.4 在油船的危险区域内设置电气设备的要求

根据我船级社钢船建造规则第7篇第1章11节的内容要满足下列要求

1） 防爆等级

为了在压载管内设置处理装置及自动控制装置，各种监视传感器及自动控制阀驱动装置等电气设备的防爆等级要在IIB T4以上。

2） 船壳回路系统

在油船上设置的电气设备是我社钢船建造规范7篇1章1101.3中例外的情况，除了指定的情形外不能接地及使用船壳回路系统。

3） 切断开关装置

在危险区域配置的电气供电回路在每个回路的安全处都要设置多级连接式切断开关装置。并且，为了防止与该切断装置连接的电气设备有其他的危险，要采取有效的措施。

4） 绝缘等级的检测

在除了本身安全的回路外，危险场所内与电气设备接触的或者穿透危险场所的急电回路及供电回路的绝缘等级要经常检测，当绝缘电阻比设定的值低时，就要响起警报。

5） 电缆

a. 电缆外套一定是非金属的

b. 可能的话， 在船体中心线处应该铺设电缆。

c.为了与甲板，舱壁及各种配管装置充分的隔离，应该铺设电缆。

d.在霜雪步行路及甲板上所铺设的电缆，为了防止其机械损伤，应该给予适当的保护。在反复经受伸缩作用的船体结构处，应该添加电缆及支座。

e. 在危险区域穿透甲板及舱壁的电缆及电缆用导管在穿透处应该满足所要求的气密和水密结构，并且要符合防火区域的要求。

f. 在使用电缆时，要特别注意两端的绝缘处理。

g. 通过危险处或与危险处连接的动力及照明用的电缆都要采用金属铠装，并且两端要接地。

4.1.5 设置的例子

图IV-2-J及K为运送闪点在60°C以下货物的油船的危险区域内设置BWTS的例子。在图IV-2-K及L中，红色方框内的压载水处理装置和压载管上设置的传感器如果在危险区域内设置，就要设置有型式认可的防爆型，其他不是防爆型的电气设备，都要设计在危险区域外。

另外，在压载管上设置的FMU（流量计装置），TSU(周转率传感器单元)等传感器也要使用防爆型。

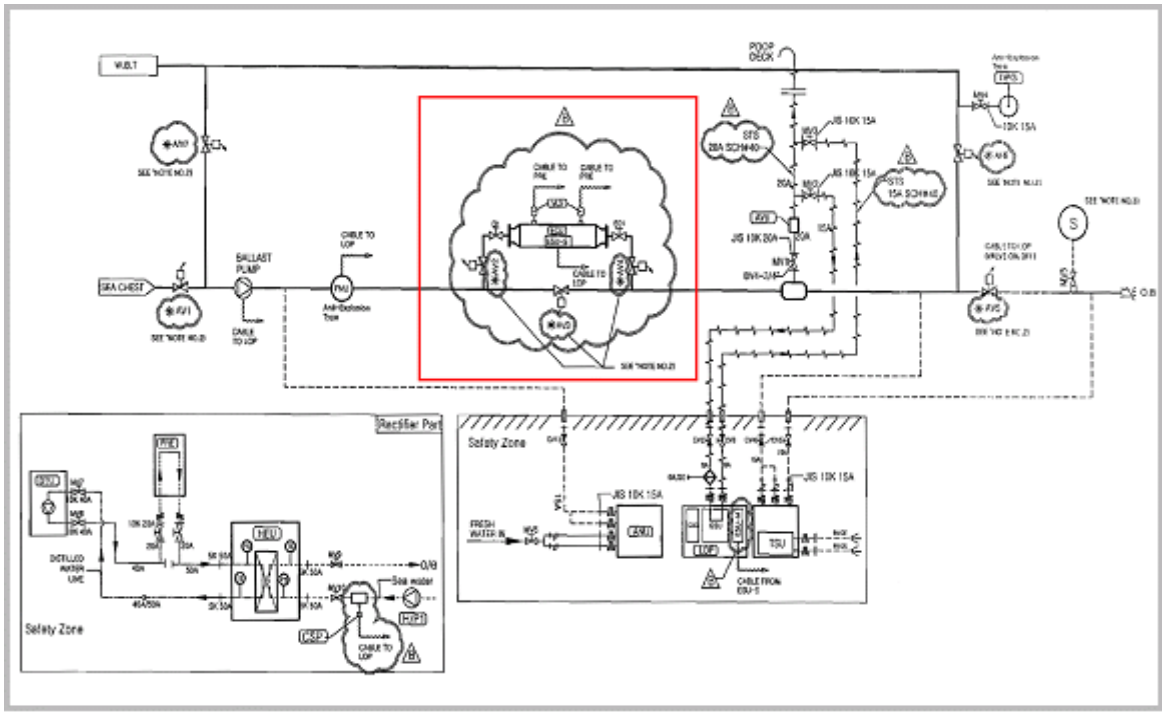


Fig.IV-2-K BWTS 的电气设备类型

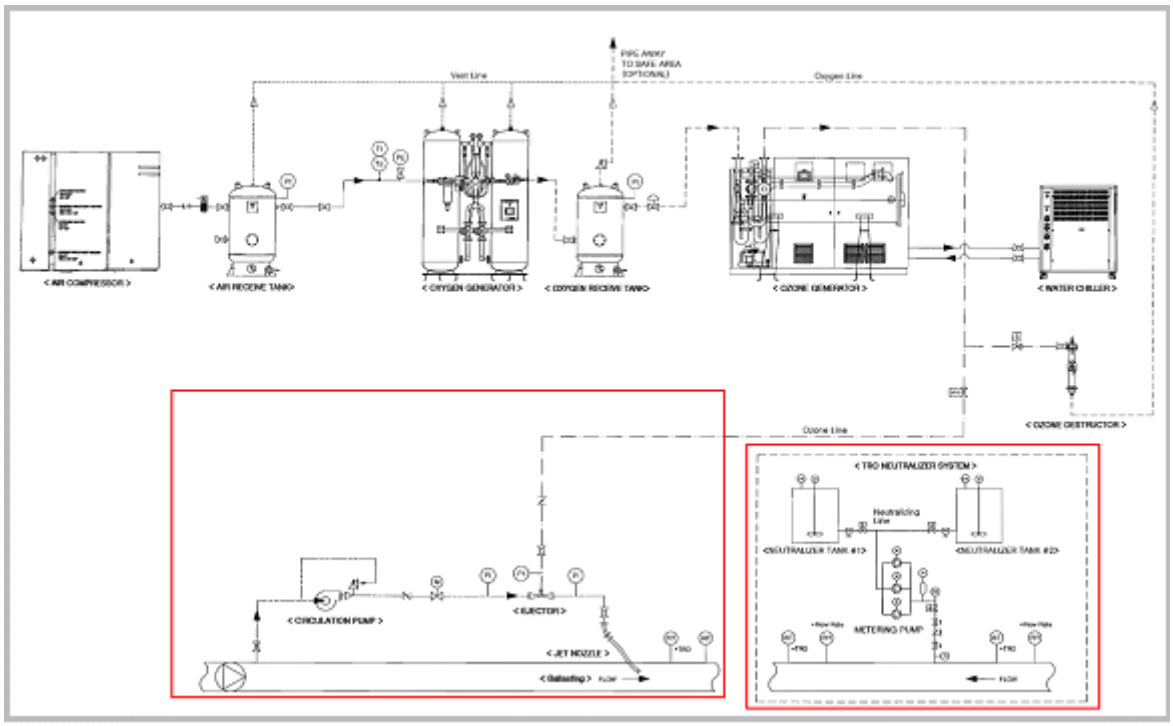


图. IV-2-L Ozone 型压载水处理系统

4.2 运送闪点超过60°C的货物油的油船（FA Tanker）

压载舱不是危险区域，根据3.2中所提及的内容，在危险区域外设置的话，不要求是防爆型。

4.3 在管道和电缆穿透处应采取的措施

在BWTS设置时所用的管道和电缆穿过甲板或舱壁时，在穿透处，与穿透的甲板和舱壁一致，要满足防火和水密结构的要求。尤其，电缆和管道穿过安全区域和危险区域之间的舱壁时，也一定要满足水密结构的要求。有关防火舱壁穿透处的详细要求，请参见我船级社规则第8篇中附录8-2“ 穿透处的划分”。

5. 特殊事项

5.1 压载水系统中bypass的警报及记录

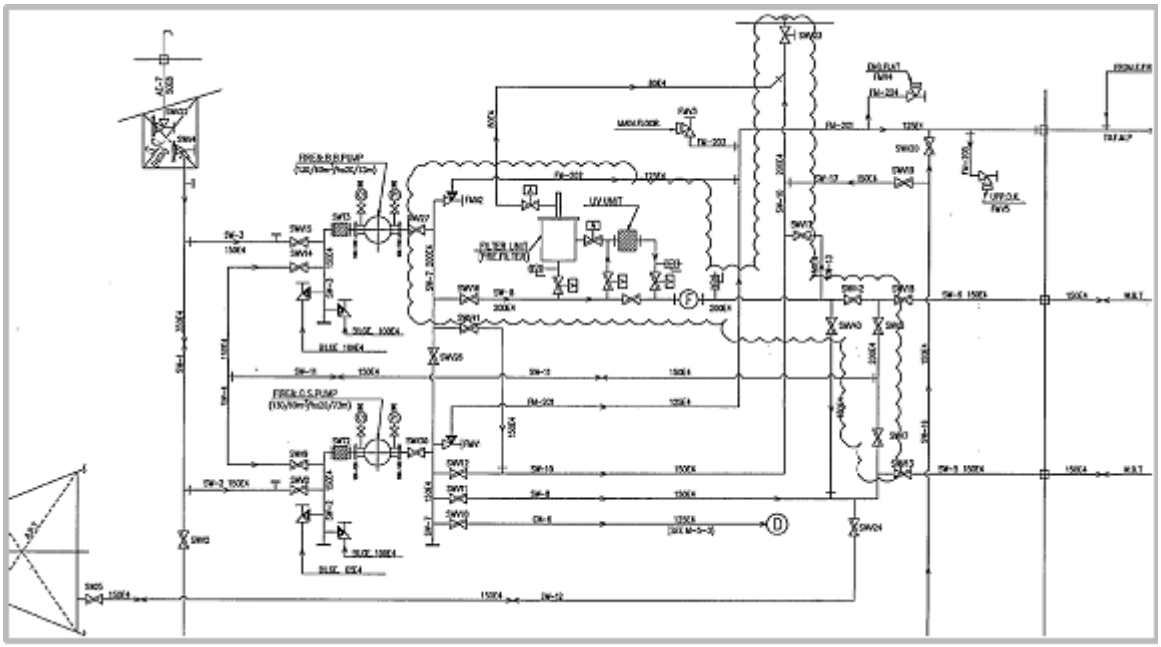
BWTS的旁通(bypass)警报及记录 在国际压载水管理公约中规定“BWTS的旁通功能（bypass），在发出警报时都要记录在控制设备中。”使用bypass的BWTS，为了能使未处理的压载水向压载舱内注入或从中排除，就要使bypass能自动接受可视可听警报后并能记录在控制装置里。旁通功能和相关的所有阀门要变为远程控制阀，另外，每个阀要设开关指示装置，从而使BWTS的控制设备中有能可以自动探测警报构成。

5.1.1安设处狭窄

大部分的船舶都设有2台以上的压载水泵，而且一般是通过泵的出口侧的两个主排水管向压载水舱内注水或由压载水舱向外排水。如果是小型船的话，可能由于安设处窄小等原因只在压载泵的出口处设置一个主排水管，这样的话在设计时要考虑下列事项。下图IV－2－M即为在BWTS上只设置一个主排水管的船舶。

1） 通过BWTS来注水和排水的所有管都拆除或者可能实现旁通的阀，由可自动发出可视可听警报的系统构成，另外，在控制装置中要能记录。

2） 分使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水的。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超过设计流速的速度通过BWTS的情况。通常一般配管按约为2~3m/s的速度来设计。



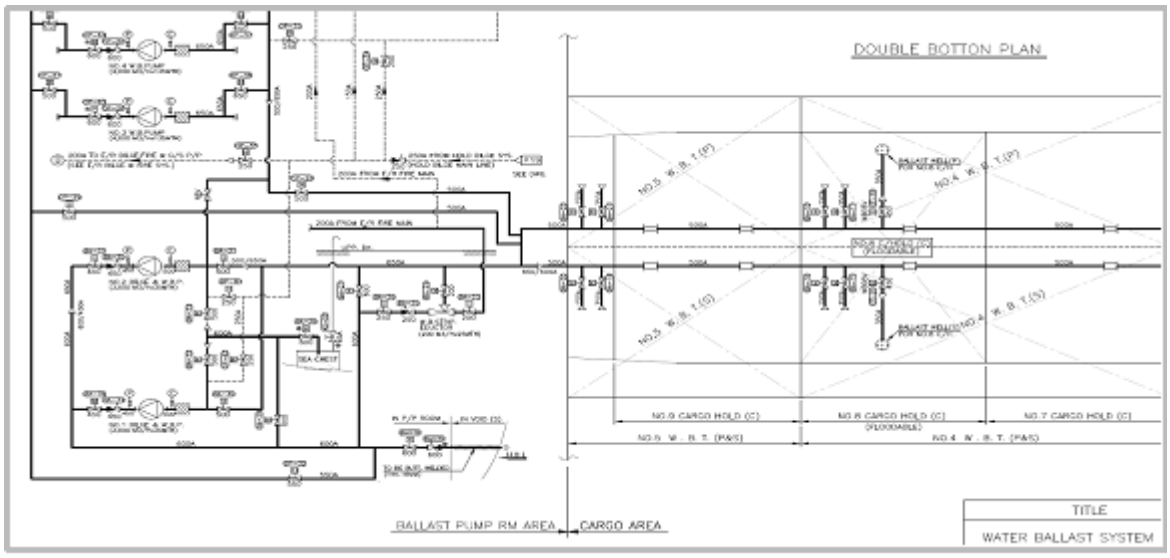
图IV－2－M在BWTS上只设置一个主排水管的船舶

5.1.2 BWTS初期的运作

初期，压载及减压载时，在指定的时间内，要求bypass及再循环型式的BWTS，在设计时，与压载水的注水和排水所涉及到的阀可以自动联锁，未经处理的压载水无法注入或排出。若有类似的情况，请参考型式认可的条件及型式认可的图纸上所有的明确记载。特别是现有船若设有具有该特性的BWTS的装置的话，要确认所配置的自动控制阀及联锁阀与型式是否符合，使用液压驱动阀来操作的，还要考虑液压动力源的（Hyd. Power Pack）用量是否充分。另外，该船配有的BWTS作业说明书中一定要包括初期作业过程的说明。

5.1.3压载卸载用喷射泵

具有大容积的压载舱的油船等类似的船舶为了压载舱内水的卸载（抽水），配备专用喷射泵的情况很多。有这种配置的船舶，选择排水时压载水另处理型的BWTS的话，设计时就要使卸载用管中排出的所有压载水可用BWTS来处理。或者拆除所有不经过BWTS的注水和排水管，另外，在卸载管上安装的阀要有可识别警报的系统构成，并且该警报要记录在控制装置里。下面IV－2－N呈现的是装有卸载用喷水泵的压载管装置图例。



图IV－2－N装有卸载用喷水泵的压载管装置图

5.1.4 现有船舶中的应用

大部分的现有船舶都配有2台以上的压载泵，通过泵出口侧的两个主排水管可以实现压载水的注入和排出。但是，在现有船舶中，如果有新设置的情况，设置空间狭窄或者管道改造等复杂的原因导致的在压载泵的出口侧只设置一个主排水管，设计时请考虑下面的事项。

1)不是通过BWTS来注水和排水的所有管都拆除，另外管上附着的与bypass有关的所有阀系统请按照上文5.1中的要求执行。

2)大部分使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水的。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超过设计流速的速度通过BWTS的情况。

5.2 重力注水和排水

超大型的油船，压载舱内部配有海底门，通过重力来实现注水和排水，这时要在海底门上配置双重的截止阀，并且要求在干舷甲板上可以实现操作。压载水的处理方式是通过压载舱来实现注

水，排水则通过其他的方式来实现。下图IV－2－O及P所示为通过重力来实现注排水的船舶的例子.

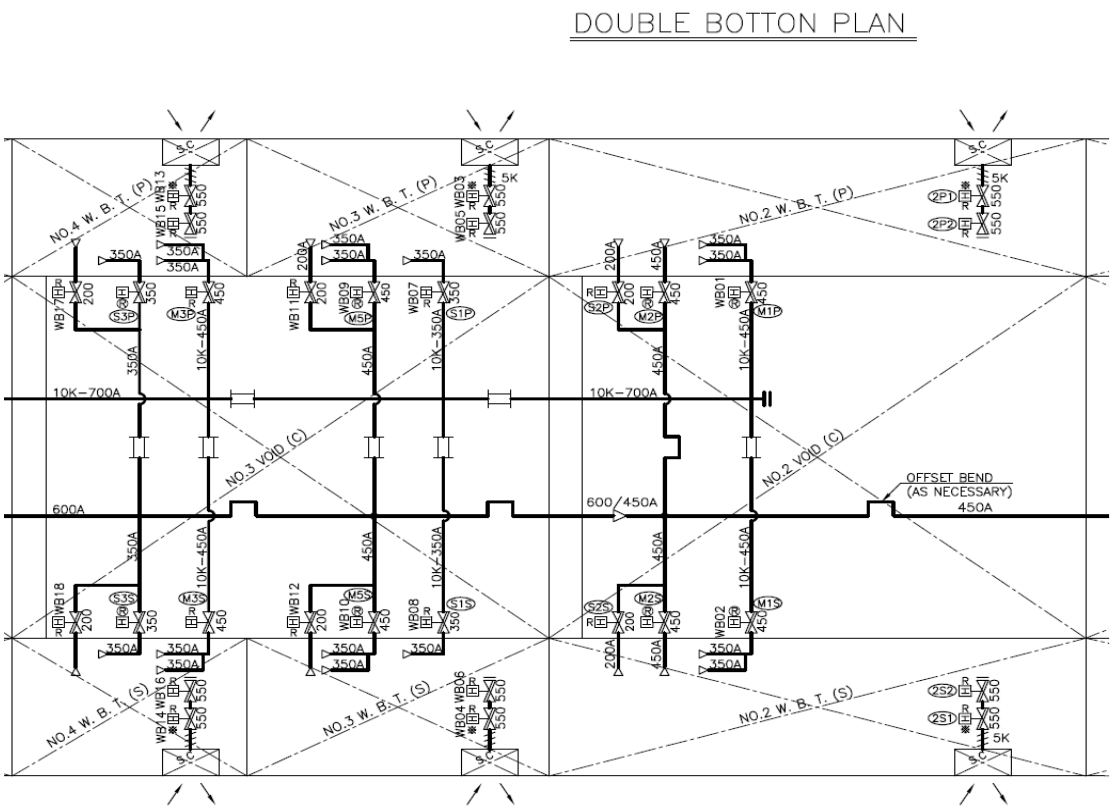
5.2.1 排水时另外的处理方式

1）设有只处理注水压载水的BWTS的船舶，注水时，在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

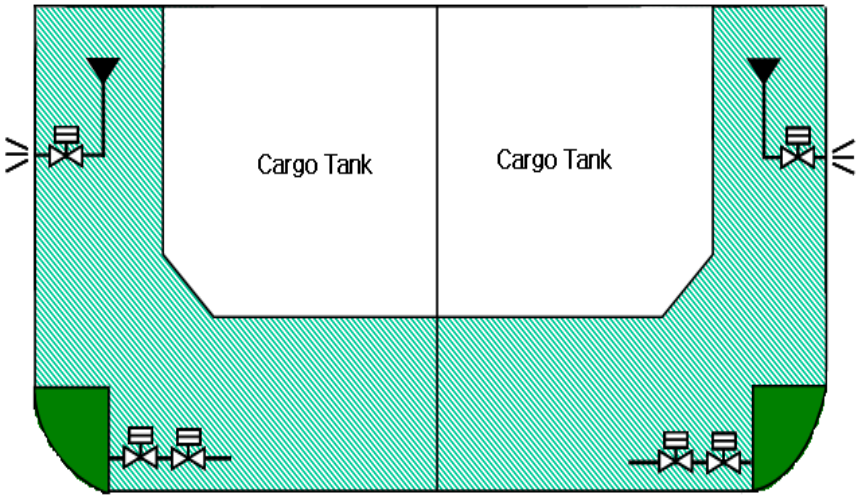
2）排水时可以通过重力来实现。

5.2.2 排水时其他的处理方式

设有其他压载水处理方式的BWTS船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。



图IV－2－O 通过重力来实现注排水的船舶



图IV－2－P通过重力来实现注排水的船舶

5.3 重力排水

5.3.1 只处理注水的方式

1） 通过重力从压载水舱内排水的船舶的情况，在设有只处理注入压载水的BWTS船舶上，压载水的排水也是通过重力来实现的。

2）注水时，无论什么情况，压载舱内未处理的海水都不得进入。并且，重力排水用的排水管上配备的阀门是止回阀。但如果设有可以用于bypass的截止阀的话，要满足前文5.1的要求。

5.3.2 排水时其他的处理方式

1）设有其他压载水处理方式的BWTS船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

2）特别是为了满足有关现有船舶压载水管理公约D1（压载水交换方法）的要求而设置的交换压载水，使用溢出管的话，请考虑上述要求。

5.4 作为压载舱使用的货舱

在大部分的油船上都配置了在很恶劣的天气航行或处于紧急状态下时可向货舱内注入压载水的配管装置，与VLCC相似的船舶的货泵舱内设置的海底门可以通过货泵舱来直接吸入水的配管型式（通常法兰盖可以切断）也存在。另外，在很多油船上，为了从货舱内排出压载水，不使用压载泵而是通过使用排油监控系统由货泵中排出来。同样，这类船舶上设置的BWTS排水时，压载水通过其他方式来处理的船舶请考虑以下事项。

5.4.1 设置管时，要使水可从货舱中排出来。

5.4.2 在货舱内，如果掺杂很多油成分的不纯物质的话，排水时，不纯物质会使BWTS的性能下降。因此，在选择配置BWTS时要充分考虑这个问题。

5.4.3 排水时，要考虑使用与压载水直接接触的紫光灯或在BWTS中设置自动洗涤功能或者使用降低与油一样高粘度物质的洗涤能力等方法。

5.4.4 如果与压载相关的管路上设置的阀具有旁通（bypass）功能，要满足上面5.1中的要求。

5.5 具有其他目的的兼用泵

在把消防泵作为压载水泵来使用的船上,BWTS要采用远程控制。为了使用消防泵的固有功能，在消防泵的消防主管道入口和出口处配置的阀要求可实现远程操作。另外，BWTS和舱底泵兼用时，要统一考虑后再设计该系统。

5.6 KR簿记符号（船级符号）UMA以上的等级

我船级社的自动化设备簿记符号UMA（UMA,UMA1,UMA2,UMA3）以上等级的船舶，根据我船级钢船建造规范中第9篇第3章的内容，要求消防泵远程启动。因此，压载水泵和消防泵兼用的船舶，在配置BWTS时也需考虑以上的事项再设计该系统。

5.7 KR簿记符号（船级符号）UMA1以上的等级

我们船级自动化设备的簿记符号UMA1以上等级的船舶，根据我船级钢船建造规范第9篇第3章的内容，要设置可远程控制压载的系统。因此，在具有UMA1以上等级的船舶上设置BWTS时，与压载水的注水排水及BWTS相关的阀要以具有远程控制功能的原则来设计。

5.8 艏尖舱 F.P.T

为了处理被考虑为安全区域的船艏F.P.T的压载，使用位于泵舱内的BWTS，由安全区域变为危险区域原则上来说是不可能的，但是，未处理在艏尖舱F.P.T处使用的压载，使用位于泵舱内的BWTS时，应该满足下列要求。（请参照IACS UR F44）

5.8.1 把F.P.T作为危险区域考虑。

5.8.2 艏尖舱F.P.T用气管开口端的点火源应该在超过IEC60092-502中所要求距离的露天甲板上设置。

5.8.3 在艏尖舱F.P.T内要具备可测量可燃性气体浓度的设施。该设施一般由与露天甲板相连的探测管及便携式探测器组合而构成。

5.8.4 艏尖舱F.P.T的测深管应该引向露天甲板的上面。

5.8.5 从艏尖舱F.P.T的出入口可以直接出入开放甲板。然而，满足下列条件，可以通过密闭区域出入船艏F.P.T。

1）密闭区域在跟货舱不接触时，船艏的出入口设置在密闭区域内气密性的窨井。这种情况下，若确定不存在可燃性气体，或在窨井上贴有关于密闭区域内设置的防爆型电气设备切断后开放等事项的警告牌。

2）若密闭区域是与货物舱相邻的情况的话，被分到危险区域，与危险区域相关的所有要求都一定满足，另外要做到可以充分的换气。

5.9 设有BWTS区域的耐火完整性（Fire Integrity）

BWTS及相关的设施设置在甲板舱室居住区域内的情况也是存在的。这种情况要根据SOLAS Reg. Ⅱ-2/3 中关于其他机舱区域和工作区域来定义。与其他区域或工作区域相邻的居住区域的舱壁和甲板要考虑SOLAS.Ⅱ-2/3规则中关于舱壁的耐火完整性达到A-0以上的要求。

5.10 水舱

如果饮用水舱作为压载水舱来使用，饮用水中所含有的化学物质可排出的话，请考虑国际压载水管理公约中与IMO相关的内容。

5.11 用电量和回路的构成

对用于BWTS设置所增加的用电量进行分析时，针对该船的电气用量是否充分要进行审查，因此，电载荷的分析材料要向我船级社提交后接受审查。另外，对于电气设备的过载和短路，要采取适当的保护。（请参照附录中用电量及回路结构的内容）

5.12 压载水舱的改造

现有的船舶按压载水国际管理公约附录A-1,Reg.5要求改造为新船时请考虑下列事项

-压载水的运输量有15%以上的变化，或者

-船的种类有变更，或者

-经政府认定，船龄可以继续延长10年以上，或者

-配件的替换，会导致BWTS变化的情形

5.13 BWTS的控制，监视及警报

在国际压载水管理公约指南8的第4节中，有关于BWTS的控制装置，监视及警报装置要求的规定。

5.13.1 控制，监视及警报装置

1）BWTS处理时所需的投入量及强度可以自动控制。控制装置在运行过程中要一直具备自我监视的性能，并且运行时必须要能自动监视和调节。

2）监视系统是否出现故障或者不运行情况，如果发生而妨碍正常运行的话，要求在所有的作业区域内能收到可视可听的警报。

5.13.2 运转及控制

1） BWTS的运转及控制方面，单纯从效果上来看，要做到在远程控制场所内容易实现控制。但这里面所说的不是与BWTS有关的所有阀自动化的意思，不包括导致处理装置不运转的阀，是指手动控制阀可以很容易控制的意思。在这种情况下，BWTS运行时，对于依照注水和排水所设置的手动阀门控制过程的指南及与该阀门相关的管装置的图纸最好都在控制场所内展示出来。

2）配有我船级社簿记符号在UMA1级以上的船舶，BWTS运转时，在相关的所有阀的操作及压载泵的驱动控制场所都要有远程控制。

5.13.3 旁通功能（bypass）及覆盖（override）

1）在设有BWTS的船舶上，紧急时期，为了保护船及船员的安全，要设置bypass 和override装置。另外，在旁通(bypass)时，控制和监视设备中可以自动接收到可视可听的警报，并且能记录在控制装置上。

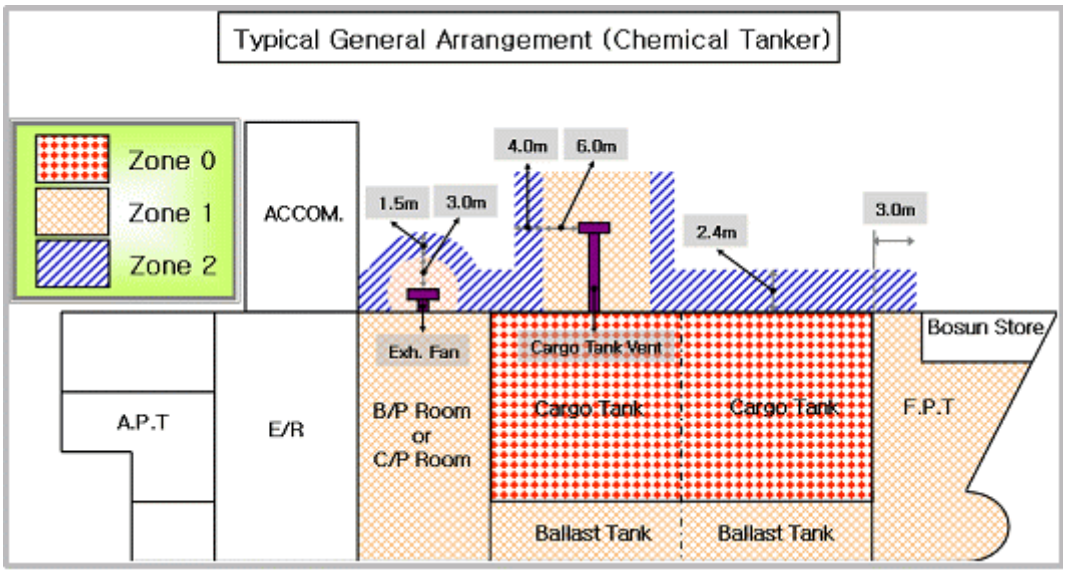
2）现有的船舶中，大部分在一侧设置压载线，对于剩余的压载线任意使用的情况，要追加可以实现监视功能的设计。与此相关的厂商在审图时要考虑所有与船舶压载相关的设施。所有的旁通相关（bypass）的目录都要提交并接受审查。

3.化学品船

1.一般事项

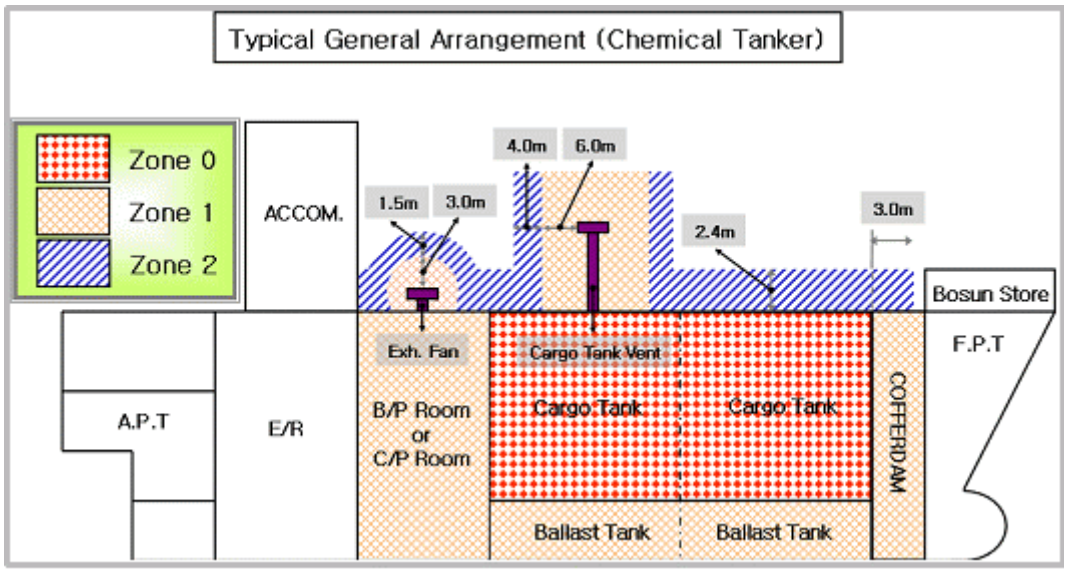
图IV－3－A,B及C呈现的是一般的化学品船的总布置图，而IV－3－D呈现的则是化学品船的舯横剖面图。

1.1 图IV－3－A 呈现的是具有货泵舱及压载泵舱，并且货舱与船艏相相邻的化学品船的总布置图。大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相邻的压载舱就被划分为危险区域。因此，压载舱的注排水可以依靠泵舱内的压载泵来进行。除此之外，大型的化学品船一般还设置喷射泵(eductor)和剥离泵（stripping）。但是，大部分船艉的注排水还是通过使用船机舱内的消防压载泵和舱底消防总用泵来进行的。

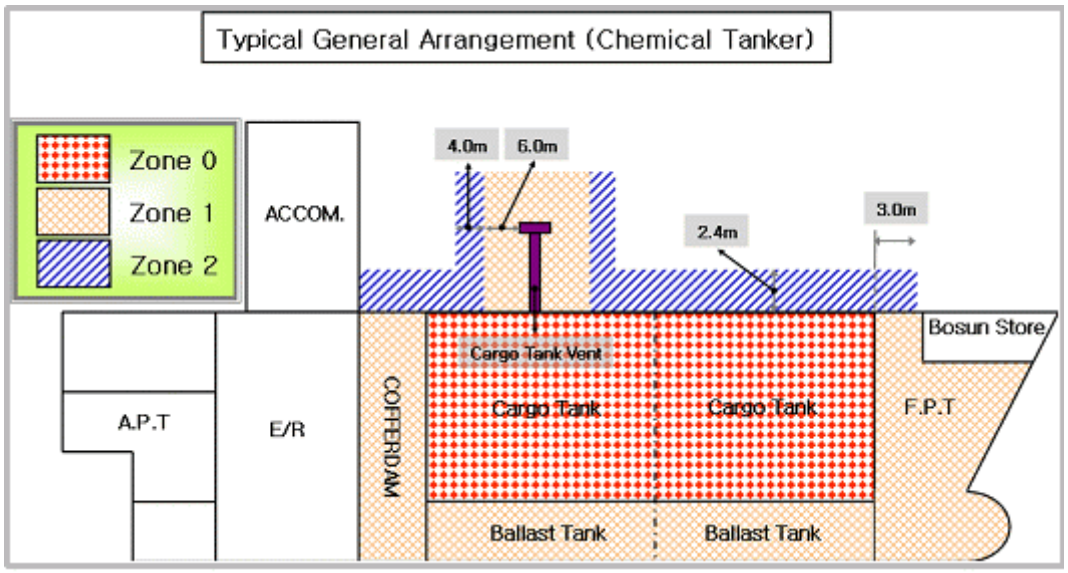


图IV－3－A 具有货泵舱及压载泵舱

1.2 图IV－2－B呈现的是具有货泵舱或压载泵舱，但由于防撞舱壁（cofferdam），燃油舱或淡水舱等结构，船艏与货舱无法相邻的化学品船的总布置图。大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相邻的压载舱就被划分为危险区域。 不过，大部分船艉的注排水还是通过使用机舱内的消防压载泵和舱底消防总用泵来进行的。另外，还有为替代船艏注水所用的泵舱内所设置的压载泵而设置的消防压载泵和舱底消防总用泵，排水则要通过泵舱内所设置的压载泵来进行。除此之外，在大型的化学品船上设置喷射泵(eductor)和剥离泵（stripping）的情况也存在。



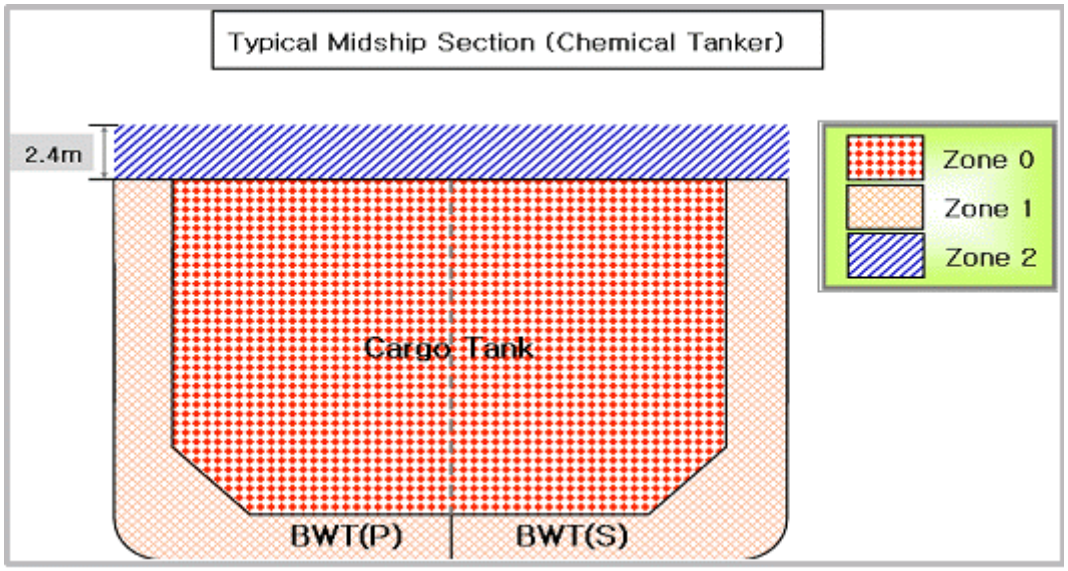
图IV－2－B具有货泵舱或压载泵舱



图IV－2－C没有货舱或压载泵舱的化学品船的总布置图

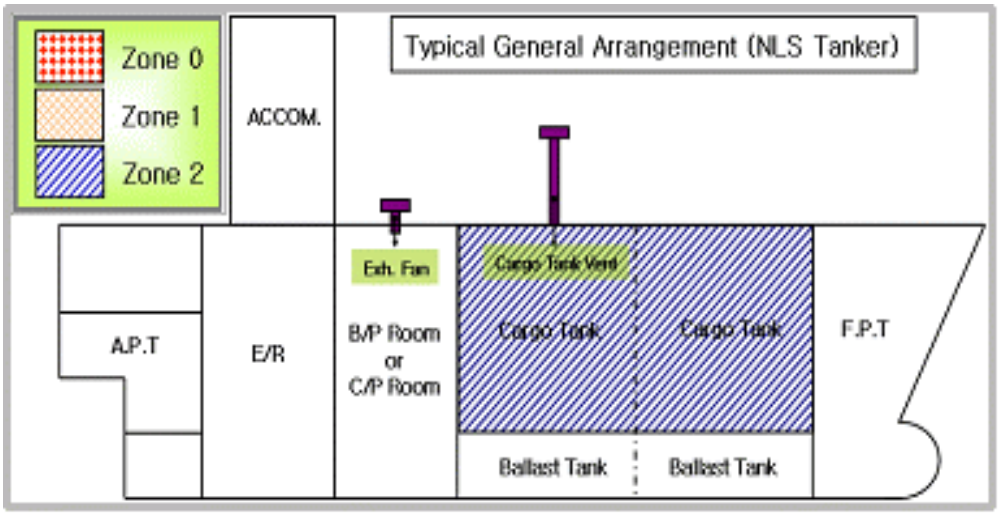
1.3 图IV－2－C呈现的是没有货舱或压载泵舱的化学品船的总布置图的例子。大部分的压载舱在货舱周围设置了L型或U型的双壳结构，相邻的压载舱就被划分为危险区域。没有泵舱的化学品船的压载泵及海水吸入口要设置在压载舱内，一般使用潜水泵，并且压载管上配置的阀要由远程操作来控制。因此，各压载水舱的注排水一般通过设置在舱内的潜水型压载泵来实现。 不过，大部分船艉的注排水还是通过使用轮机舱内的消防压载泵和舱底消防总用泵来进行的。另外，还有在为替代船艏注水所使用的泵舱内设置的潜水型压载泵而设置的消防压载泵和舱底消防总用泵时，排水需通过潜水泵来进行。除此之外，在大型的化学品船上设

置喷射泵(eductor)和剥离泵（stripping）的情况也存在。



图IV－2－C没有货舱或压载泵舱的化学品船的舯横剖面图

1.4 图IV－3－E呈现的是IBC Code中18节中所示的只运送货物的化学品船（NLS）的总布置图及舯横剖面图的图例。大部分的压载舱周围设置了L型或U型的双壳结构，相邻的压载舱被划分为安全区域。各压载舱的注排水都是通过舱底消防总用泵和消防压载泵或者轮机舱内的压载泵来实现的。



图IV－3－E只运送货物的化学品船（NLS）的总布置图

2. 相关规则

2.1 KR钢船建造规范的第7篇第6章 305 （IBC Code Reg.3.5）

化学品船的压载设备要符合下列要求。

2.1.1 专用压载舱内所用的泵，压载水管，通风管及其他类似的装置与货舱内使用的类似的装置及货物舱要独立设置。与货舱相邻的专用压载水舱的排出设备要在轮机及居住区域以外的区域设置。注入设备在货舱甲板处注入，而设有止回阀的情况，则通过机械区域内设置的泵来实现。

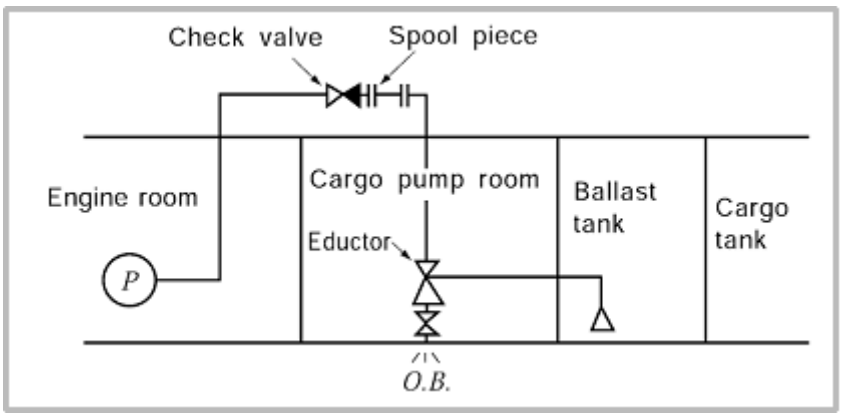
2.1.2 在货舱内为注入压载水而使用的专用压载舱泵要求可在甲板处作业。如果设有货油舱的注入管或货物管系的固定连接管还不行的话，还要设置止回阀。

2.1.3 孔隙空间，装载货物或货物残留物的舱与双层舱壁分开的情况除外，双壳舱及压载舱需设置在 货泵舱，泵舱，孔隙空间，污水箱，双壳舱及类似场所的船舶排出设备要设置在货物区域内。

2.2 KR钢船建造规则的应用指南第7篇第6章305

2.2.1 一般事项

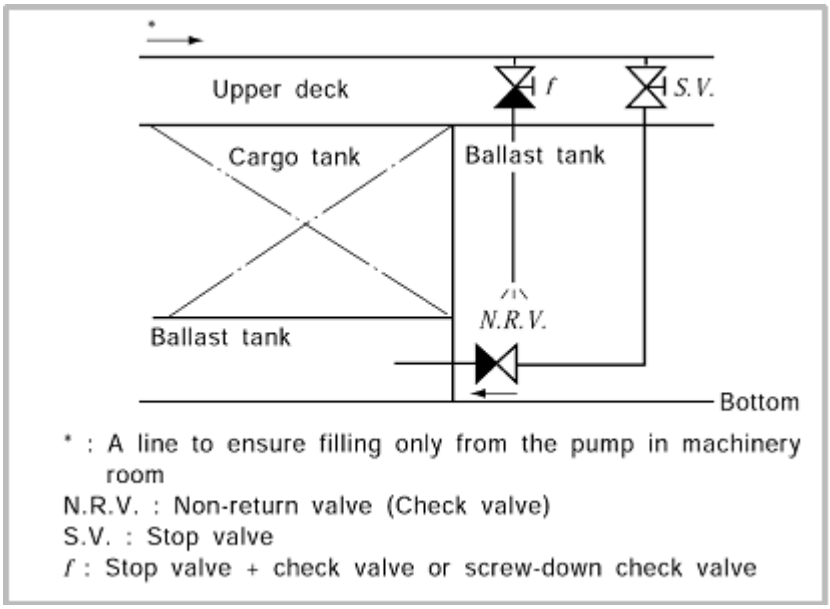
1）与货舱相相邻的专用压载舱的排水方法如图IV-3-F所示，轮机区域内设有压载泵的货泵舱通过使用喷射泵向船外排出。



图IV-3-F与货舱相相邻的专用压载舱的排水方法

2）根据规则305中第一行的规定，在货舱甲板上设置止回阀来注入，特别是我们船级社指

定外的，如图IV-3-G所示，在露天甲板处所设置的只能注入而无法排出的管上要设置截止阀或可操作的组合阀(截止阀+ 止回阀)。并且，对于有些由于管道损伤而逐渐产生累积进水时，不但要满足稳定性的要求，而且要充分考虑防止流向被划分为危险区域的压载舱内以及货物流向其他区域等事故的发生。

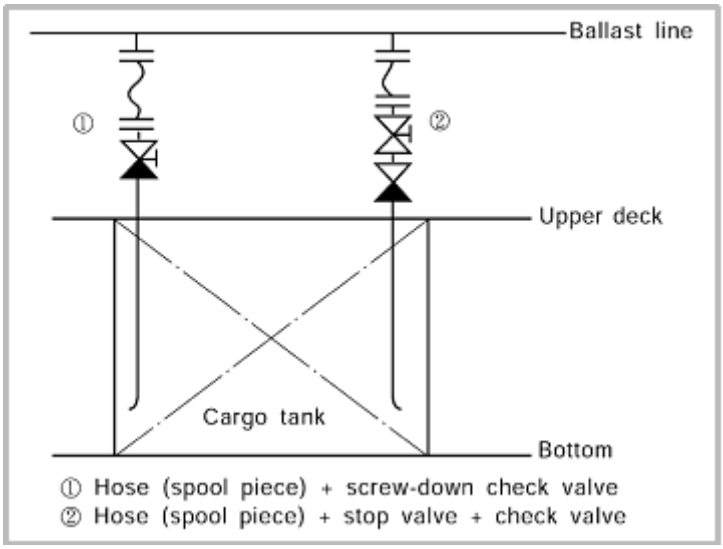


如图IV-3-G压载水注入图

3）与货舱相邻的压载舱的管装置及与货舱不相邻的压载舱的管装置，原则上讲应该各自独立。

2.2.2 货舱内的压载水的注水

1） 规范305的第二行中提到的，注入管通过货舱或与货物管的固定连接管注入其中，否则，如图IV－3－H所示的设有止回阀的情况。这种情况只能在露天甲板上注入，并且要求设置接口，胶管和止回阀等。



图IV－3－H压载水注入图-1

2）根据1）中所说的在甲板处注入时，为了防止货物舱内配管产生的静电最小化，要把注入管延长至接近地面的地方。

3. 危险区域及电气设备的保护形式

3.1 运送闪点在60℃以下的货物的化学品船的危险区域

运送闪点在60℃以下的货物的化学品船时，根据IEC60092－502 Reg.4.2中的规定，根据可燃性油蒸汽存在的概率和危险性把其划分为Zone 0, Zone 1和Zone2，由于Zone等级的不同，要设置的电气设备的型式也有所不同。其中BWTS及相关的压载舱被定义为危险区域Zone1, BWTS的设置可能性比较高的货物泵舱被定义为Zone1, 货物甲板上2.4m处到最高处被定义为Zone2区域。因此，在这些危险区域内所设置的电气设备，要特别考虑防爆的要求。图IV－3－A~D为化学品船内危险区域划分的图例。与危险区域及电气设备的保护型式有关的详细内容请参考附录“根据船种类划分的危险区域及电气设备的型式”中第二行的内容。

3.2 运送闪点超过60° C的货物的化学品船的危险区域

运送闪点超过60° C 的货物的化学品船时，根据IEC 60092－502 Reg.4.3 的规定把货物舱，货物舱的通风管，货物管的内部都划分为Zone2。图IV－2－E所示为FA Tanker中危险区域划分的图例。

4. BWTS的设置

4.1 运送闪点在60°C以下的货物的化学品船上BWTS的设置

图IV-2-A，B 及 C为运送闪点在60°C以下的货物的化学品船危险区域的划分图例。根据国际压载水公约/指南/G8 .4.9行的规定，与BWTS相关的所有电气设备要设置在危险区域外。如无法避免的话，要安装通过型式认可的防爆性装置，并且应该避开所有可能形成驱动静电的位置。

4.1.1 关于BWTS所设置的位置

在运送60°C以下货物的化学品船中，除了要应用防爆型的型式认可的电气设备外，还要满足3.1中所提及的在危险区域外部设置的要求。然而，由于压载舱本身被定为危险区域，与其有关的所有压载管道都被定为危险区域Zone1。另外，在压载管上应该直接设置，有型式认可的BWTS处理装置及传感器等电气装置。

1） 在货泵舱或压载泵舱内设置时

在有货泵舱或压载泵舱的化学品船上设有压载水的处理装置的情况也存在。图IV-2-F为设有货舱泵的船舶的概略图。考虑在危险区域设置的与BWTS相关的电气设备，必须为通过型式认可的防爆型。

2） 在机舱/泵舱以外处设置时

没有货泵舱或者压载泵舱的化学品船，由于在轮机区域和居住区域内不可能设置，所以很难找到设置的位置。这种情况下，在甲板上面设置BWTS的情况也是存在的。图IV-2-G就是在甲板上设置BWTS的概略图。在甲板上设置BWTS时，请考虑下列事项。

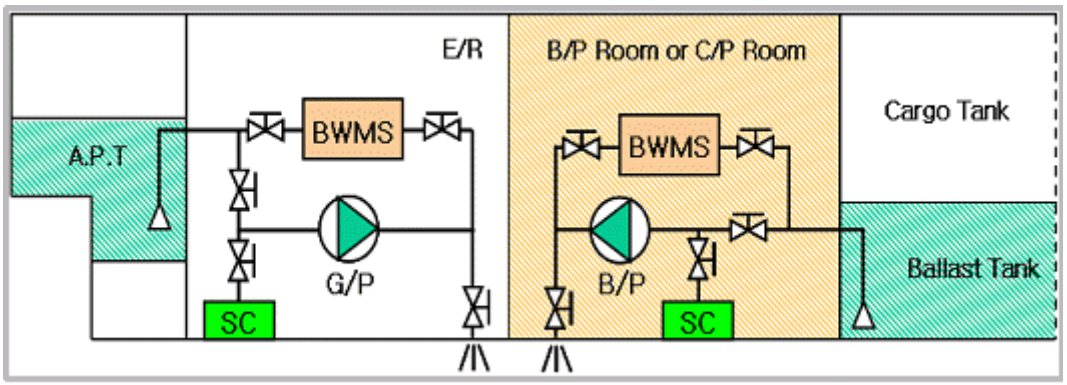


图 IV-3-I 泵室内设置压载水

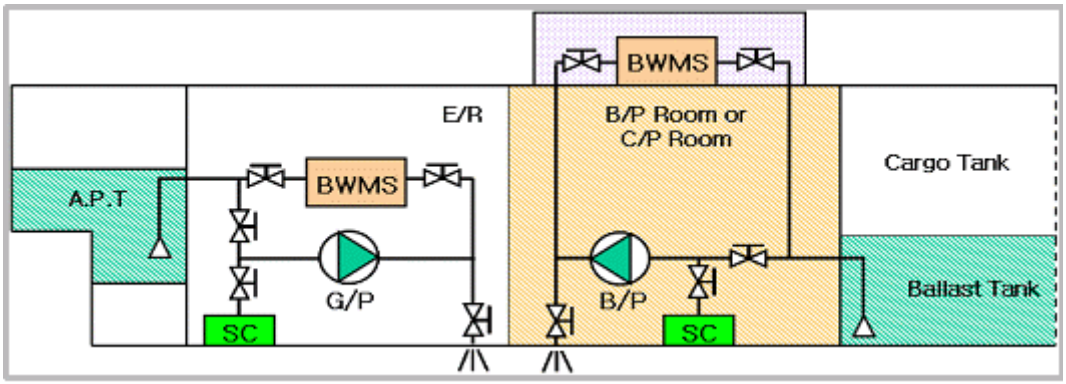


图 IV-3-J 在泵室外设置压载水

a. 与甲板上的灯等高处设置BWTS，要把压载水管引到甲板上，压载水处理方式，要考虑关于压载泵的水头减少，还有压载水由高处向低处移动时，压载管会发生过度的振动。为了防止过度振动的发生，可以安装真空阀或采取其他相应的措施。

b. 货物甲板上设置防撞舱壁（cofferdam)，在开口及进出口的高度2.4米以上的位置看作安全区域的位置设置非防爆型BWTS时，跟前面说明过的相同，由于压载管本身属于危险区域Zone1，在该区域内的法兰，阀等会有漏水等原因，而BWTS作为危险区域2时，在该区域内设置的电气设备要采用适当的防爆型式。但是，如果BWTS处理装置区根据IEC60092-502的要求采取了适当的安全措施时，通过我船级社检验后可被认定为安全区域。

c. 在露天甲板上的其他密闭区域设置BWTS时，密闭区域会使船舶的总吨数增加。特别是船舶总吨数的变化使得设备有所变化时，需同基本技术部协商。（例：500吨，1600吨，2000吨，10000吨等）

d. 在处理压载水时产生臭氧的设备处应该安装臭氧感应器以便臭氧放出时发出警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊的措施引出。

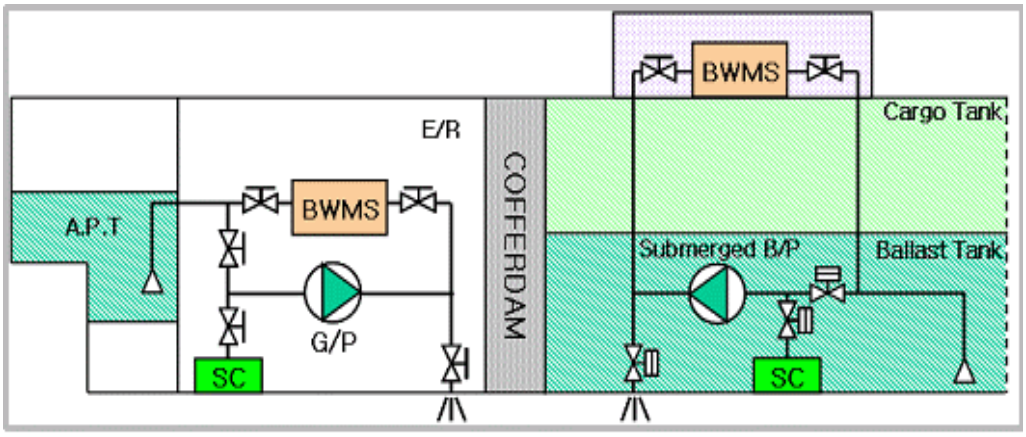


图 IV-3-K 在没有泵室的化学品船上设置压载水系统

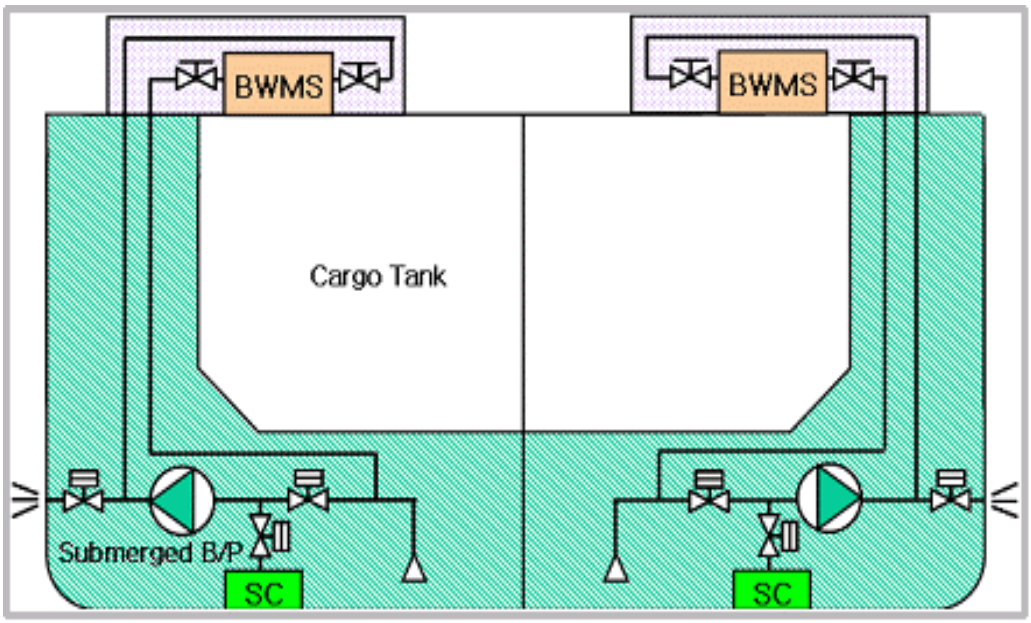


图 IV-3-L 在没有泵室的化学品船上设置压载水系统

e. 在处理BWTS处理后， 在使用会产生氢气等危险气体的型式时，如果流出的危险气体可以储存在密闭区域内的话，危险气体排出管应该引向外面的安全场所。

f. 如果在露天甲板上设置BWTS的话，在选择设备时要考虑选择适当的IP等级，并且为防止货物受到物理性的损伤，要设置在受保护的区域内。

3）在轮机室内部设置的情况

在装载闪点在60°C以上的货物以外的油船的轮机舱内不能设置压载水处理装置和压载水取样类的设备。但是，大部分的油船艉尖舱A.P.T的注排水是通过轮机舱内的消防压载泵和舱底消防

总用泵来进行的。另外，在很多被看作是安全区域的艏尖舱F.P.T处，注水是通过轮机舱内代替压载泵而设置的消防总用泵和消防压载泵来进行，而排水则是由轮机舱内的压载泵来进行的。这类船舶需要考虑以下事项。

a. 为了处理安全区域的艉尖舱（A.P.T ）或艏尖舱（F.P.T）的压载水，须把专用的BWTS设置在轮机舱等安全的区域内。但是，在排水时，需要其他排水处理型的BWTS的话，主要在泵内使用压载泵来排水，但如果是在轮机舱内设置的BWTS不能使用时，要考虑以上的事项。

b.在为处理压载水而产生臭氧的设备所在处应该安装臭氧感应器以便臭氧放出时发出的警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊的引出设施。

c.在BWTS处理后，若使用会产生氢气等危险气体的型式时，若流出的危险气体可以储存在密闭区域时，那么危险气体排出管应该引向外面的安全场所。

d.轮机舱内与BWTS相关的设备在向压载泵内设置的与BWTS相关的设备中注入处理物质时，要遵守下列要求。

- 一定，只在注入时使用。
- 通过与机舱室货泵室内的舱壁不穿透的甲板来注入
- 一定要使用小口径管
- 为了防止注入管内的逆流现象应该在货舱内设置正确的切断方法。下图IV-2-J所示为类似的切断方法的例子。

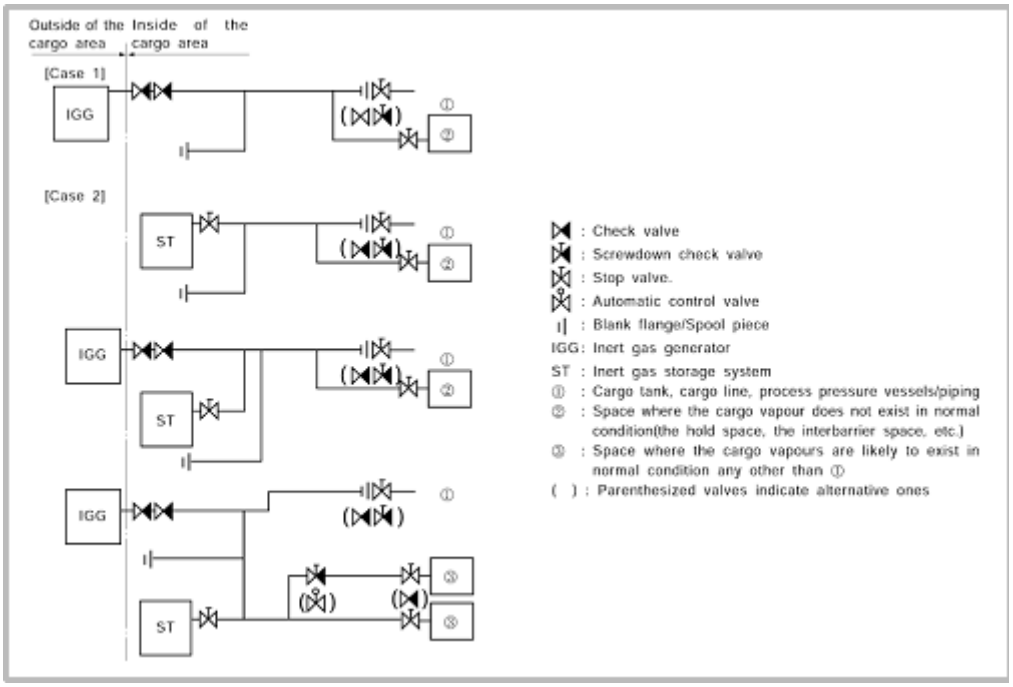


图. IV-3-M 封堵方法的例子

4.1.2 压载抽样式电气设备

（TRO）总残余氧化剂气体传感器，气体传感器单元的压载管直接设置在抽样型式的危险区域外，并且要使用认可的防爆产品。在安全区域内设置时，也要设置适当的型式。

4.1.3 关于电气分解方式要特别考虑的事项

1）线路的电压下降

使用电气分解式BWTS时，通过使用整流器来把440V的交流电（或220V）变为36V以下的直流电，从而实现压载水处理装置的电的供给，并且这时会有很大的电流流经供给线路中。因此，由于输送电的距离长会使电压下降，为了能使处理设备正常地运转，应该把电缆设置成小于制造商所限定的长度。

2） 导电条（母线）的线路构成

电气分解时，由于输送较大的电流，当处理设备容量很大的时候，电缆的尺寸和售价都会有相当大的增加。由于这个原因，为了使设备小型化，就有了由导电条（母线）构成的线路。导电条（母线）要选择我船级社型式认可的产品，并且一定要在后备箱内配置等级号在IP54以上的该产品。导电条（母线）尽可能避开在危险区域或露天甲板上设置，万一设置在了危险区域的话，一定要使用防爆型，特别是在从安全区域到危险区域的穿透处设置时，还要满足有关舱壁穿透处防火构造和气密构造的要求。另外，关于船内及舱壁穿透处的设置，一定要使用我船级社认可的方式。

4.1.4 在化学品船内的危险区域内设置电气设备的一般要求

根据我船级社钢船建造规范第7篇第6章第10节的内容，应符合下列要求。

1）要求电气设备由可燃性物质所引起的火宅及爆炸的危险性最小化。

2）通常在电气设备上使用的特定货物的材料很容易受到损害，在导体，绝缘体，金属零件等的选择时，要考虑其个别的特性。必要的时候，要保护组件使其不与气体或蒸汽接触。

3）闪点没超过60°C，加热货物，可加热到闪点的15°C以内的货物，以及闪点在60°C以下的货物统一适用。

4）独立型货物舱内的电气都要接地。所有贴有垫片的货物管的焊口及软管的接触处也要接地。

5）切断开关装置（Disconnection Switch）

在危险区域配置的电气的供电回路在每个回路的安全处都要设置多级连接式切断开关装置。并且，为了防止与该切断装置连接的电气设备有其他的危险，要采取有效的措施。

6）绝缘等级的检测

除了本身安全的回路外，危险场所内与电气设备接触的或者穿透危险场所的急电回路及供电回路的绝缘等级要经常检测，当绝缘电阻比低于设定值时，要有警报响起。

5） 电缆

a. 电缆外套一定是非金属的

b. 可能的话，在船体中心线处应该铺设电缆

c.为了与甲板，舱壁及各种配管装置充分的隔离，应该铺设电缆。

d.在霜雪步行路及甲板上所铺设的电缆，为了防止其机械损伤，应该给予适当的保护。在反复经受伸缩作用的船体结构处，应该添加电缆及支座。

e. 在与危险区域的甲板及舱壁穿透的电缆及电缆用导管在穿透处应该满足要求的气密和水密结构，并且要符合防火区域的要求。

f. 在使用电缆时，要特别注意两端的绝缘处理。

g. 通过危险处或与危险处连接的动力及照明用的电缆都要采用金属铠装，并且两端要接地。

4.1.5 设置的例子

图IV-2-J及K为运送闪点在60°C以下货物的油船的危险区域内设置BWTS的例子。在图IV-3-M及N中，红色方框内的压在水处理装置和压载管上设置的传感器如果是在危险区域内设置的，就要设为有型式认可的防爆型，其他非防爆型电气设备，都要设计为在危险区域外。

另外，在压载管上设置的FMU（流量计装置），TSU(周转率传感器单元)等传感器也要使用防爆

型。

4.2 IBC Code Chapter 18中至运送货物的化学品船（NLS Tanker）

由于压载舱不属于危险区域，因此，在3.2行中提及的危险区域外设置的情形，则不要求是防爆型。

4.3 在管道及电缆的穿透处应采取的措施

在BWTS设置时所用的管道和电缆穿过甲板或舱壁时，在穿透处，与穿透的甲板和舱壁一致要满足防火和水密结构的要求。尤其是，电缆和管道穿过安全区域和危险区域之间的舱壁时，也一定要满足水密结构的要求。有关防火舱壁穿透处的详细要求，请参见我船级社规则第8篇中附录8-2“ 穿透处的划分”。

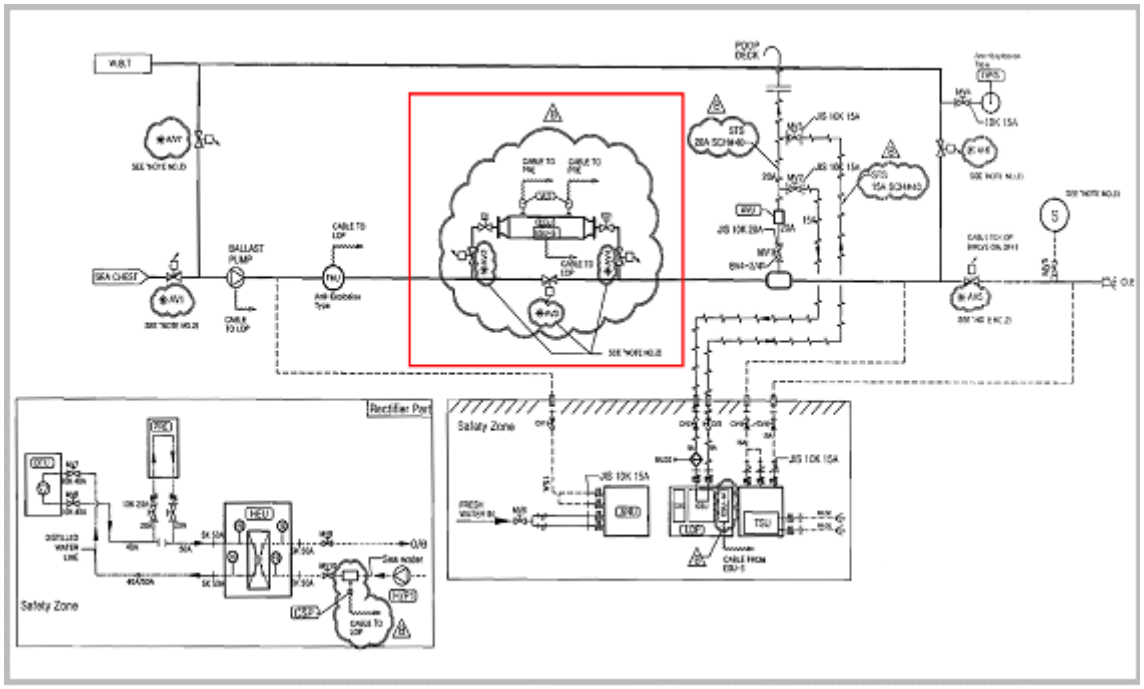


图 IV-3-N 电解型压载水处理系统

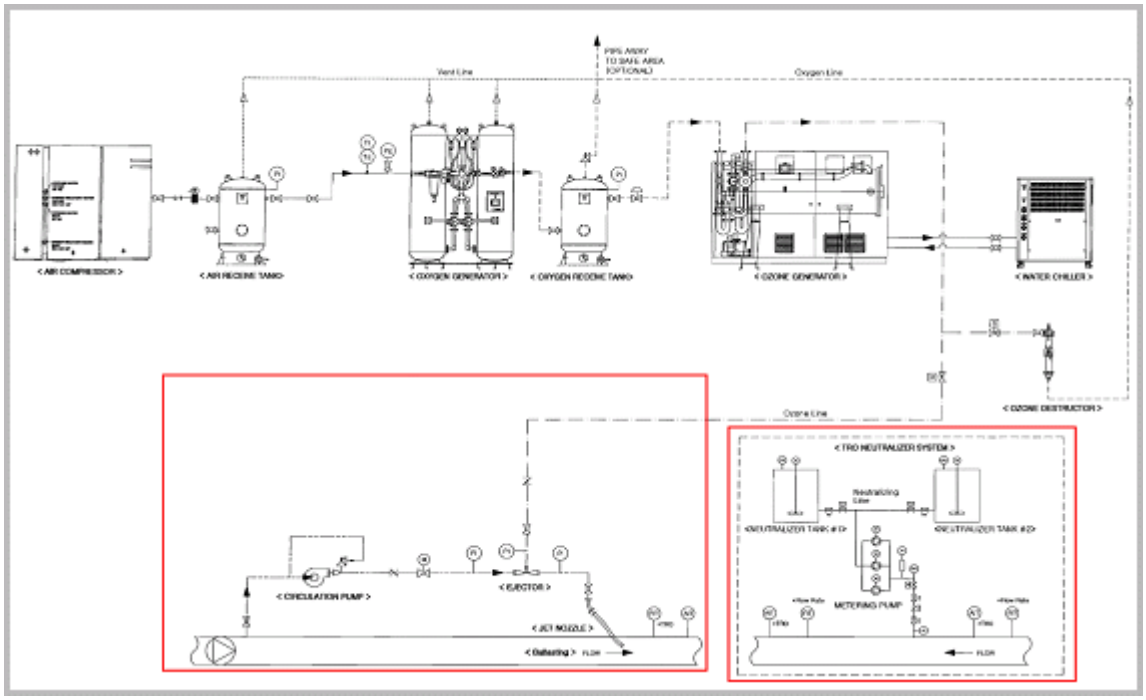


图 IV-3-O Ozone 型压载水处理系统

5. 特别事项

5.1 BWTS的旁通(bypass)警报及记录

在国际压载水管理公约中规定“BWTS的旁通功能（bypass），在发出警报时都要记录在控制设备中。”通过bypass的BWTS，为了能使未处理的压载水向压载舱内注入或从中排除，就要使bypass能自动接受可视可听警报后并能记录在控制装置里。旁通功能和相关的所有阀门要变为远程控制阀，另外，每个阀要设开关指示装置，从而使BWTS的控制设备中有能可以自动探测警报的bypass构成。

5.1.1 安设处狭窄

大部分的船舶都设有2台以上的压载水泵，而且一般是通过泵的出口侧的两个主排水管向压载水舱内注水或由压载水舱向外排水。如果是小型船的话，可能由于安设处窄小等原因只在压载

泵的出口处设置一个主排水管，这样的话在设计时要考虑下列事项。下图IV－2－M即为在BWTS上只设置一个主排水管的船舶。

1） 不是通过BWTS来注水和排水的所有管都拆除或者是可能实现旁通功能的阀则要有可自动发出可视可听警报的系统构成，另外，在控制装置中要能记录。

2） 大部分使用两台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超过设计流速的速度通过BWTS的情况。通常一般配管按约为2~3m/s的速度来设计。

5.1.2 BWTS的初期运转

初期，压载及减压载时，在指定的时间内，要求bypass及再循环型式的BWTS，在设计时，与压载水的注水和排水所涉及到的阀自动联锁使得未经处理的压载水无法注入或排出。若有类似的情况，请参考型式认可的条件及型式认可的图纸上所有的明确记载。特别是现有船若设有具有该特性的BWTS的装置的话，要确认所配置的自动控制阀及联锁阀的型式是否符合，使用液压驱动阀来操作的，还要考虑液压动力源的（Hyd. Power Pack）用量是否充分。另外，该船配有的BWTS作业说明书中一定要包括初期作业过程的说明。

5.1.3 压载卸载用喷射泵

具有大容积的压载舱的化学品船等种类的船舶为了压载舱内水的卸载（抽水），配备专用喷射泵的情况很多。有这种配置的船舶，选择排水时压载水另处理型的BWTS的话，设计时就要使卸载用管中排出的所有压载水可用BWTS来处理。或者拆除所有不经过BWTS的注水和排水管，另外，在卸载管上安装的阀要有可识别警报的系统构成，并且该警报要记录在控制装置里。下面IV－3－Q呈现的是装有卸载用喷水泵的压载管装置图例。

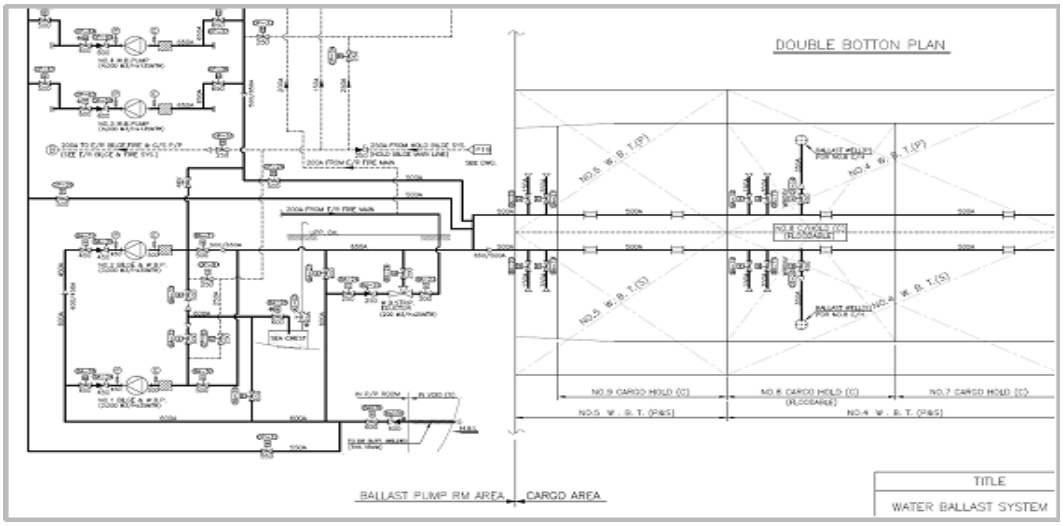


图. IV-3-Q 装有卸载用喷水泵的压载管装置

5.1.4 现有船中的应用

大部分的现有船舶都配有2台以上的压载泵，通过泵出口侧的两个主排水管可以实现压载水的注入和排出。但是，在现有船舶中，如果有新设置的情况，设置空间狭窄或者管道改造很复杂等原因导致的在压载泵的出口侧只设置了一个主排水管的情形，设计时请考虑下面的事项。

1)不是通过BWTS来注水和排水的所有管都拆除，另外管上附着的与bypass有关的所有阀系统请按照上文5.1中的要求执行。

2)大部分使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水的。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超设计流速的速度通过BWTS的情形。

5.2 重力注水和排水

像超大型的化学品货船，压载舱内部配有海底门，通过重力来实现注水和排水，这时要在海底门上配置双重的截止阀，并且要求在干舷甲板上可以实现操作。压载水的处理方式是通过压载舱来实现注水的，排水则通过其他的方式来实现。下图IV－3－R及S所示为通过重力来实现注排水的船舶的例子。

5.2.1 排水时另外的处理方式

1）设有只处理注水压载水的BWTS的船舶，注水时，在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

2）排水时可以通过重力来实现。

5.2.2 排水时其他的处理方式

1）设有其他压载水处理方式BWTS的船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果是具有bypass功能的话，要满足上文中5.1的要求。

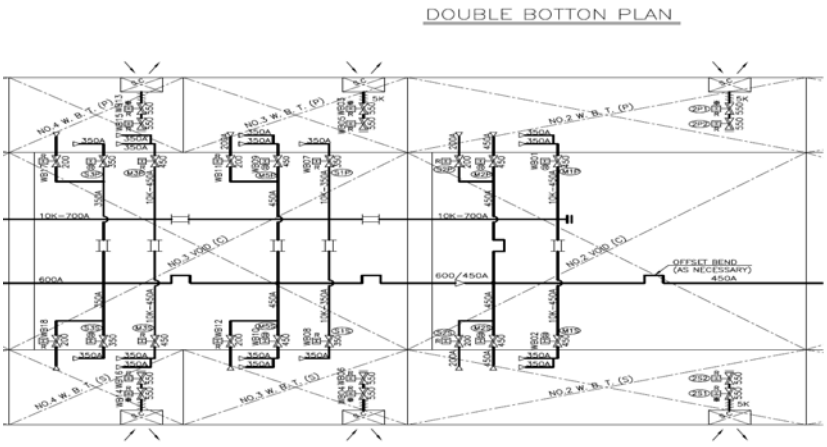


图 V-3-R 通过重力来排水

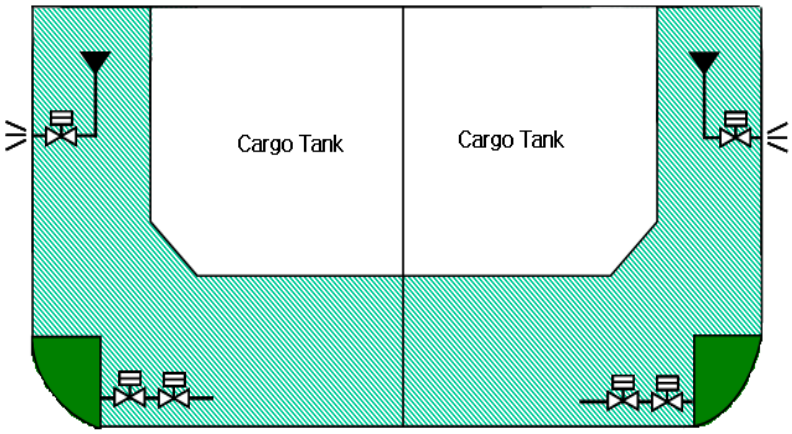


图 V-3-S 通过重力来排水

5.3 重力排水

5.3.1 只处理注水的方式

1） 通过重力从压载水舱内排水的船舶的情况，在设有只处理压载水的BWTS的船舶上，压载水的排水也是通过重力来实现的。

2）注水时，无论什么情况，压在舱内未处理的海水不能进入。并且，重力排水用的排水管上配备的阀门是止回阀。但如果设有可以用于bypass的截止阀的话，要满足前文5.1的要求。

5.3.2 排水时其他的处理方式

1）设有其他压载水处理方式BWTS的船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

2）特别是为了满足有关现有船舶压载水管理公约D1（压载水交换方法）的要求而设置的交换压载水，如果使用溢出管的话，请考虑上述要求。

5.4 作为压载舱使用的货舱

在大部分的油船上都配置了在很恶劣的天气航行或处于紧急状态下时可向货舱内注入压载水的配管装置，与VLCC相似的船舶的货泵舱内设置的海底门可以通过货泵舱来直接吸入水的配管这种型式（通常通过盲板可以切断）也存在。另外，在很多油船上，为了从货舱内排出压载水，不使用压载泵而是通过使用排油监控系统从货泵中排出来。同样，这类船舶上设置的BWTS排水时，压载水要通过其他的方式处理的船舶请考虑以下事项。

5.4.1 设置管时，要使水可从货舱中排出来。

5.4.2 在货舱内，若掺杂了很多油成分等不纯物质的话，排水时，不纯物质会使BWTS的性能下降。因此，在选择配置BWTS时要充分考虑这个问题。

5.4.3 排水时，要考虑与压载水直接接触的紫光灯以及BWTS设置的自动洗涤功能或者使与油粘度一样高的物质的洗涤能力显著下降等方式 。

5.5 具有其他目的的兼用泵

在把消防泵作为压载水泵来使用的船上,BWTS要采用远程控制。 为了使用消防泵的固有功能，在消防泵的消防主管道入口和出口处配置的阀要可实现远程操作。另外，BWTS和舱底泵兼用的情况，要统一考虑后再设计。

5.6 KR簿记符号（船级符号）UMA以上的等级

我船级社的自动化设备簿记符号UMA（UMA,UMA1,UMA2,UMA3）以上等级的船舶，根据我船级钢船建造规范中第9篇第3章的内容，要求消防泵可远程启动。因此，压载水泵和消防泵兼用的船舶，在配置BWTS时也需考虑以上的事项来设计该系统。

5.7 KR簿记符号（船级符号）UMA1以上的等级

我们船级自动化设备的簿记符号UMA1以上等级的船舶，根据我船级钢船建造规范第9篇第3章的内容，要设置可远程控制的压载系统。因此，在具有UMA1以上等级的船舶上设置BWTS时，与压载水的注水排水及BWTS相关的阀要以具有远程控制功能的原则来设计。

5.8 艏尖舱 F.P.T

为了处理被考虑为安全区域的船艏F.P.T的压载，使用位于泵舱内的BWTS，由安全区域变为危险区域原则上来说是不可能的。但是，为了处理艏尖舱F.P.T处使用的压载，使用位于泵舱内的BWTS时，应该满足下列要求。（请参照IACS UR F44）

5.8.1 把F.P.T作为危险区域考虑。

5.8.2 艏尖舱F.P.T用气管开口端的点火源应该在超过IEC60092-502中所要求距离的露天甲板上设置。

5.8.3 在艏尖舱F.P.T内要具备可测量可燃性气体浓度的设施。该设施一般由与露天甲板相连的探测管及便携式探测器组合而构成。

5.8.4 艏尖舱F.P.T的测深管应该引向露天甲板的上面。

5.8.5 从艏尖舱F.P.T的出入口可以直接出入开放甲板。然而，满足下列条件，可以通过密闭区域出入艏尖舱F.P.T。

1）密闭区域在跟货舱不接触时，船艏的出入口是设置在密闭区域内的的气密性的窨井。这种情况下，若确定不存在可燃性气体，或在窨井上相关密闭区域内设置的防爆型电气设备切断后开放等事项的警告牌。

2）若密闭区域与货物舱相邻时，被划分为危险区域，**与危险区域相关的所有要求都一定要满足**，另外要做到可以充分的换气。

5.9 设有BWTS区域的耐火完整性（Fire Integrity）

BWTS及相关的设施设置在甲板舱室居住区域内的情况也是存在的。这种情况要根据SOLAS Reg. Ⅱ-2/3 中关于其他机舱区域和工作区域来定义。与其他区域或工作区域相邻的居住区域的舱壁和甲板要考虑SOLAS.Ⅱ-2/3规则中关于舱壁的耐火完整性要达到A-0以上的要求。

5.10 水舱

如果饮用水舱作为压载水舱来使用，饮用水中所含有的化学物质可以排出的话，请考虑国际压载水管理公约中与IMO相关的内容。

5.11 用电量和回路的构成

对用于BWTS设置所增加的用电量进行分析时，针对该船的电气用量是否充分，要进行审查，因此，电载荷的分析材料向我船级社提交后要接受审查。另外，对于电气设备的过载和短路，要采取适当的保护措施。（请参照附录中用电量及回路结构的内容）

5.12 压载水舱的改造

现有的船舶按压载水国际管理公约附录A-1,Reg.5要求改造为新船时请考虑下列事项

-压载水的运输量有15%以上的变化，或者

-船的种类有变更，或者

-经政府认定，船龄可以继续延长10年以上，或者

-配件的替换，导致BWTS变化的情形

5.13 BWTS的控制，监视及警报

在国际压载水管理公约指南8的第4节中，有关于BWTS的控制装置，监视及警报装置要求的规定。

5.13.1控制，监视及警报装置

1）BWTS处理时所需的投入量及强度可以自动控制。控制装置在运行过程中要一直具备自我监视的性能，并且运行时必须要能自动监视和调节。

2）监视系统是否出现故障或者有不运行等情况发生会妨碍正常运行的话，要求在所有的作业区域内能收到可视可听的警报。

5.13.2运转及控制

1） BWTS的运转及控制方面，单纯从效果上来看，要做到在远程控制场所内容易实现控制。但这里面所说的不是与BWTS有关的所有阀自动化的意思，不包括导致处理装置不运转的阀，是指手动控制阀可以很容易的控制的意思。在这种情况下，在BWTS运行时，与注排水的手动阀控制程序相关的指南及管装置的图纸，最好都在控制场所内展示出来。

2）配有我船级社簿记符号在UMA1级以上的船舶，BWTS运转时，在相关的所有阀的操作及压载泵的驱动控制场所都要有远程控制。

5.13.3 旁通功能（bypass）及覆盖（override）

1）在设有BWTS的船舶上，紧急时期，为了保护船及船员的安全，要设置bypass 和override装置。另外，在旁通(bypass)时，控制和监视设备中可以自动接收到可视可听的警报，并且能记录在控制装置上。

2） 现有的船舶中，大部分在一侧设置压载线，对于剩余的压载线任意使用的情况，要追加可以实现监视功能的设计。与此相关的厂商在审图时要考虑所有与船舶的压载相关的设施。所有的旁通情况（bypass）的目录都要提交并接受审查。

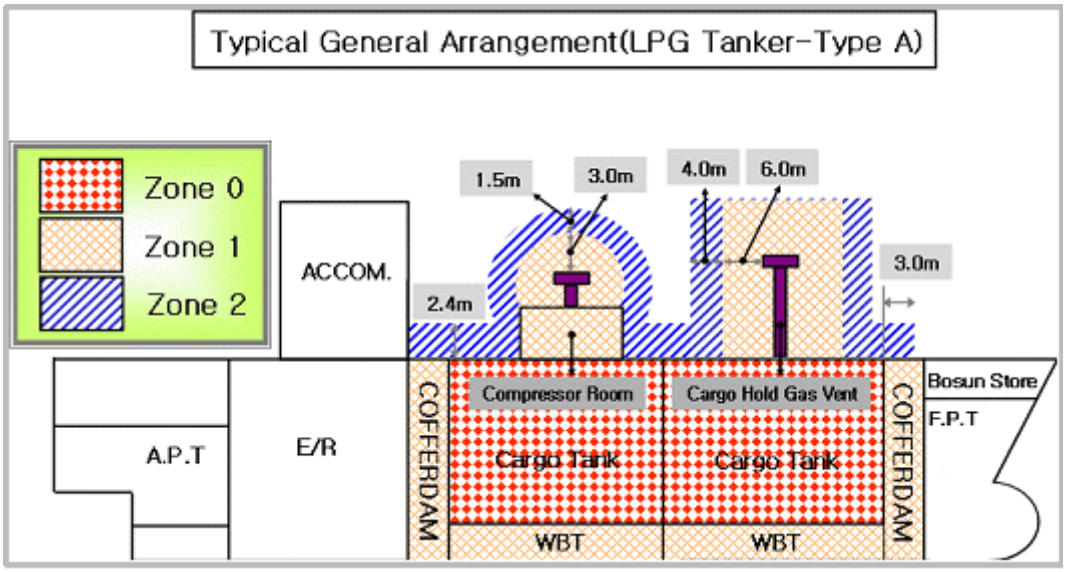
4. 气体载运船

1. 一般事项

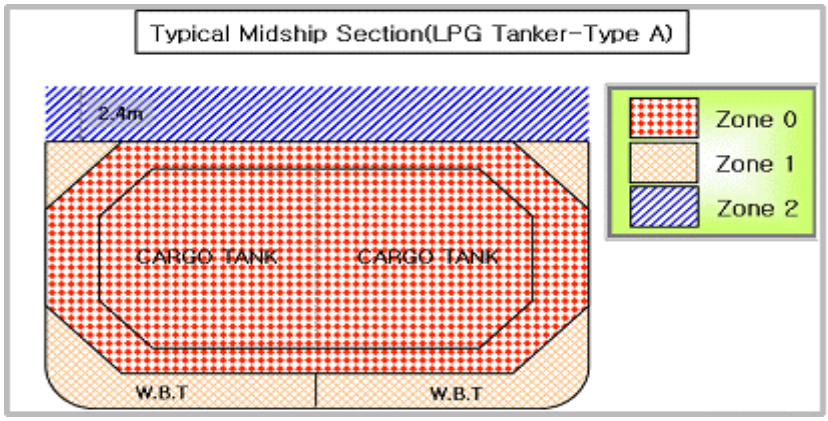
根据KR钢船建造规范7篇5章402（IGC Code Reg.4.2）要求，依据运送液化石油或液化天然气的气体载运船的承载货物的货物围护系统（CCS：Cargo Containment System）的不同，可分为一体型货舱，膜式舱柜，半薄薄膜槽，独立货舱（Type A,B,C）及内部防热防腐舱等几种型式。

1.1 石油液化气船

图IV－4－A~B所示，大部分为石油液化气船的独立型货物围护舱。



图IV－4－A石油液化气船的总布置图



图IV－4－B石油液化气船的舯横剖面图

1.1.1 石油液化船-A类

1）图IV-4-A和IV-4-B为A类石油液化气船的一般配置图及舯横剖面图的例子。大部分A类的货舱都是低温低压的型式，货舱容量一般在20K,40K或者80K。中大型的石油液化船一般都采用这种型式。

2）图IV-4-B所示的舯横剖面图，为独立型货舱中A类货物围护系统的石油液化气船的货物围护设计结构，另外还有密闭货舱。为了实现货舱区域的警戒，配置了压载舱。但是，如KR的钢船建造规范7篇5章407.2中的要求，在大气压下，货物温度在-55°C以上的时候，为了避免使用不必要的船体结构两层隔墙，在货舱的两弦侧与顶部中的一部分形成了没有压载舱的船体外板。因此，这种压载舱不能实现货物围护系统和直接警戒。参见这种A类的石油液化气船的舯横剖面图，可以看出这种船拥有与典型的单壳散货船类似的结构。

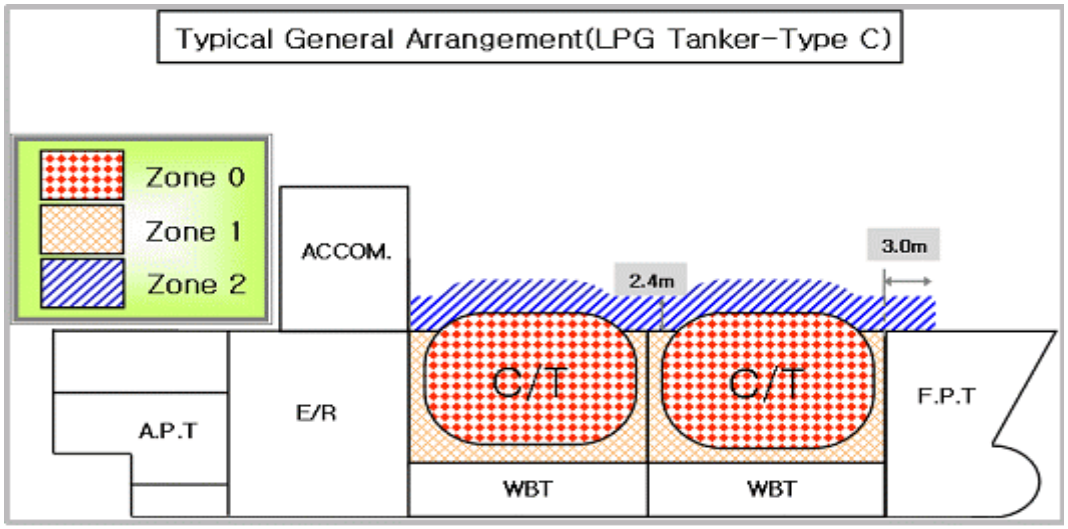
3)轮机室内的压载泵的配置要符合KR钢船建造规范7篇5章307.4（IGC Code Reg.3.7.4）的要求。因此，大部分的大型A类石油液化气船舶要在轮机室内设置两台专用的消防压载泵或舱底消防总用泵作为专用的压载泵。为了实现该泵在包括艉尖舱在内的所有压载舱的注水及排水，有些大型的船还会设置喷射泵或类似的压载剥离泵。

1.1.2 C类石油液化气船

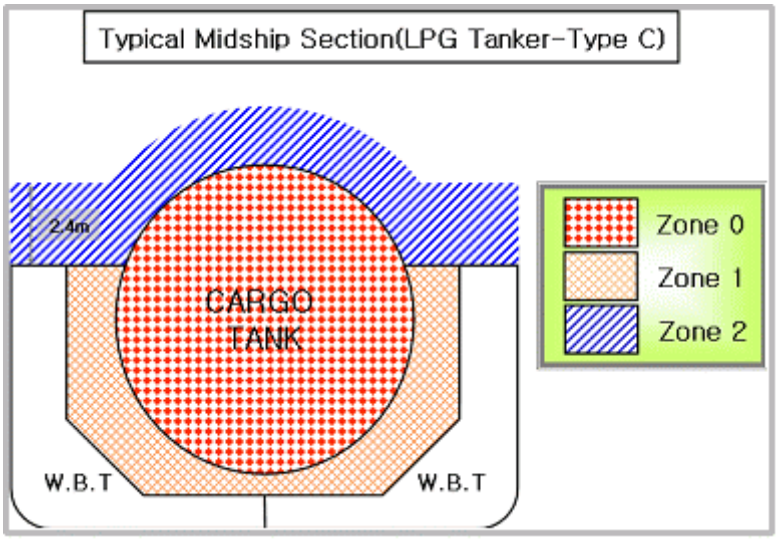
1）图IV-4-C及D所示为典型的C类 石油液化气船舶的一般配置舯横剖面图。大部分C类货物舱都有高压容器或气缸型式的货舱，并且这种形式被容量在10K以下的中小型石油液化气船所广泛应用。

2）图IV-4-B所示的舯横剖面图，为独立型货舱中A类货物围护系统的石油液化气船的货物围护设计结构，另外还有密闭货舱。为了实现货舱区域的警戒，配置了压载舱。因此，这种压载舱不能实现货物围护系统和直接警戒。

3）轮机室内的压载泵的配置要符合KR钢船建造规范7篇5章307.4（IGC Code Reg.3.7.4）的要求。因此，大部分的大型C类石油液化气船舶要在轮机室内设置专用的消防压载泵或舱底消防总用泵作为专用的压载泵来实现排水 。



图IV－4－C 石油液化气船舶的一般配置图



图IV－4－D石油液化气船舶的舯横剖面图

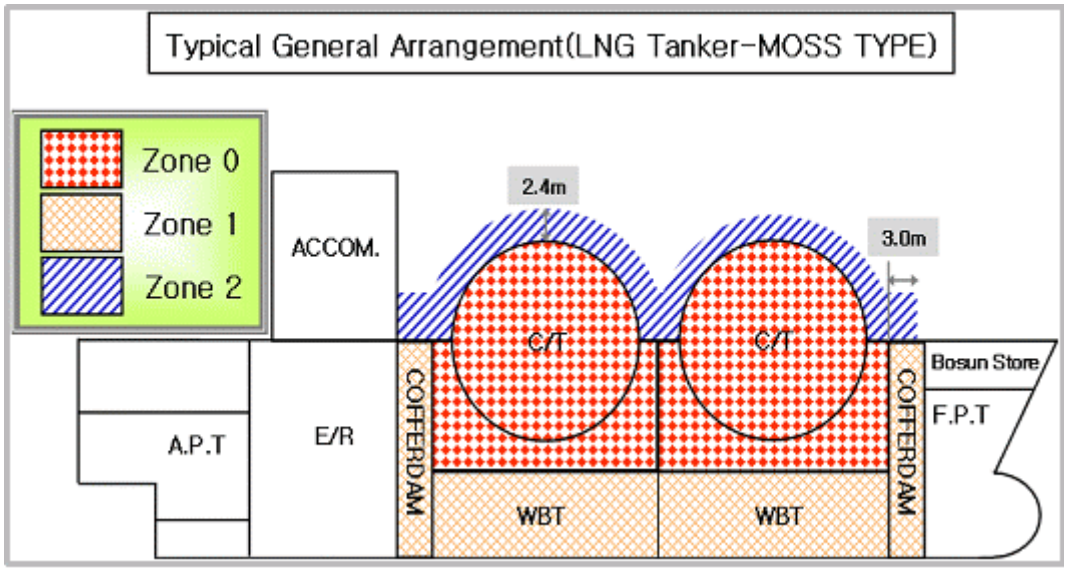
1.2 液化天然气船

液化天然气船中，具有独立货舱B类围护系统结构的Moss型液货船及具有膜式舱柜（MARK III, GT N0.96, CS 1）围护系统的膜式舱柜型液化天然气船是最为常见的类型。

1.2.1 Moss型液化天然气船

1）图IV-4-E及F所示为典型的Moss型液化天然气船的一般配置图及舯横剖面图。图IV-4-F舯横剖面图为独立型货舱中C类货物围护系统的石油液化气船的货物围护设计结构，另外还有密闭货舱。为了实现货舱区域的警戒，配置了压载舱。因而，这种压载舱不能实现货物围护系统和直接警戒。

2）轮机室内的压载泵的配置要符合KR钢船建造规范7篇5章307.4（IGC Code Reg.3.7.4）的要求。因此，大部分的Moss型液化天然气船舶要在轮机室内设置两台专用的消防压载泵或舱底消防总用泵作为专用的压载泵。为了实现该泵在包括艉尖舱在内的所有压载舱的注水及排水，有些大型的船还会设置喷射泵或类似的压载剥离泵。



图IV-4-E Moss型液化天然气船的一般配置图

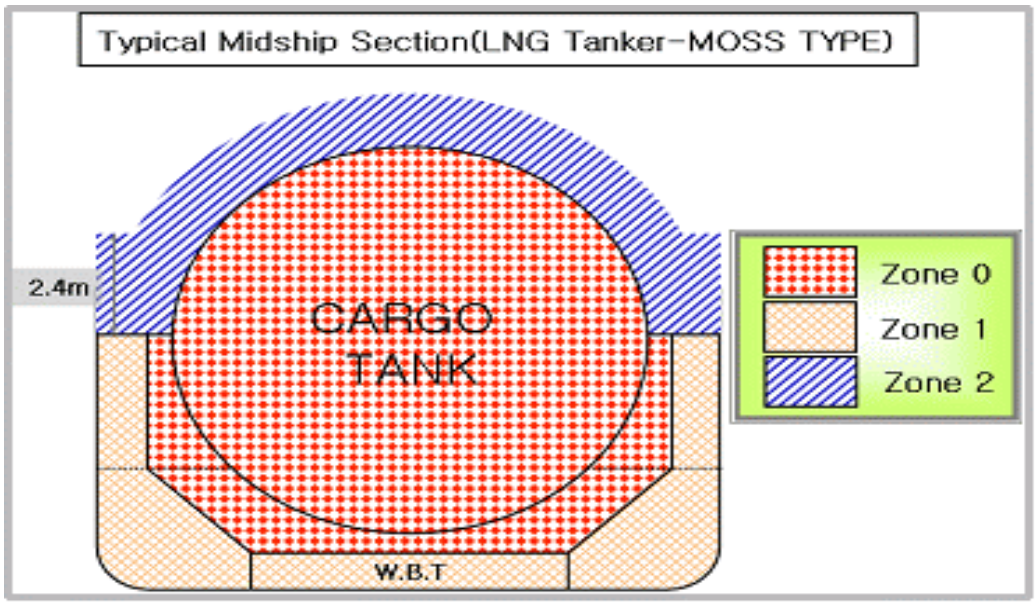
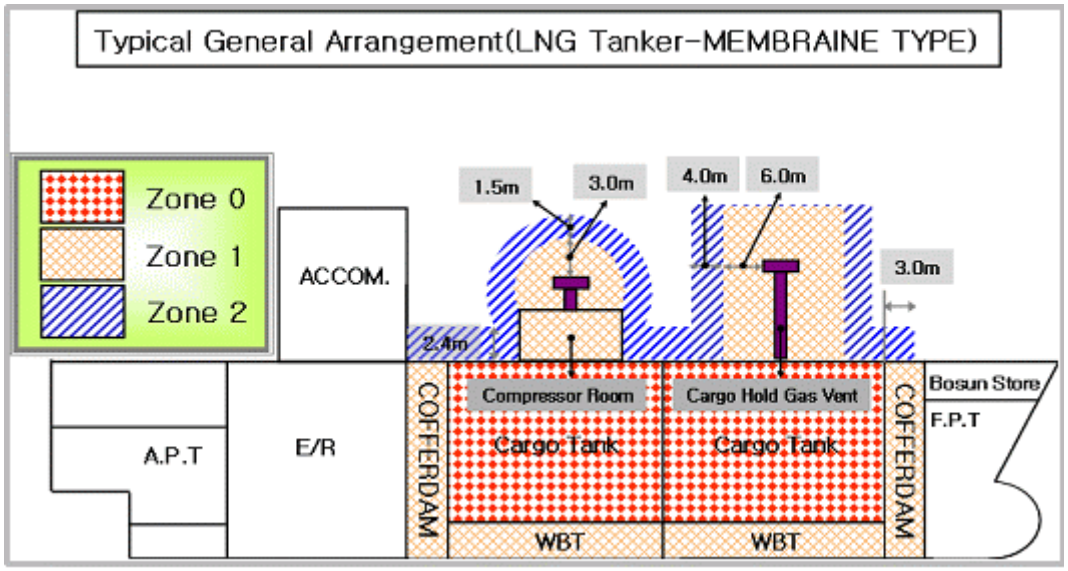
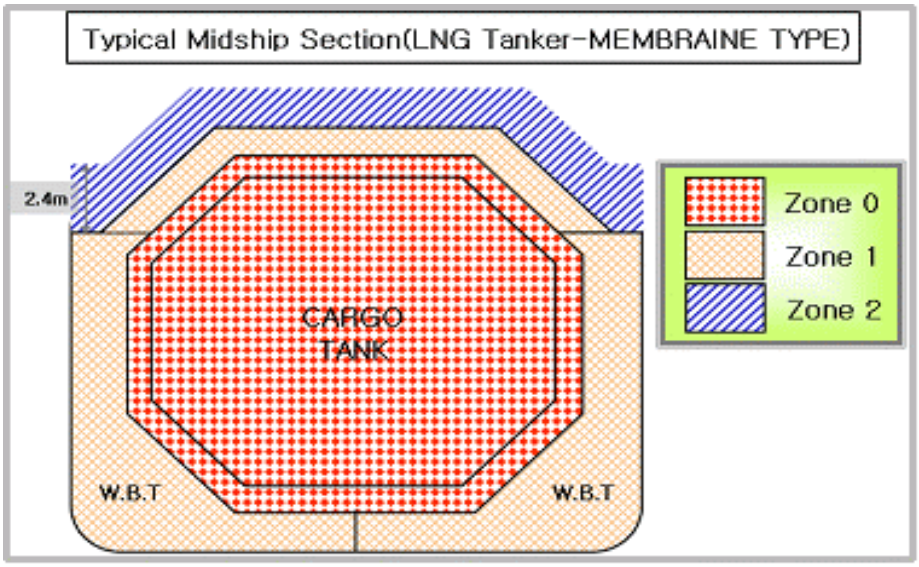


图 IV-4-F Moss型液化天然气船的舯横剖面图



图IV－4－G典型的膜式舱柜型液化天然气船的一般配置图



图IV－4－H 典型的膜式舱柜型液化天然气船的舯横剖面图

1.2.2 膜式舱柜型液化天然气船

1）具有膜式舱柜式围护系统的液化天然气船货物的围护系统是由第一层隔板围护货物的第二层隔板构成的，并且具有支持这种隔板的内壳板结构。在这种内壳板及船体外板间配置了压载舱结构。

2）图IV－4－G及H所示为典型的膜式舱柜型液化天然气船的一般配置图及舯横剖面图。如舯横剖面图图IV－4－H所示， 具有膜式舱柜式围护系统的液化天然气船货物的围护系统是由第一层隔板围护货物的第二层隔板构成的，并且具有支持这种隔板的内壳板结构。在这种内壳板及船体外板间配置了压载舱结构。 因而，这种压载舱能直接实现货

物围护系统和直接警戒。

3）轮机室内的压载泵的配置要符合KR钢船建造规范7篇5章307.4（IGC Code Reg.3.7.4）的要求。因此，大部分的膜式舱柜型液化天然气船舶要在轮机室内设置两台专用的消防压载泵或舱底消防总用泵作为专用的压载泵。为了实现该泵在包括艉尖舱在内的所有压载舱的注水及排水，有些大型的船还会须置喷射泵或类似的压载剥离泵。

2.相关规范

2.1 KR钢船规范7篇5章307.4（IGC Code Reg.3.7.4）

在气体载运船的压载区域（包括使用了压载管的湿式箱式龙骨），燃料油舱及气体安全区域与轮机舱内的泵由管来连接，或者与泵体直接连接的话，由泵直接向船外导出。这种情况与箱型龙骨到气体安全区域内的泵相连接的管的任何位置都不要设置valve 和manifold. 泵的空气管在轮机室内不能有开口。

3.危险区域（Dangerous Zone）

根据在 IEC 60092-502 Reg.4.4中可燃性气体存在的概率及危险性可划分为Zone0, Zone1, Zone2等。由于Zone等级的不同，设置的电器设备的型式也有所不同。根据气体载运船的的第二层隔板是否符合要求，来划分压载舱是否为危险区域，在具有代表性的C类船舶中，如果包含第二层隔板不符合要求的货舱围护系统，那么货物舱区域被指定为Zone 1，而压载货舱则不是危险区域。与危险区域及货物舱电气设备的保护类型相关的详细内容，请参照Appendix A不同种类船舶危险区域及电气设备型式中第四行的内容。

3.1 A类石油液化气船

如图IV-4-A及B所示，货物围护系统及相相邻的货物舱区域如果被划分为Zone 0的话，相相邻的压载舱和排管周围则被划分为Zone 1区域。并且，货舱上面被划分为Zone 2。

3.2 C类的石油液化气船

如图IV-4-C及D所示，如果货物围护系统被划分为危险区域Zone 0,与货物围护系统相相邻的货物舱区域及排管周围则被划分为Zone 1,并且货物舱上的甲板区域被划分为Zone 2. 但货舱及压载舱则被划分为安全区域。

3.3 Moss型液化天然气船

如图IV-4-E及F所示，货物围护系统及与其相相邻的货舱区域被划分为危险区域Zone 0。

与压载舱相相邻的的压载舱及排出管的周围被划分为Zone1.另外，货舱上部也被划分为 Zone 2。

3.4 膜式舱柜型液化天然气

如图IV-4-G及H所示，第一层隔板与第二层隔板被划分为危险区域Zone 0,与货舱相相邻的压载舱及排管的周围被划分为Zone 1,另外，货舱上面的甲板被划分为Zone 2。

4. BWTS的设置

4.1 在轮机舱内设置

在轮机舱内设置的与货舱相相邻的压载舱内的压载泵要符合KR钢船建造规范7篇5章 307.4（IGC Code Reg. 3.7.4）中的内容。因而，大部分的气体载运船舶通过压载泵来实现压载水的注水和排水。符合第二层隔板要求的船舶，尽管根据IEC 60092-502中关于危险区域的定义，压载管应该看作是Zone 1区域，但如果格外符合了IGC Code中关于泵的设置的要求的话。轮机区域内设置的BWTS也可以看作是没有违背规范的要求。但是，由于压载管被看作是Zone 1, 在压载管上直接设置的BWTS处理装置及控制和监视用传感器都要符合认证型式的防爆要求。另外，为了使压载管中泄漏的气体的危险性能最小化，可能成为泄漏气体的的危险源的法兰及阀要尽量最少化。不需要第二层隔板的C类船舶的压载舱被认为是安全区域，不能在危险区域内设置的BWTS的电气设备也没有必要是防爆型的。

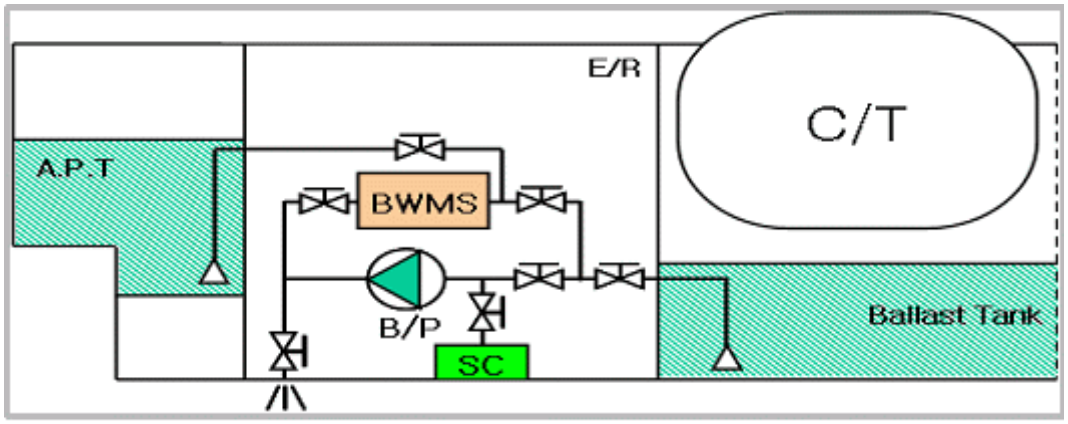
4.1.1 C类石油液化气船

图IV-4-I 为C类石油液化气船的轮机舱内BWTS设置的简略图。大部分的船舶使用轮机舱内设置的消防压载泵及舱底消防总用泵来实现注水和排水。

1）独立型C类石油液化气船的压载舱不被考虑为危险区域而是安全区域的，使用非防爆型的BWTS来处理压载水更好。

2）在处理压载水时在产生臭氧及类似气体的场所，要设置臭氧探测器以至于在泄漏时可以获得相关警报。另外，产生臭氧的管要使用双层管或者完全无缝焊接管SUS Pipe等特殊的方式。

3）如果在BWTS处理后会有氢气等类似的危险气体产生的话，要采取措施防止危险气体在轮机舱内流出。并且排放危险气体的管道要导向轮机舱外安全的地方。

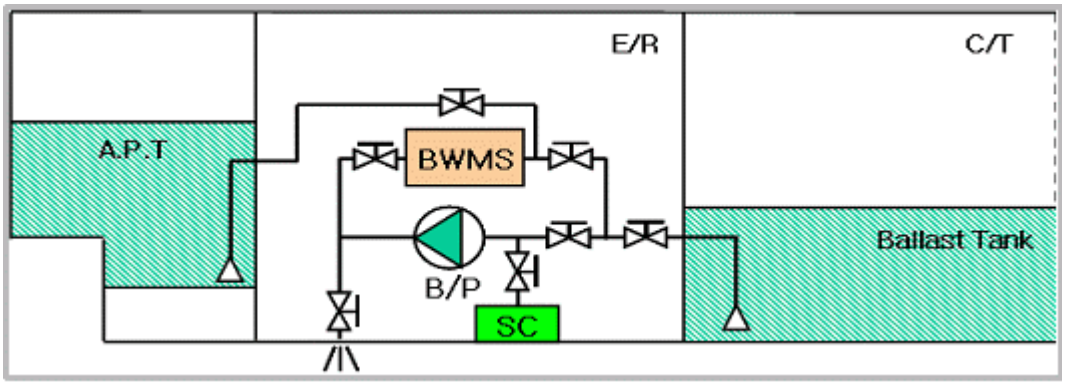


图IV-4-I C类石油液化气船的轮机舱内BWTS设置的简略图

4.1.2 C类石油液化气船以外的其他船舶

图IV-4-J,K及L 为A类石油液化气船，Moss型船及Membrane型石油液化气船的轮机舱内设置BWTS的简略图。大部分压载舱内的注排水是通过船舶轮机舱内设置的专用的压载泵来实现的。

如图IV-4-A& B 及图IV-4-E~H中与A类石油液化气船，Moss型船及Membrane型石油液化气船的货物围护系统相相邻的压载舱可以考虑为危险区域Zone 1。然而，在KR钢船建造规则7篇5章307.4（IGC Code Reg.3.7.4）中规定，为了使用与货舱相相邻的压载水舱而在轮机舱内设置的压载泵，这样的话，就要使轮机舱内设置的BWTS能处理压载水。压载舱被划为危险区域Zone 1，因此需要考虑以下事项。



图IV-4-JA类石油液化气船轮机舱内设置BWTS

1）BWTS如果只处理向压载舱内注水的情况时，经我船级社的检验，可以设置为非防爆型的BWTS处理装置。但是，在排水时需要设置必要的型式认可的防爆型电气设备，并且用非防爆型BWTS处理排水时，要保证电源由不能任意投入的系统构成。

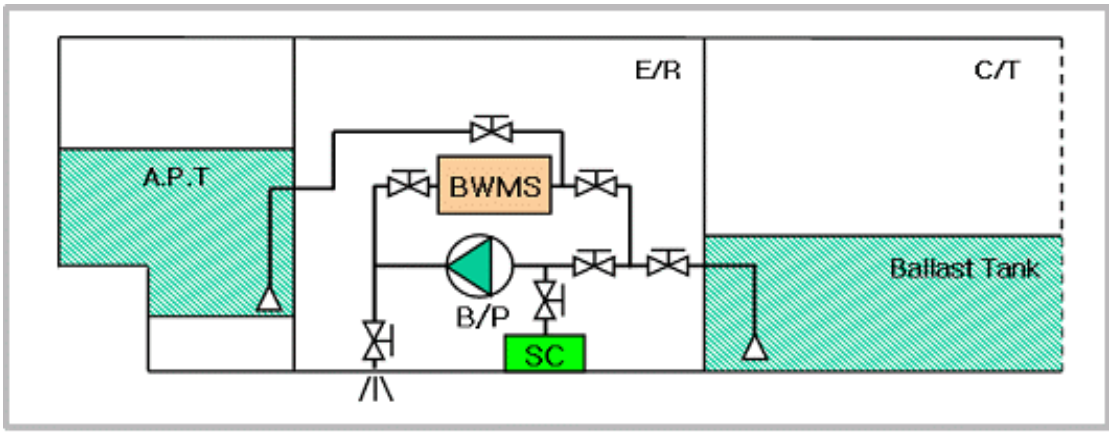
2）选用压载舱的注排水都能处理的BWTS船舶时，压载管及相关的电气设备（BWTS处理装置及各种传感器等）都要是型式认可的防爆型。

3） 在有些BWTS中设有总残余氧化剂传感器及气体传感器的设备上设有排水管的情形，排

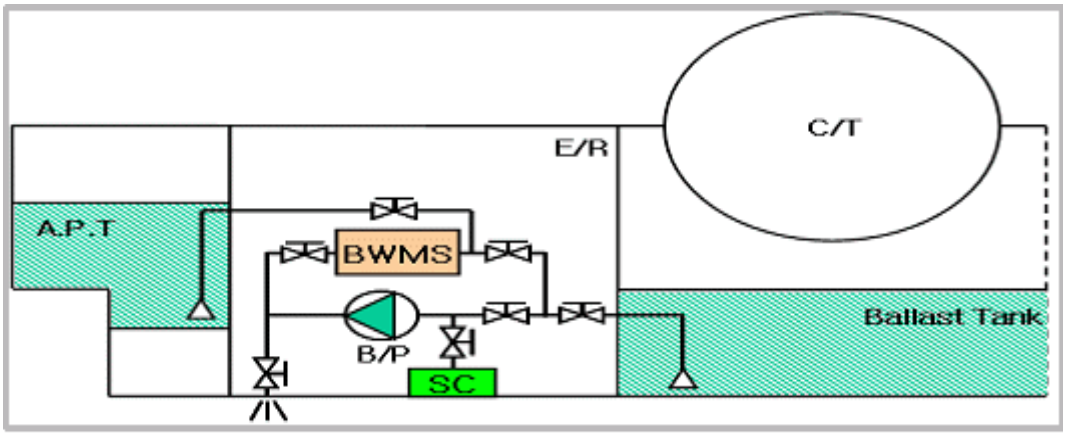
水管要向外导出或者在轮机舱内直接设置导向船外的管。

4） 在有些BWTS中设有自动通风机组的设备上设有通风管时，该管要引向轮机舱外的安全场所。

5）在压载排管上附着的抽样管应该引向轮机舱外。在BWTS处理后，若有氢气或类似的危险气体产生时，应该保证危险气体不流向轮机舱内，并且危险气体排出管应该排向轮机舱外的安全场所。由于处理压载水会产生臭氧等气体的装置所在的区域内，应该设置臭氧探测器，并要设有流出时能发出警报的装置。另外，运送产生的臭氧的管路要求使用双层管或安全焊接管SUS Pipe等特殊功能的结构。



图IV-4-K Membrane型石油液化气船的轮机舱内设置BWTS



图IV-4-L Moss型船的轮机舱内设置BWTS

4.2 在轮机舱外设置

为了在轮机室内设置必要的装置，要求有符合要求的空间。然而，如果轮机舱狭窄或者配管比

较困难的话，在轮机舱外设置BWTS的情况也存在。在露天甲板上的其他密闭区域设置BWTS的话，其他的密闭区域会使船舶的总吨数有所增加。特别是船舶的总吨数有所变化，是由于设备有显著的变化的情形，要与基本技术部进行协商。

4.2.1 C类的石油液化气船

图IV-4-M为C类石油液化气船外部设置BWTS的简略图。甲板上等轮机舱外设置BWTS时，要考虑下面的要求。

1）如图IV-4-C及D所示，要在危险区域外部设置BWTS。如果不得已在被看作危险区域的场所内设置BWTS的话，要设为认可的防爆型。

2）与甲板上部等高处设置BWTS，要把压载水管引到甲板上，压载水处理方式，要考虑关于压载泵的水头的减少，还有压载水由高处向低处移动时，压载管会发生过度的振动。为了防止过度振动的发生，应该采用真空阀等相应的措施。

3）如图IV-4-C及D所示，甲板上很多区域被划分为危险区域，考虑到这个问题，需要把BWTS设在危险区以外的地方。若不得已要设在被划为危险区域的场所内的话，要特别考虑电气设备防爆等级。

4）在为处理压载水而产生臭氧的设备处应该安装臭氧感应器以便臭氧放出时发出警报。此外，在甲板以外设有的臭氧供给管可用两层管或者完全焊接管SUS Pipe等特殊的引出措施。

5）在BWTS处理后，若使用会产生氢气等危险气体的型式时，流出的危险气体可以储存在密闭区域内的话，危险气体排出管应该引向外面的安全场所。

6）在露天甲板上设置BWTS的情况，各装备都要考虑选择正确的IP 等级。

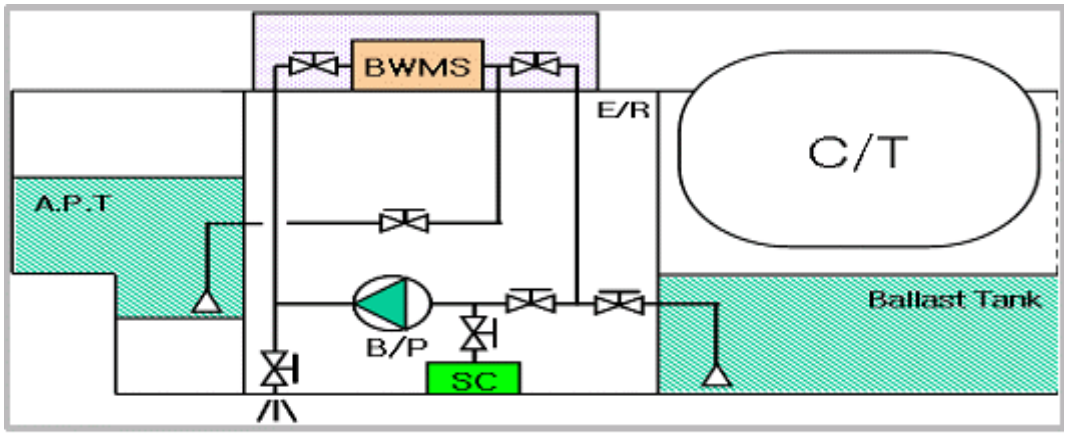


图 V-4-M 在石油液化气船的机舱外设置压载水

4.2.2 C类石油液化气船以外的船舶

图IV-4-N,O及P为A类石油液化船，Moss型石油液化船及Membrane型石油液化船的轮机

舱外设置BWTS的简略图。在C类独立型货舱的石油液化气船以外的A类石油液化船，Moss型石油液化船及Membrane型石油液化船的货物围护系统相邻的压载舱被划分为危险区域。

1）在甲板上面，被设定为安全区的密闭区域上设置BWTS的话，要考虑下列要求。

a.只处理压载舱注水的BWTS的电气设备采用防爆型电气设备，没有什么特别的问题。

b.在有些BWTS的总残余氧化剂传感器组，气体传感器组上设有排水管的话，这些排水管要引向密闭区域外的安全场所。

c. 在有些BWTS中设有自动通风机组的设备上设有通风管的话，该管要引向轮机舱外的安全场所。

d. 在压载排管上附着的抽样管应该引向轮机舱外。

e. 由于处理压载水而会产生臭氧等气体的装置所在的区域内，应该设置臭氧探测器，并要设有流出时能发出警报的装置。另外，运送产生的臭氧的管路要求使用双层管或安全焊接SUS Pipe等特殊功能的结构。

f. 在BWTS处理后，若有氢气或类似的危险气体产生，应该保证危险气体不排向密闭区域，并且危险气体排出管应该引向密闭区域外的安全场所。

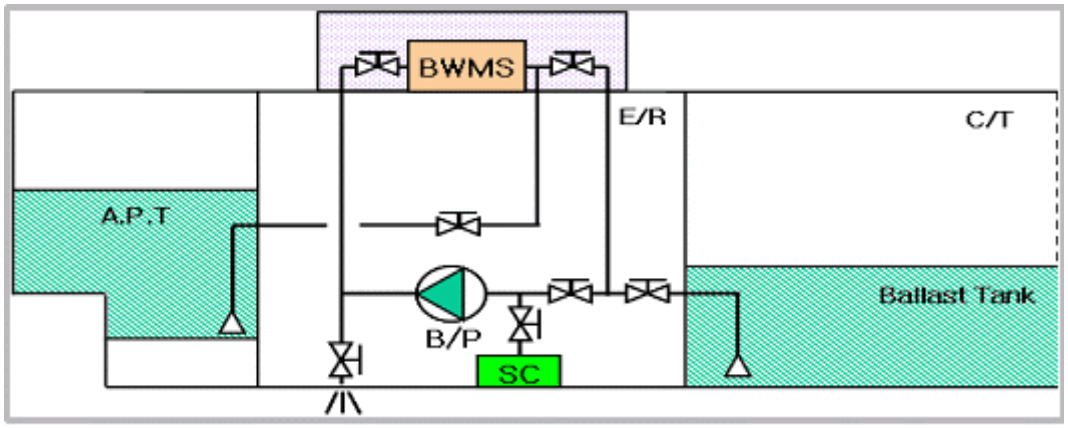


图 IV-4-N 在石油液化气船的机舱外设置压载水

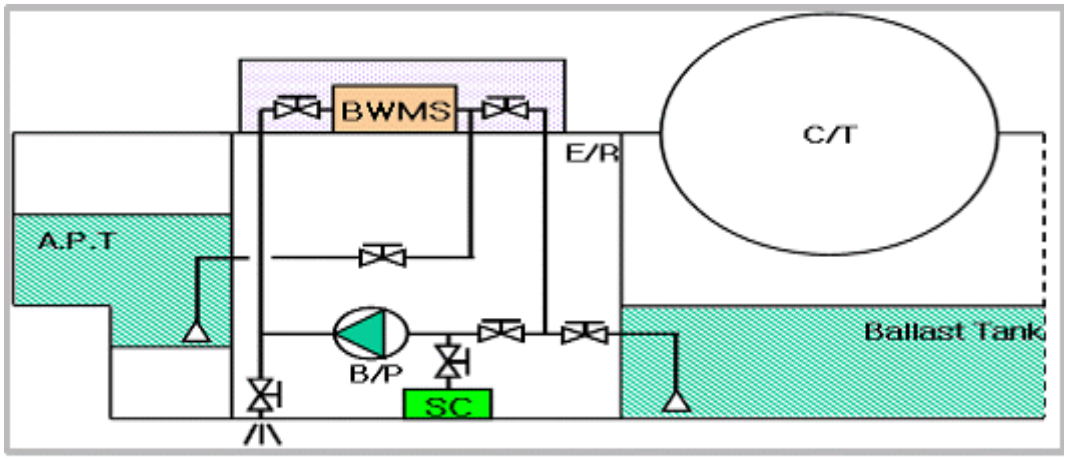


图 IV-4-O 在 Moss 型石油液化气船的机舱外设置压载水

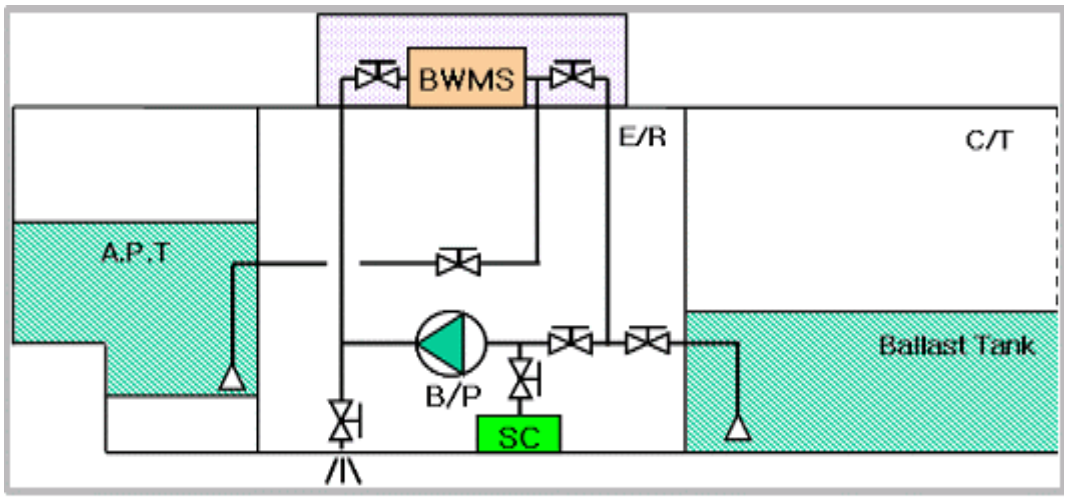


图 IV-4-P Membrane 型石油液化气船的机舱外设置压载水

2）与甲板上等高处设置BWTS时，要把压载水管引到甲板上，压载水处理方式，要考虑关于压载泵的水头的减少，还有压载水由高处向低处移动时，压载管会发生过度的振动。为了防止过度振动的发生，应该采用真空阀等相应的措施。

3）如图IV-4-A，E及G所示，要在危险区域外，设置BWTS，不得已被看做是危险区域的场所内设置BWTS的话，要设置认可的防爆型。

4）BWTS设置在露天甲板上的话，各设备要考虑选择正确的IP等级。

4.3 BWTS 设置时的注意事项

4.3.1 管及电缆穿透部位采取的措施

安装BWTS使用穿过舱壁及甲板的管或电缆时，穿透处的舱壁和甲板要使用统一的防火构造或水密构造来建造。特别是电缆和管穿过安全区域与危险区域之间的舱壁时，还一定要满足气密构造的要求。 关于穿透处的详细内容请参见我船级规范第8篇附录8－2节中“穿透处的划分”。

4.3.2 压载抽样型电气设备

总残余氧化剂传感器组，气体传感器组被划分为危险区域的压载舱的压载管如果为直接抽样式时，要在危险区域外设置认可的防爆型产品，安全区域内设置的情况，也要在安全区域内设置合适的型式。

4.3.3 关于电气分解方式要特别考虑的事项

1）线路的电压下降

使用电气分解式BWTS时，通过使用整流器来把440V的交流电（或220V）变为36V以下的直流电，从而实现压载水处理装置电的供给，并且这时会有很大的电流流经供给线路中。因此，由于输送电的距离长会使电压下降，为了能使处理设备正常地运转，应该把电缆设置成小于制造商所限定的长度。

2）导电条（母线）的线路构成

电气分解时，由于输送较大的电流，当处理设备容量很大的时候，电缆的尺寸和售价都会有相当大的增加。由于这个原因，为了使设备小型化，就有了由导电条（母线）构成的线路。导电条（母线）要选择我船级社型式认可的产品，并且一定要在后备箱内配置等级号在IP54以上的该产品。导电条（母线）要尽可能避开在危险区域或露天甲板上设置，万一设置在了危险区域的话，一定要使用防爆型，特别是在从安全区域到危险区域的穿透处设置时， 还要满足有关舱壁穿透处防火构造和气密构造的要求。另外，关于船内及舱壁穿透处的设置，一定要使用我船级社认可的型式。

5. 特殊事项

5.1 BWTS的旁通(bypass)警报及记录

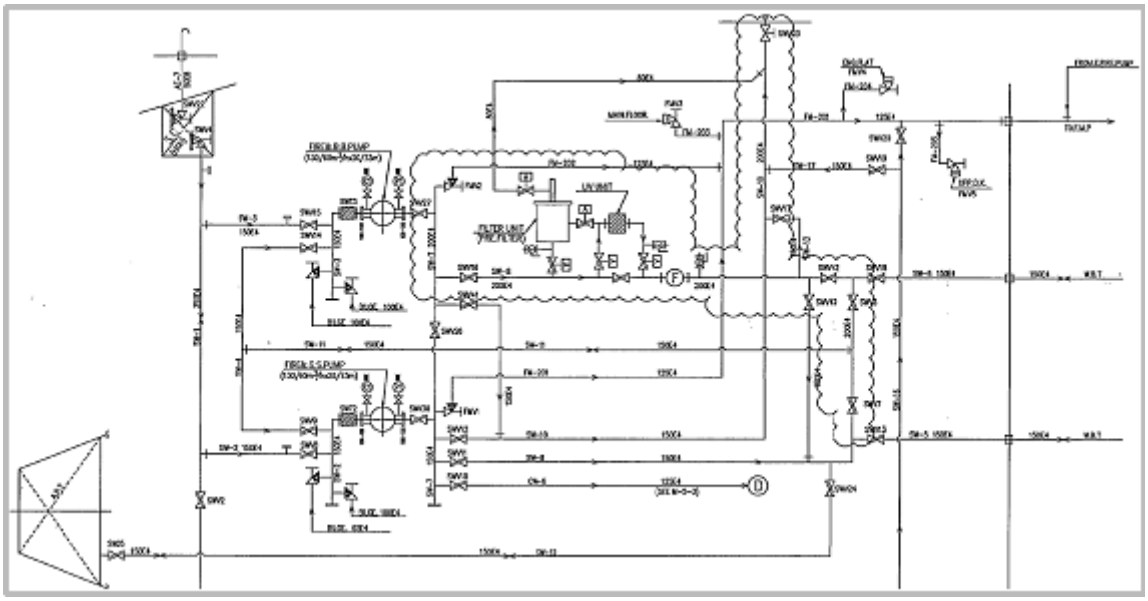
在国际压载水管理公约中规定“BWTS的旁通功能（bypass），在发出警报时都要记录在控制设备中。”通过bypass的BWTS，为了能使未处理的压载水向压载舱内注入或从中排除，就要使bypass能自动接受可视可听警报后并能记录在控制装置里。旁通功能和相关的所有阀门要变为远程控制阀，另外，每个阀要设开关指示装置，从而使BWTS的控制设备中有能可以自动探测警报的bypass构成。

5.1.1 安设处狭窄

大部分的船舶都设有2台以上的压载水泵，而且一般是通过泵的出口侧的两个主排水管向压载水舱内注水或由压载水舱向外排水。如果是小型船的话，可能由于安设处窄小等原因只在压载泵的出口处设置一个主排水管，这样的话在设计时要考虑下列事项。下图IV－4－Q即为在BWTS上只设置一个主排水管的船舶。

1） 通过BWTS来注水和排水的所有管都拆除或者可能实现旁通的阀，由可自动发出可视可听警报的系统构成，另外，在控制装置中要能记录。

2） 分别使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水的。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超过设计流速的速度通过BWTS的情况。通常一般配管按约为2~3m/s的速度来设计。



图IV－4－Q在BWTS上只设置一个主排水管的船舶

5.1.2 BWTS的初期运转

初期，压载及减压载时，在指定的时间内，要求bypass及再循环型式的BWTS，在设计时，与压载水的注水和排水所涉及到的阀可以自动连锁使得未经处理的压载水无法注入或排出。若有类似的情况，请参考型式认可的条件及型式认可的图纸上所有的明确记载。特别是现有船若设有具有该特性的BWTS装置的话，要确认所配置的自动控制阀及联锁阀型式是否相符，使用液压驱动阀来操作的，还要考虑液压动力源的（Hyd. Power Pack）用量是否充分。另外，该船配有的BWTS作业说明书中一定要包括初期作业过程的说明。

5.1.3 压载卸载用喷射泵

具有大容积的压载舱的油船等类似的船舶为了压载舱内水的卸载（抽水），配备专用喷射泵的情况很多。有这种配置的船舶，选择排水时压载水若使用其他型式的BWTS，设计时就要保证卸载用管中排出的所有压载水可用BWTS来处理。或者拆除所有不经过BWTS的注水和排水管，另外，在卸载管上安装的阀要有可识别警报的系统构成，并且该警报要记录在控制装置里。

5.1.4 现有船舶中的应用

大部分的现有船舶都配有2台以上的压载泵，通过泵出口侧的两个主排水管可以实现压载水的注入和排出。但是，在现有船舶中，如果有新设置的情况，设置空间狭窄或者管道改造很复杂等原因导致的在压载泵的出口侧只设置了一个主排水管的情形，设计时请考虑下面的事项。

1)不是通过BWTS来注水和排水的所有管都要拆除，另外管上附着的与bypass有关的所有阀系统请按照上文5.1中的要求执行。

2)大部分使用2台泵，一台是用于压载水的注水，另一台则是为了向主排水管中运送压载水的。由此可见，在设计时应该考虑，由于配管的流速增加，配管受到过盈压力或以超设计流速的速度通过BWTS的情况。

5.2 重力排水

5.2.1 只处理注水的方式

1）与石油液化气船或液化天然气船所类似的，通过重力从压载水舱内排水的船舶，在设有只处理压载水的BWTS的船舶上，压载水的排水也是通过重力来实现的。

2）注水时，无论什么情况，压在舱内未处理的海水不能进入。并且，重力排水用的排水管上配备的阀门是止回阀。但如果设有可以用于bypass的截止阀的话，要满足上文中5.1的要求。

5.2.2 排水时另外的处理方式

1）设有另外的压载水处理方式的BWTS的船舶，排水时要处理压载水，同时在海底门上配备的阀一定要关闭。另外，该阀门如果具有bypass功能的话，要满足上文中5.1的要求。

2）特别是为了满足有关现有船舶压载水管理公约D1（压载水交换方法）的要求而设置的交换压载水，如果使用溢出管的话，请考虑上述要求。

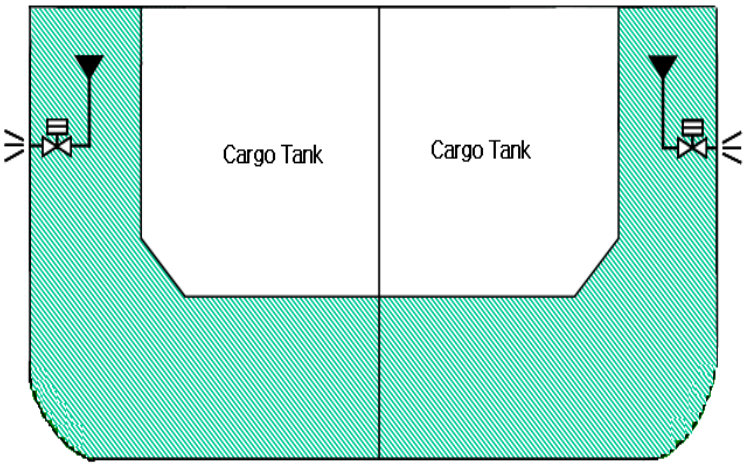


图 IV－4－R 用重力来实现排水

5.3 具有其他目的的兼用泵

在把消防泵作为压载水泵来使用的船上,BWTS要采用远程控制。为了使用消防泵的固有功能，在消防泵的消防主管道入口和出口处配置的阀要可实现远程操作。另外，BWTS和舱底泵兼

用的情形，要统一考虑后再设计该系统。

5.4 KR簿记符号（船级符号）UMA以上的等级

我船级社的自动化设备簿记符号UMA（UMA,UMA1,UMA2,UMA3）以上等级的船舶，根据我船级钢船建造规范中第9篇第3章的内容，要求消防泵远程启动。因此，压载水泵和消防泵兼用的船舶，在配置BWTS时也需考虑以上的事项来设计该系统。

5.5 KR簿记符号（船级符号）UMA1以上的等级

我们船级自动化设备的簿记符号UMA1以上等级的船舶，根据我船级钢船建造规范第9篇第3章的内容，要设置可远程控制压载的系统。因此，在具有UMA1以上等级的船舶上设置BWTS时，与压载水的注水排水及BWTS相关的阀要以具有远程控制功能的原则来设计。

5.6 水舱

如果饮用水舱作为压载水舱来使用，饮用水中所含有的化学物质可能排出的话，请考虑国际压载水管理公约中与IMO相关的内容。

5.7 用电量和回路的构成

对用于BWTS的设置所增加的用电量进行分析时，针对该船的电气用量是否充分要进行审查，因此，电载荷的分析材料向我船级社提交后要接受审查。另外，对于电气设备的过载和短路，要采取适当的保护。（请参照附录中用电量及回路结构的内容）

5.8 设有BWTS的区域的耐火完整性（Fire Integrity）

BWTS及相关的设施设置在甲板舱室居住区域内的情况也是存在的。这种情况要根据SOLAS Reg. Ⅱ-2/3 中关于其他机舱区域和工作区域来定义。与其他区域或工作区域相邻的居住区域的舱壁和甲板要考虑SOLAS.Ⅱ-2/3规则中关于舱壁的耐火完整性要达到A-0以上的要求。

5.9 压载水舱改造

现有的船舶按压载水国际管理公约附录A-1,Reg.5要求改造为新船时请考虑下列事项

-压载水的运输量有15%以上的变化，或者

-船的种类有变更，或者

-经政府认定，船龄可以继续延长10年以上，或者

-配件的替换，会导致BWTS变化的情形

5.10 BWTS的控制，监视及警报

在国际压载管理公约指南8的第4节中，有关于BWTS的控制装置，监视及警报装置要求的规

定。

5.10.1 控制，监视及警报装置

1）BWTS处理时所需的投入量及强度可以自动控制。控制装置在运行过程中要一直具备自我监视的性能，并且运行时必须要能自动监视和调节。

2）监视系统是否出现故障或者不运行情况，如果发生而妨碍正常运行的话，要求在所有的作业区域内能收到可视可听的警报。

5.10.2运转及控制

1） BWTS的运转及控制方面，单纯从效果上来看，要做到在远程控制场所内容易实现控制。但这里面所说的不是与BWTS有关的所有阀自动化的意思，不包括导致处理装置不运转的阀，是指手动控制阀可以很容易的控制的意思。对于这种情况，BWTS运行时，注水和排水的手动阀门控制程序的指南和标有相关阀门的管装置的图纸最好在控制场所中展示出来。

2）配有我船级社簿记符号在UMA1级以上的船舶，BWTS运转时，在相关的所有阀的操作及压载泵的驱动控制场所都要有远程控制。

5.13.3 旁通功能（bypass）及覆盖（override）

1）在设有BWTS的船舶上，紧急时期，为了保护船及船员的安全，要设置bypass 和override装置。另外，在旁通(bypass)时，控制和监视设备中可以自动接收到可视可听的警报，并且能记录在控制装置上。

2） 现有的船舶中，大部分在一侧设置压载线，对于剩余的压载线任意使用的情况，要追加可以实现监视功能的设计。与此相关的厂商在审图时要考虑所有与船舶的压载相关的设施。所有的旁通情况（bypass）的目录都要提交并接受审查。

第五章 压载水的采样.

1.一般事项

1.1 根据压载水管理协约第A-2规范，压载水的排出是根据协约附录中的要求来进行压载水的管理。与此同时，依照压载水的管理协约条文中第九条,使用该协约的船舶在其他当事国的港口或码头内时，要首先判断该海域的船舶是否适用于协约，以此为目的，依靠当事国所委任的具有正当权利的检验官员来检验。为了关注受检的船只，我们只要根据相关机构所开发的指南（G2）来限制和执行压载水的提取就可以了。

1.2 为了满足协约中D-1及D-2的规定，由于具有不同的参数，这两条规定是互不相同的。该指南书是有关协约D-1及D-2的规则（压载水，管理系统）所适用的压载水提取位置及设备的内容。

1.3 虽然协约中不包含提取位置相关的要求，但在 Res.MEPC.174(58)上所通过的“压载水处理系统的认证相关的指南（G8）”具有跟提取设备相关的要求。这不仅是为了型式认证，也是以实现“压载水指南（G2）”的要求为目的的。

1.4 现在 在IMO上关于提取方法及验证方法的很多相关论题正在展开，相关的指南还将待定。

1.5 术语的定义

1）提取位置（ Sampling Point）：在压载水管路内可以实现任意位置的提取。
2）提取设备（ Sampling Facilities）：为了提取而设置的设备。

2. 压载水的提取要求

2.1 满足压载水交换基准D-1规定的提取要求

压载水舱内提取泵，为了使用提取瓶和其他的容器测深管，空气管以及入孔要相通，压载水排出管也要求是贯通的。

2.2 满足压载水的性能基准D-2所规定的提取要求

2.2.1 为了确定是否满足D-2的规定，要在最大的排管中的最近的排出地点来提取。特别是压载

水排水时，如果是其他处理形式的BWTS船舶的话，一定要在压载水船外的排管附近实现。

2.2.2 如是不能从压载水的排管中提取的压载水的情形，一个专门的提取装置是非常必要的。

2.2.3 例外的事项，不通过压载泵，如果通过船侧上部的Wing Tank内的船外阀来直接排出的压载舱露出来的话，会有在舱内提取的合适的方法。

2.2.4 下面列出的理由对于通过测深管及空气管来提取的D-2规则不适用。

1） 作为多次科学实验的结果，通过测深管及空气管来提取的方式在压载水排出时，所产生的生物的浓度无法确切的评估。
2） 在舱内提取的方法虽然对于在压载舱内处理及取水时适用，但是，在处理过程中，若有压载水产生的话，舱内提取法则不适用。

2.3 从压载水排水管中提取的要求

2.3.1 提取的地点应该设在与某个压载水向船外排出相邻的排出管的直线部分的内部。提取设备应该设置在可以提取到有代表性样品的位置。样品需要在流动液体具有代表性位置的注入和排出管处提取。提取设备应该在注入排出管内的流动液体充分彻底混合的某一点处设置。

2.3.2 为了使提样管的开口可以在管内平滑缓慢的移动，要把棱角圆化。对于要面对流体的直线取样管的长度不能小于取样管的直径。取样管的开口要逆流放，延长的长度要与流体的方向平行，并且与排出管的中心一致。也就是说提取管要根据排出管的直线部分来设置，逆流的部分要设置为 “L”型。

2.3.3 为了保证样品提取管的维修，要求通过手动或机械操作可以拆除，或在远程操作系统内设置。样品提取管的入口及内部，由于生物或非生物的附着可能会造成阻塞的可能，在设计时可以在入口处防御，或在提取中做到可以拆卸，或在提取前较容易清洗。

2.3.4 样品提取管要经过镀锌的处理，使用内部防腐蚀性的材质来处理。如果样品流量的控制符合要求的话，就不必设置Gate和蝶阀，而是设置隔膜阀。为了流量的分配还应该使用球阀

3. 利用CFD（计算流体力学）来验证采样接口处的设置

3.1 等速性

3.1.1 为了准确的测定压载水内的生物的浓度，建议设置具有“等速性”的采样设备，由于这个原因，流体与采样机的入口接触时，要使管内的主流中的流体不能集中或者扩散。

3.1.2 等速度的采样区的直径通常来说根据下列方程式来计算。

*Diso ： 采样区入口处的直径

* Dm ： 排线中主流量的直径

* Qiso ： 采样区入口处的体积流量比

* Qm ： 排线的体积流量比

3.2 在压载水排管中插入采样连接口的几个例子

3.2.1 图Ⅴ-4-A意在说明设计时应避免在采样区周围，再循环区域及高速倾斜区域发生压载水粒子的碰撞。

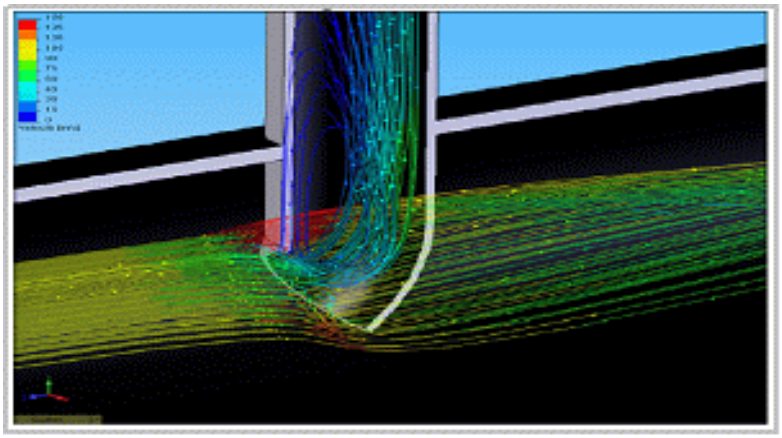


Fig. V-4-A 45o Cut-off Sample Flow(3D Flow Trajectories)

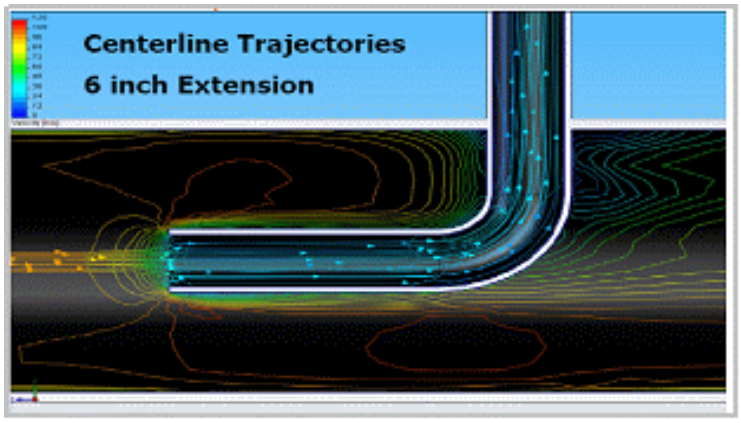


Fig. V-4-B Elbow Sample Flow

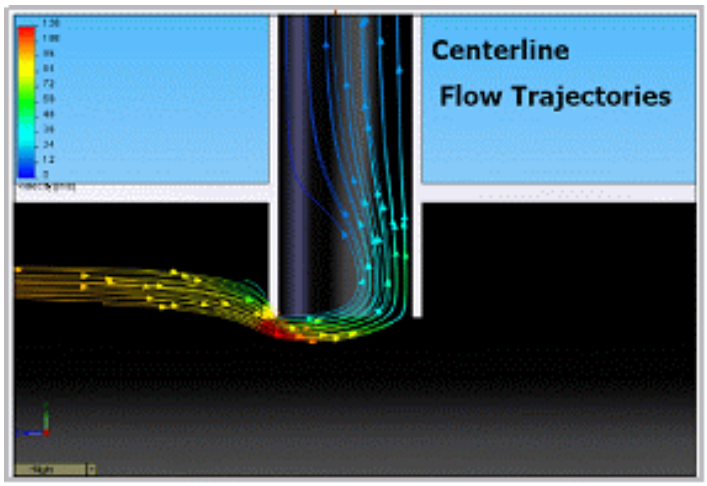


Fig. V-4-C Extended Tee Sample Flow

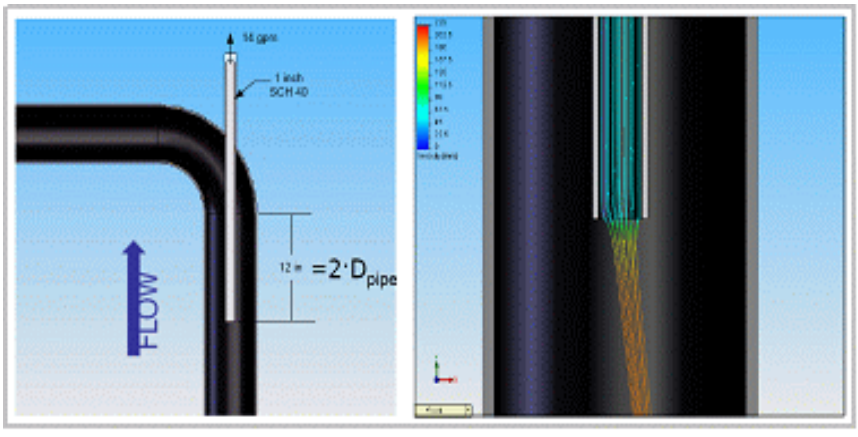


Fig. V-4-D Actual Sample Port onboard and Flow

3.2.2 图Ⅴ-4-B 所示的内容意在说明设计时采用通过平稳流速区域及注入管的中间所设置的采样管可以按比例来提取样品的设计形式。

1）图Ⅴ-4-C 意在说明设计时应该避免压载水在采样区有碰撞逆流的发生，因为这样会降低泵的使用效率。

2）图Ⅴ-4-D所示为船上实际的压载水排出管内设置样品提取区域的连接情况。

第六章 压载水处理系统的认证

1.压载水管理系统的要求

1.1 压载水处理系统

1.1.1 压载水处理系统的概要

1）压载水处理系统是否满足协约D-2规则（请参见Ⅱ-2-C）中所提的基准需要通过实验来进行判断。协约附录 G8-Part II及 Part II中所制定的需要通过船上实验及陆基实验而从主管机关获得型式认证。

2）根据该协约所适用的船的总吨数，种类（如图 II-2-A）的要求获得主管机关的型式认证后的压载水处理系统方可设置。

1.1.2 术语的定义

1）船上实验(Shipboard Testing)：是指为了确定压载水处理系统是否符合协约 D-2所指定的基准，而根据协约附录G8-Part II在船上要进行压载水处理系统实际规模的实验。

2）陆基实验（ Land-based Testing)：是指为了确定压载水处理系统是否符合协约 D-2规则所指定的基准，而根据协约附录G8-Part III对实验室，生产该装置的工厂，或系泊的驳船以及实验船上所用的样品的工厂所进行的压载水处理系统的实验。

3）控制装置(Control Equipment)：是指为压载水处理装置的运行及控制而需要设置的装置。

4）监控系统（Monitoring Equipment）：是指为了评估压载水处理装置的有效运行而设置的装置。

5）额定处理容量（Treatment Rated Capacity(TRC)）:是指获得型式认证的压载水处理系统单位时间内以立方米为单位来表示的最大的连续容量。也就是指依照压载水协约D-2规则规定的基准所适用的压载水处理系统单位时间内可以处理的压载水的量 。

1.2 压载水处理系统的一般要求

1.2.1 警报装置及自动化

1）警报装置

No.	Case	Activity
1.	有妨碍正常运行的故障发生时	可视可听 警报 (压载水作业时所控制的所有区域)
2.	为了能够实现清扫，矫正，修理等的情况	可视警报 控制装置 自动记录
3.	压载水处理系统在某种情况下产生 bypass 的情形 (紧急时刻为了保护船及船上的船员的安全要适当地设置 bypass 或者 override)	警报 控制装置 自动记录
※ 压载水处理系统的 bypass 是指为了确保船及船上船员的安全在紧急时不通过压载水处理系统而是通过 bypass 来承载压载水并排出的特殊情况。		

2） 自动化设备

a.由于压载水处理系统的运行及控制要简单化，因此，与压载水处理装置运行相关的所有设备都应该实现自动化。

b.压载水处理系统的控制装置应该具有运行连续性的自我监视功能。

c.监视装置就是记录压载水处理系统的正常的作业及故障的装置。

d.在控制装置中应设置简单的测量手段意在实现位移量的测量，控制装置的反复性及控制装置机械的归零能力。

1.2.2 记录及检查

1）容易损耗或者损伤的压载水作业部位都该在容易接近处设置。压载水处理系统的日常装备及故障分析程序是指生产商在运行及中止相关的指南中的明确规定，并且调整修理等都应该记录下来。

2）在定期检查时，要设置厂商所提供的指南中规定的用来测量压载水处理系统中构件性能的设备。最后，为了检验的目的要在船上配有能确定调整日子的证书。并且只有生产商及生产商指定的人才能进行该精密检测。

3）为了能确保遵循协约B-2的规则（压载水，记录簿及相关协约），控制装置的记录资料要保存24个月，为了根据要求进行正式的检验，要能出示记录或可以打印记录。控制装置要更换时，应提供具有可在船上能保存更换前24个月的资料的相应措施。

Regulations for Ballast Water Record Book (Reg. B-2 of the Convention)

1) Ballast Water record book entries should be maintained onboard the ship for a minimum period of two years after the last entry has been made and thereafter in the Company's control for a minimum period of three years.
2) In the event of exceptional discharge of Ballast Water not otherwise exempted by the BWM convention, an entry should be made in the Ballast Water record book describing the circumstances of, and the reason for, the discharge
3) In the event of exceptional discharge of Ballast Water not otherwise exempted by the BWM convention, an entry should be made in the Ballast Water record book describing the circumstances of, and the reason for, the discharge

1.3 压载水处理装置的一般要求

1.3.1 控制装置

1）压载水处理装置需要通过相应的自动化设备来确保正常运行所需要的设施与控制装置能一起制动。

1.3.2 危险区域

1）压载水处理装置若设置在具有可燃性条件的位置时，压载水处理装置应该符合安全规范的要求。

2）作为压载水处理系统一部分的所有电气装置要设置在非危险区域，如果不可避免地要设在危险区域的话，为了安全考虑要依照主管机关的认定。在危险区域要避免配置电气形式的驱动。

1.4 应用在现有船上时的注意事项

1.4.1 耗电量及主电源的容量

1）如果在船上新设置了压载水处理系统的话，对主电容的容量是否充分要进行检查。因此，压载水处理系统所属的电能所保护的电力调查表要提交并接受检验。

2）应该确定在电力调查表中有关压载水处理系统容量的计算是否合理。一般来说，电力调查表如下表V-1.4.1-A所示，根据正常航海，出入港，货物处理等情况下所使用符合计算要求的电能压载水处理系统，由于压载水处理系统在处理货物时也有使用的可能性，因此，有关处理货物时所使用电量的计算也要添加到里面。那么，如果船舶的基本主电源的电量不充足的话，就要设置发电机。

3）如果所添加设置的发电机的容量是100KW以上的话，经由船级审图后，要接受机械方面的检验。

4）一般来说，船舶的尺寸变大的话，压载水舱的容量也要变大，压载水处理系统的耗电量也要增大。因此，大型船舶的发电机的容量是否充分一定要在电力调查表上确认。

1.4.2 电力调查表的例子

1）虽然每个设计公司的电力调查表都有点差别，但是，一般来说货船的的大小如表-1.4.1-A所示分为4种航海模式，由于只有压载水泵可以使用，压载水泵的载荷所包含的航海模式的压载水处理系统也要计算。

2）包括在压载水负载的航海模式，计算所消耗最多载荷率的时候，该船压载水处理系统设置后，要判断电能是否充足。

表-1.4.1-A电力调查表

	Normal Seagoing	At Port In/Out	At CargoHandling	At Harbor
Continuous Load(kW)	278.6	1148	1123	230.2
Intermittent Load(kW)	198.8	145	280.7	194.8
Diversity Factor(%)	40	40	40	40
Actual Intermittent Load(kW)	79.5	58	112.3	77.9
Total Load(kW)	358	1206	1235.3	308
Capacity of Generator(kW)	475	475	475	475
Number of Working Generator	1	3	3	1
Generator Load Factor(%)	75.3%	84.6%	86.6%	64.8%

3）电力调查表中的“At Cargo Handling” 航海模式，假设在消耗很多载荷的模式下使用压载泵的话，该船的电力消耗量为62KW，若为新安装压载水处理系统时，上述的电力调查表中使用压载泵的模式，要添加载荷的计算，添加后的电力调查表如下表Table V-1.4.1-B。

表 V-1.4.1-B 包含压载水处理系统载荷

	Normal Seagoing	At Port In/Out	At Cargo Handling	At Harbor
Continuous Load(kW)	278.6	1148	1123	230.2
Intermittent Load(kW)	198.8	145	280.7	194.8
Diversity Factor(%)	40	40	40	40
Actual Intermittent Load(kW)	79.5	58	112.3	77.9
Ballast Treatment System(kW)			60	
Total Load(kW)	358	1206	1295.3	308
Capacity of Generator(kW)	475	475	475	475
Number of Working Generator	1	3	3	1
Generator Load Factor(%)	75.3%	84.6%	90.9%	64.8%

4）由表 V-1.4.1-B可以看出在“At Cargo Handling”航海模式下，要确定90.9%的负载率计算的主电源容量是否充分。但是，若计算的负载率超过100%，并判断出已存的电源用量不足，就要考虑所添加的发电机设备。

1.4.3 危险区域内的设置

1）在危险区域内不能设置电气设备。但是，在危险区域可以在特定区域内设置指定的已获得型式认证的防爆型电气。

2）在压载水处理装置的特定危险区域内只能设置允许的已获得型式认证的产品。没有必要在压载水处理装置的所有部分都设置防爆型的获得型式认证的产品，但一般来说在危险区域必须确定采用防爆型的已获得型式认证的产品。

1.4.4 防爆型设备

1）在危险区域，根据IEC的要求按下表V-1.4.3-A来分类

表V-1.4.3-A危险区域的分类及定义

危险区域分类	定义
Zone 0	爆炸性气体或水蒸气爆炸可能的浓度持续存在的区域
Zone 1	通常运行的条件下，爆炸性气体的浓度可以达到危险程度的区域
Zone 2	紧急状态下，可能有爆炸性气体存在的区域

2）防爆构造类型与下表V-1.4.3-B所示相同，根据危险区域的不同可以使用不同的防爆结构。危险区域Zone 0，只能使用本质安全型的防爆构造。

表 V-1.4.3-B 根据防爆结构的种类及区域所划分的防爆结构

Type of Explosion Protection	Code	Applicable Zone
Flameproof	d	1, 2
Pressurization	p	1, 2
Increased Safety	e	2
Intrinsic Safety	ia, ib	0*, 1, 2
Oil Immersion	o	1, 2
Powder Filling	q	2
Encapsulation	m	1, 2
Special	s	1, 2

*ia : Zone 0,1,2 ib : Zone 1,2 (Not Zone 0)

* Applicable explosion protected constructions by different zones.

Zone 0 : Intrinsic Safety (ia)

Zone 1 : Zone 0 + Intrinsic Safety (ib),
Flame-proof (d), Pressurization
(p), Oil-Immersion (0)

Zone 2 : Zone 1 + Zone 2 + Increased Safety (e)

3）船上的危险区域根据船的种类及搭载货物的情况来看， 主要是在货船，散装货船，汽车运输船上。其中，若为货船，压载水线及相关区域，双壳结构，开放甲板，围堰等危险区域存在的压载水船舶，在设置时，要注意个别的要求。

2. 审图及船上检验

2.1 在船上设置前的图面审核

2.1.1 若在新船上设置压载水处理系统，则需要接受轮机技术部的认证，图纸审核时需要的图纸目录如下，并且产品必须是由政府获得型式认证的产品。

1）船舶生产商的详细图面（船东或生产商）--包括下列事项

a. 压载水处理系统的设置图

b. 采样设备

c. 与产品有关的泵及管的配置图

2）产品的运行及技术手册（船东及船舶生产商）--包括下列事项

a.主要结构件的运行及与设备相关的详细技术要求

b. 与正常运行程序相关的事项

c. 压载水处理装置的故障无法处理时压载水的排出方案，以及能确保设备及船舶安全的应急措施事项。

d. 能查出差错的信息（监视装置的概略图及说明书，电气电子设备的电路图等）

e. 构件的位置及设置的相关要求，以及确保安全及危险区域警戒能一致保存的设备。

f.与采样设备管配置相关的详细的技术设置规程

3）废弃物正当的管理，包括处理措施相关的说明书，及压载水处理系统的副产物相关的说明书（例，滤后产物，圆心分离的浓缩物，废弃或残存的化学物质）（船东及造船商）

4）压载水处理系统的检测流程手册（船东及造船商）

a. 性能测试时包括所有的检测事项

5）产品的设置及相关的机器配置图（船厂）

6）产品的设置及相关的系统配置图（船厂）

7）电气设备配置图（船厂）

8）动力系统图（船厂）

9）电力明细表（船厂）

2.1.2 如在现有船上设置压载水处理系统，则需要接受轮机技术部的认证，图纸审核时需要的图

纸目录如下，并且产品必须是由政府获得型式认证的产品。

1）船舶生产商的详细图面（船东或生产商）--包括下列事项

a. 压载水处理系统的设置图

b. 采样设备

c. 与产品相关的泵及管的配置图

2）产品的运行及技术手册（船东及船舶生产商）--包括下列事项

a.主要结构件的运行及与设备相关的详细技术要求。

b. 与正常运行程序相关的事项。

c. 压载水处理装置的故障无法处理时压载水的排出方案，以及能确保设备及船舶安全的应急措施事项。

d. 能查出错误的适当的信息（监视装置的概略图及说明书，电气电子设备的电路图等）。

e. 构件的位置及设置相关的要求，以及确保安全及危险区域的警戒能保持的设备。

f. 与采样设备管配置相关的详细的技术设置规程。

3）废弃物正当的管理，包括处理措施相关的说明书，及压载水处理系统的副产物相关的说明书（例，滤后产物，圆心分离的浓缩物，废弃或残存的化学物质）（船东及造船商）

4）压载水处理系统的检测流程手册（船东及造船商）

a. 性能测试时包括所有的检测事项

5）产品的设置及相关的机器配置图（船厂）

6）产品的设置及相关的系统配置图（船厂）

7）电气设备配置图（船厂）

8）动力系统图（船厂）

9）电力明细表（船厂）

2.1.3 使用活性物质的压载水处理系统(G9)设置时,添加的注意事项。

1）根据包括压载水处理后保存期间的评估及毒性稀释相关影响的评估要根据指南G9的程序来进行，并且毒性实验的结果要与手册一起提供。

2.2 机械检验

2.2.1 韩国政府型式认可的产品

1）从韩国政府来获得型式认证时，我船级社作为合理性实验的机关将参与最终图纸的审核及合理性试验等过程，因此，考虑到与此相关的图纸及材料提交送审等，我船级社的型式认证可免除，要进行自选图纸的认证及机设备检验，然后发行证书。

Exemption of Class. Type Approval -> Drawing Approval for Registered Ships-> Issue of a Certificate

（船级型式认证免除—自选图纸的认证---设备检验—船级设备证书发行）

2.2.2 其他国政府的型式认证产品（包括RO的型式认证）

1）考虑到我船级根本无法参与的型式认证过程的情况，考虑到要确认自选图纸认证时所要提交的图纸中型式认证产品的一致性比较困难，可以先获得我船级的型式认证，然后自选图面认证最后经机械设备检验后，便可发行证书。

Exemption of Class. Type Approval -> Drawing Approval for Registered Ships -> Inspection of Materials of Equipment -> Issue of a Certificate

（船级型式认证证书的发行---自选图面认证---设备检验—船级设备检验证书的发行）

2.2.3 单件产品的检验

1）在业所所属的分社进行该检验

2）设备检验的项目

a. 根据图纸及规格对结构/外观等进行检验并对表示的事项进行确认

b.存在附加水压情况的水压实验

c.控制面板及启动面板等的耐电压/抗绝缘实验

d. 性能实验（但，生物实验除外）

2.3 整船检验

2.3.1 船上要保管的图纸清单

1）从我船级获得认证的上面所提及的图纸及下列文件一定要在船上保管。

a. 压载水处理系统的型式认证证书的副本

b. 能确定压载水处理系统的电气及电子构件的环境实验是按型式实验的规定来进行的，由主管部门发行确认书或由主管部门指定的实验机构发行确认书。

c. 设置规格说明书

d. 设置操作说明书

e. 初期检查矫正说明书

2.3.2. 对下列事项进行确认

1）压载水处理系统的设置是否根据设置技术规范书来进行的

2）压载水处理系统是否适用于主管部门或代理部门所发行的压载水处理系统型式认证证书

3）压载水处理系统的所有安装依照厂商的装配规范书来进行

4）所有运行用的出入口处的泵及管根据配置图来设置

5）工作人员的铺设过程是否满意，特别是舱壁穿透处或压载水系统的穿透部是否符合相关的基准

6）控制及监视装置是否正常作业并且材料要能保存24个月并且正式检验的记录要求可见并且能打印出来。

7）提供具有代表性的可提取压载水样品的样品提取设备

3. 国内法规（船舶压载水管理法）的应用

3.1 关于船舶压载水管理的检验

3.1.1 图纸的认证

1）设有压载水处理系统的船舶的所有者要获得国土海洋部长官（或韩国船级社代行）对图纸的认证。

2）船的所有者要在获得图纸认证的船上设置。

3.1.2 定期检验

1）船舶所有者要对设有压载水处理系统的船舶在最初设置后航海时或有效日期（5年）超过等情况要进行定期的检验。

2）对于定期检验合格的船舶，需要提交“船舶压载水管理设备检验证书”

3）船舶所有者要把检验证书配备在相关的船上。

附录

A.根据船的种类而划分的危险区域及电气设备的型式

B.在加利福尼亚州关于压在水处理系统的要求

C.在纽约关于压载水处理系统的要求

D.进入澳大利亚港口的压载水管理系统的验证手段

E.有关生产商的调查表

附录 A

根据船的种类而划分的危险区域及电气设备的型式

1．根据 IMSBC CODE 及 IMDG CODE 所规定的运送危险货物的船舶
（一般货物船，散装货船，集装箱船，Ro－Ro 船，车辆专用船）

1.1 IMO中关于CLASS级别的分类

1.2 Dangerous goods, for which safety measures may be required with respect to the electrical equipment, are specified in the IMO documents listed in the Foreword and grouped into the following classes.

a) Dangerous goods in packaged form

Class 1	Explosives, except goods in division 1.4, compatibility group S of the IMDG Code
Class 2.1	All flammable gases, compressed, liquefied or dissolved under pressure
Class 3	All flammable liquids having a flashpoint from –18 °C up to 23 °C (closed-cup test)
Class 6.1	All toxic substances having a flashpoint below 23 °C (closed-cup test)
Class 8	All corrosive liquids having a flashpoint 23 °C and below (closed-cup test)

b) Solid dangerous goods in bulk

Class 4.1	Flammable solids
Class 4.2	Substances liable to spontaneous combustion
Class 4.3	Substances which, in contact with water, emit flammable gases
Class 5.1	Oxidizing substances
Class 9	Miscellaneous dangerous substances, that is, any other substance which experience has shown, or may show, to be of such a dangerous character that the provisions of this part will apply to it.

c) MHB Materials which, when carried in bulk, present sufficient hazards to require specific precautions

1.2 根据 CLASS 级别来设置电气设备

Class 4.1,4.2 的散装货物

若在密闭的货舱区域及与其相关的通风管上设置电气设备，应设置满足该区域防爆要求的适当型式的电气设备。

Class 4.3 散装货物，Class 2.1,3,6.1,8 货物

（1）下面所列出的危险区域内应设置适合各货物防爆等级（最小 IIBT 以上）的电气设备。

1）密闭的存放货物区域

2）存放货物的区域及具有开口的密闭及半密闭场所

3）距存放货物用的通风管及通风口 3m 以内的区域

（2）存放货物区设有污水管（bilge pipe）的密闭区域内（例：管槽空间）设有污水管用的法兰，阀，泵等设置时，可在密闭区域内设置电气设备，应该使用与下列相同型式的电气设备。但根据 IEC60092-506 的要求在安全区域内吸入的空气加压后，没设置警报装置的情况，可以设置一般型式的电气。

1）根据各货物的防爆等级来设置适当的电气。

2）设置 Exn 防爆的电气设备。

3）能证明使用时无火花或电弧出现，表面温度不超过许可限度的的电气设备。

1.3 根据船所装载的货物划分的电气设备的符号等级

表 1　根据 IEC60092-506 中规定的按散装货物种类划分的电气设备的保护型式

Table A.1 – Solid bulk cargoes

Dangerous goods	IMO class	Dominant risk [a)]	Degrees of protection against explosive dust atmosphere	Protection against explosive gas atmosphere	
				Apparatus group	Tempera-ture class
Aluminium dross	MHB	H_2	–	IIC	T2
Aluminium ferrosilicon powder	4,3	H_2	–	IIC	T2
Aluminium silicon powder uncoated	4,3	H_2	–	IIC	T2
Ammonium nitrate fertilizers – Type A – Type B	 5,1 9	 2) 2)	 – –	 – –	 – –
Coal	MHB	Dust Methane	IP5X	IIA	T4
Direct reduced iron	MHB	H_2	–	IIC	T2
Ferrophosphorus (no briquettes)	MHB	H_2	–	IIC	T1
Ferrosilicon	4,3	H_2	–	IIC	T1
Iron oxide, spent Iron sponge, spent	4,2	Dust	IP5X	IIA	T2
Seed cake, expellers	4,2	Hexane	–	IIA	T3
Silicomanganese	MHB	H_2	–	IIC	T1
Sulphur	4,1	Inherent	IP5X	–	T4
Zinc ashes Zinc dross Zinc residues Zinc skimmings	4,3	H_2	–	IIC	T2
NOTE Provision shall be made to disconnect all electrical circuits terminating within cargo spaces, in accordance with 5.1.					
a) This column relates only to the possible evolution of substances which will affect the installation of electrical equipment and cables.					

2. 运送闪点在 60℃以下的货物舱的危险区域

运送闪点在 60℃以下的货物舱的情况，根据 IEC60092-502 4.2 中规定的易燃性油蒸汽的存在的概率及危险性划分为 Zone 0 到 Zone 2 几个区域，根据 Zone 的等级来设置不同型式的电气设备。

2.1 Zone 0

1）货舱

2）货舱的通风管

3）货物管道

2.2 Zone 1

1）与货物舱相邻的防撞舱壁，双重底结构，箱形龙骨等区域

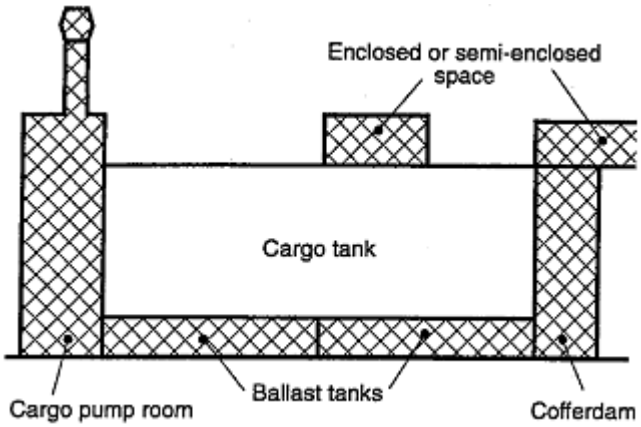


图 1 危险区域 例 1

2）货物舱正上方的围蔽场所及半围蔽场所以及在货舱舱壁直线方向上具有舱壁的围蔽及半围蔽场所。

3）货舱泵室，遮蔽货物用软管的区域，装有含有货物的管道的围蔽场所及办围蔽场所。

4）露天甲板上所有的货舱开口，气体或蒸汽的开口，距离货物泵室的通风口 3m 以内的区域及半围蔽场所。离排气管处 3m 以内的区域。

5) 距离货物舱的排气管 6m 以内的区域

6）距离货物舱室通风口周围的溢出围板 2.4m,高度在 3my 以内的区域

7） 距离货舱室入口及通风口，围堰开口 1.5m 以内的区域。

8）长期开口处向着危险区域的紧闭场所及半紧闭场所

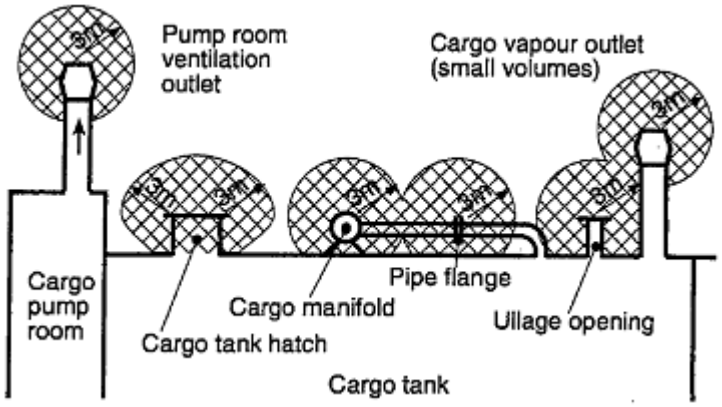


图 2 危险区域 例 2

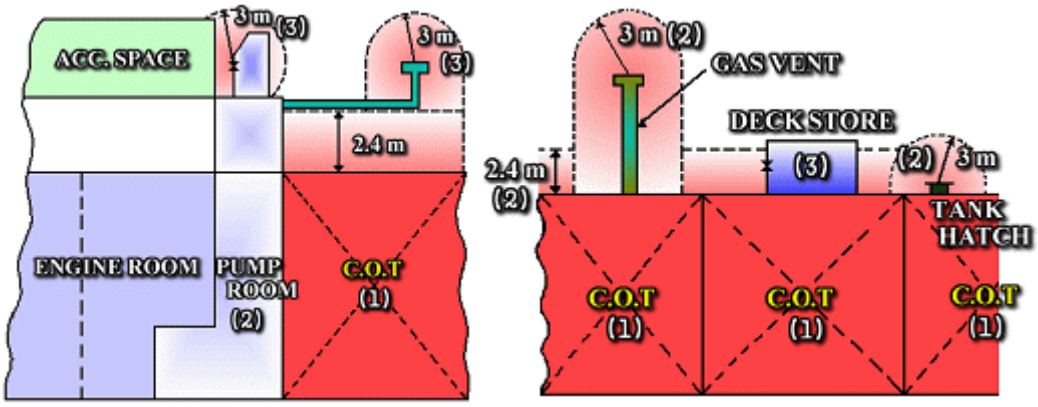


图 3　危险区域　例 3

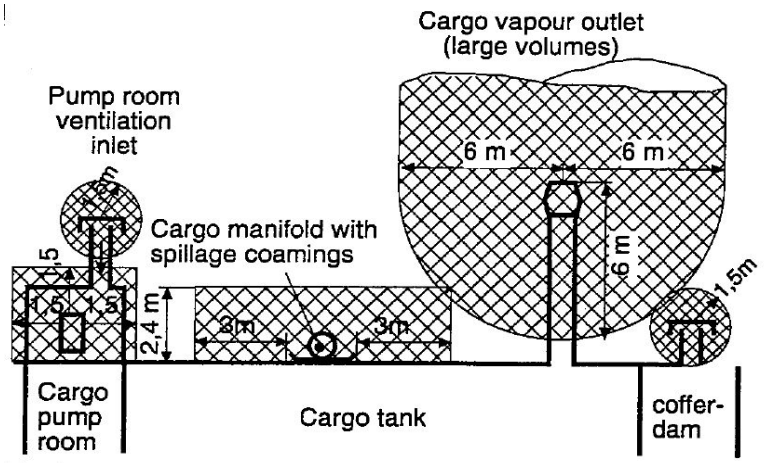


图 4 危险区域 例 4

2.3 Zone 2

(1)距离 2.2 中规定的 Zone1 区域 1.5m 以内的开放区域或者半密闭区域。

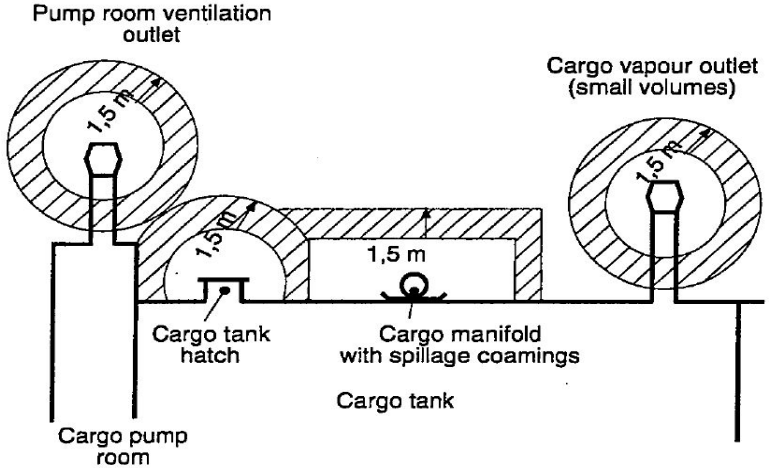


图 5 危险区域的 例 5

（2）货舱上到露天甲板上方 2.4m 高度的范围内，距船舶的首尾各 3m 的露天区域。

（3）2.2 中的 5）中所说的位置延长 4m 以内的区域。

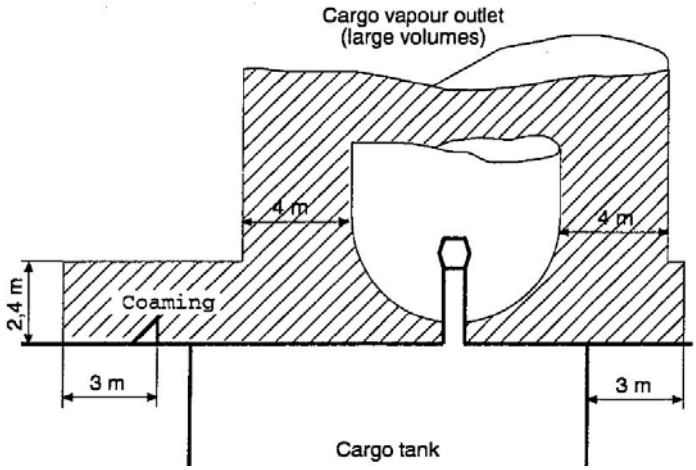


图 6 危险区域 例 6

2.4 根据货物的种类划分的电气设备的防爆型式

请参考IBC CODE 17章中根据货物种类不同的应用

3. 运送闪点超过60℃的货舱的危险区域

运送闪点超过60℃的货物的货舱请根据IEC 60092-502 4.3所规定把货物舱，货物舱通风管，货物管道内部规定为危险区域Zone 2。

4. 气体载运船的危险区域

气体载运船的情况，根据在IEC 60092-50204.4中易燃性气体的存在概率及危险性，划分为由Zone 0到Zone2的几个区域。因此，要根据Zone的等级来设置不同型式的电气设备。

4.1 Zone 0

（1）货物的遮蔽设备及货物的管装置

（2） 运送需第2层货物遮蔽墙的货物时的货物舱区域

（3）不需要第2层货物遮蔽墙的货物时的货舱区域

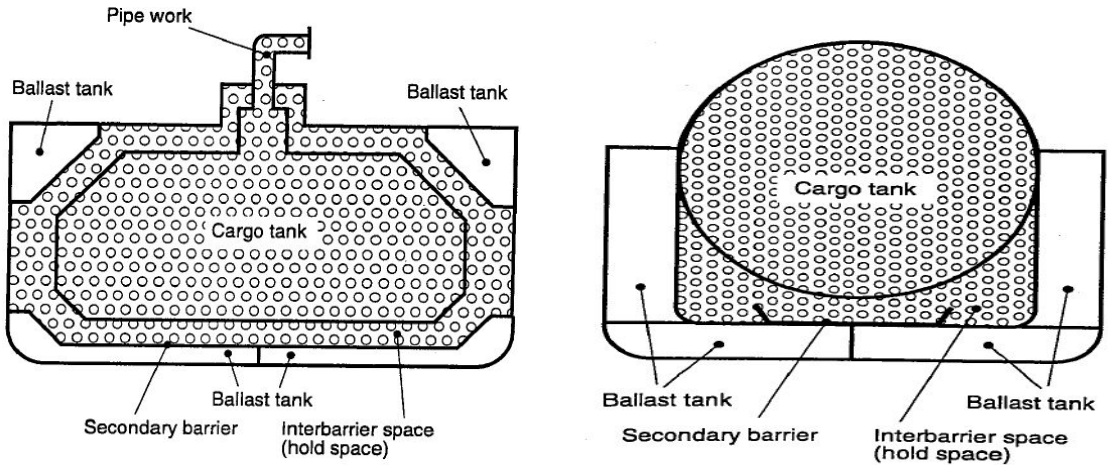
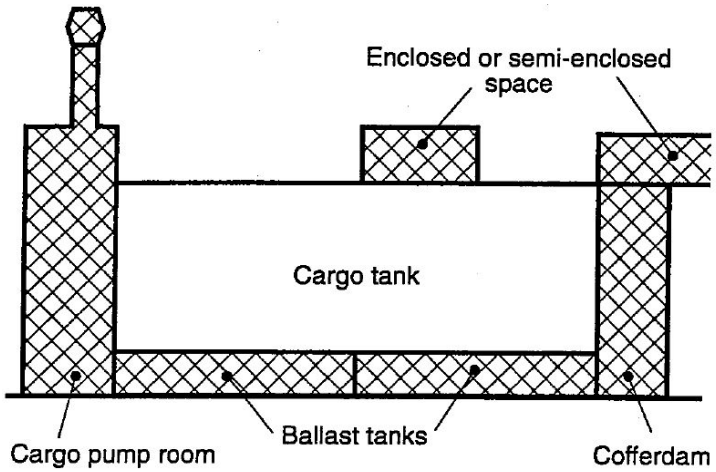


图7 需要第二层遮蔽墙的货物舱的危险区域

4.2 Zone 1

（1）与货舱相邻的防撞舱壁，双层底结构及箱形龙骨或其他区域及货物舱正上方的围蔽场所及半围蔽场所及在货舱舱壁直线方向上具有舱壁的围蔽及半围蔽场所。



（图8 危险区域 例8）

（2）所有货舱的开口，气体或蒸汽的开口，距离货物泵室的通风口3m以内的区域及半围蔽场所。

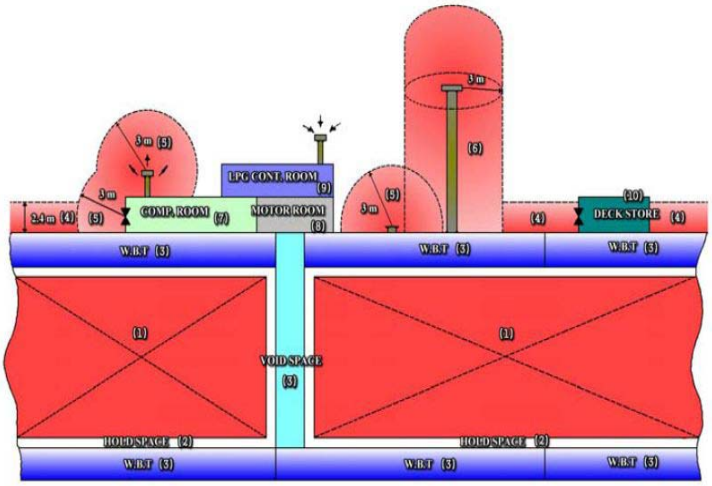


图9 危险区域的例子

（3）上面所提及的4.1中的 2）中货物舱区域气密钢材周边的隔离区域（见图10）

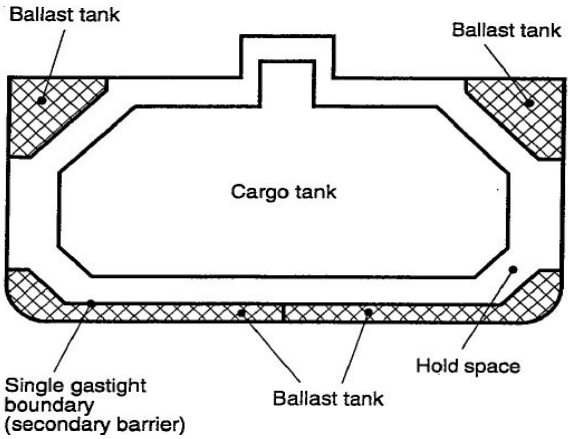


图10 危险区域的例子

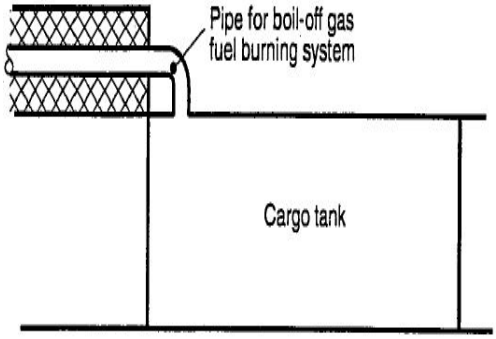


图11 危险区域的例子

（4）货物泵室及货物压缩机室，使用货物软管的区域

（5）可进货物的管道所设置的密闭及半密闭区域，根据1306中的第5行的规定，具有气体探测装置的区域及使用燃料蒸发（boil off）的我船级及钢船规则7篇6章16节规定的区域不被划分为该节中所规定的气体危险区域。

（6）上述的Zone1的气体危险场所或区域内具有开口的密闭区域及半密闭区域。

4.3 Zone 2

（1）货物区域的开放甲板及开放甲板上据货物区域前后各3m以内的区域，高度则为露天甲板上2.4m以内的区域。

（2）有货物遮蔽设备暴露的情况，距外表面2.4m以内的区域。

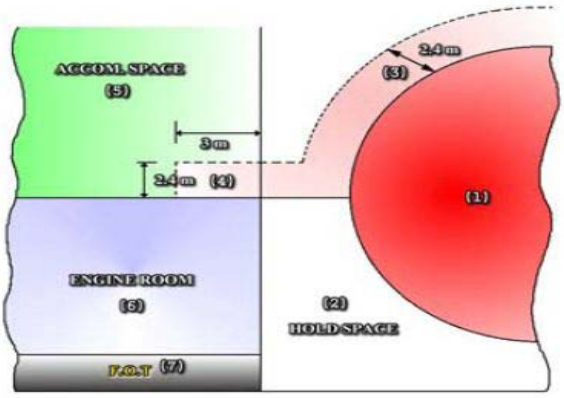


图12 危险区域的例子

4.4 根据IGC CODE中规定的货物种类不同而划分的电气设备的保护型式

表2 IGC CODE按货物种类划分的电气设备的保护型式

NAME OF SUBSTANCE	U.N. NO.	GAS & VAPOUR GROUP	TEMP. CLASS
Acetaldehyde	1089	IIA	T4
Ammonia, anhydride	1005	IIA	T1
Butadiene	1010	IIB	T2
Butane	1011	IIA	T2
Butane-propane mixtures	1011/1978	IIA	T2
Butylenes	1012	-	-
Diethyl ether	1155	IIB	T4
Dimethylamine	1032	IIA	T2
Ethane	1961	IIA	T1
Ethyl chloride	1037	IIA	T1
Ethylene	1038	IIB	T2
Ethylene oxide	1040	IIB	T2
Ethylene oxide-propylene oxide mixures with ethylene oxide content of not more than 30% by weight	2983	IIB	T2
Isoprene	1218	IIB	T3
Isopropylamine	1221	IIA	T2
Methane (LNG)	1972	IIA	T1
Methyl acetylenepradiene mixtures	1060	-	-
Methyl bromide	1062	-	-
Methyl chloride	1063	IIA	T1
Monoethylamine	1036	IIA	T2
Propane	1978	IIA	T1
Propylene	1077	IIA	T2
Propylene oxide	1280	IIB	T2
Vinyl chloride	1086	IIA	T3
Vinyl ethyl ether	1302	IIB	T3
Vinyliden chloride	1303	IIA	T2

B.在加利福尼亚州关于压在水处理系统的要求

KR
KOREAN REGISTER OF SHIPPING
23-7, Jang-Dong, Yusung-gu,
Yusung P. O. Box 29, Taejon,
The Republic of Korea
Phone : +82-42-869-9346
Fax : +82-42-862-6098
E-mail : kr-clt@krs.co.kr
Date : 1 September 2009

NO. 2009027/IMO

TECHNICAL INFORMATION

Person in charge : Kim Kyong-Min

Subject : The notice for the application date for each ship and the approval for Ballast Water Management Plan with regard to BWM Convention

International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004(hereinafter referred to "the convention) was adopted in February 2004 and has not been in effective yet. However, the convention will be retroactively applied to the existing ships and new ships distinguished by the ship's delivery year of 2009(based on keel laying date) when it is entered into force.

The purpose of this Technical Information is to inform that First, the application date for each vessel for Ballast water exchange standard(D-1) and Ballast water performance standard, Second, the approval for Ballast water Management Plan(BWMP) which is dealt with the procedure of Ballast water exchange and Ballast performance standard for the ship, Third, the three methods which are described in the convention for Ballast water exchange standard(D-1).

This Technical Information contains additional information to the previously KR issued Technical Informations, 2007006/IMO(14 May 2007) and 2009007/IMO(04 March 2009) which are issued with regard to the BWM Convention.

- Contents -

: The convention shall be applied to all ships including existing ships as shown in the table.

Based on ship's keel laying date, the D1 or D2 requirement shall be complied regardless of the effective date of the convention.

"Constructed" referred in the convention and this technical Information means "ship's Keel was laid" and "Anniversary date of delivery of the ship" means the day and the month of each year based on the delivery date referred in IOPP(International Oil Pollution Prevention) Cert. for the ship.

D1(Reg.D-1) means Ballast Water Exchange Standard and D2(Reg.D-2) means Ballast Water Performance Standard.

[The application date of D1 and D2 for the existing ships and new ships]

Reg.B-3	Keel laying	BW tank capacity, ㎥	2009	2010	2011	2012	2013	2014	2015	2016	2017
【Existing ships ; ships constructed before 2009】											
Para.1.2	before 2009	less than 1,500	D1 or D2								D2
Para 1.1	before 2009	between 1,500 and 5,000	D1 or D2						D2		
Para 1.2	before 2009	greater than 5,000	D1 or D2								D2
【New ships ; ships constructed on or after 2009】											
Para. 3	On or after 2009	less than 5,000	D2								
Para. 4	on or after 2009, before 2012	5,000 or more	D1 or D2								D2
Para. 5	on or after 2012		-			D2					

1.1 For the existing ship(constructed before 2009), when the convention is in effective

1) The existing ship shall comply with the D1(Ballast water exchange standard) requirement not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in the year 2009 regardless of the capacity of ballast water tanks.

2) D2(ballast water performance standard) requirement shall be complied not later than the following date depending on the capacity of ship's ballast water tank.

a) Ships carrying Ballast water less than 1,500㎥ or greater than 5,000㎥
⇒ Not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in the year 2016.

b) Ships carrying Ballast water capacity between 1,500㎥ and 5,000㎥
⇒ Not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in the year 2014.

1.2 For the new ship(constructed on or after 2009), when the convention is in effective

a) Ships carrying ballast water less than 5,000㎥ which constructed on or after 2009
⇒ **D2 requirement shall be applied at the time of construction of the ship**

(According to Res.A.1005(25), a ship constructed in 2009(2009.01.01 ∽ 2009.12.31) with a ballast capacity of less than 5,000 ㎥ may not be required to comply with regulation D-2 until its second annual survey, but no later than 31 December 2011 subject to the approval by the Administration as follows:).

※ Notice
However, it should be noted that a ship constructed in 2009(2009.01.01 ∽ 2009.12.31) with a Ballast Water Capacity of less than 5,000㎥ shall install BWMS which at least meets the standard described in regulation D-2 as far as practicable except for the ship owner's particular request.

b) Ships carrying ballast water more than 5,000㎥ which are constructed between 01 January 2009 and 31 December 2011
⇒ D1 requirement shall be applied as soon as the convention is in effective and D2 requirement shall be complied with not later than 31 December 2016.

c) Ships carrying ballast water capacity more than 5,000㎥ which are constructed on or after 2012
⇒ D2 requirement shall be applied at the time of construction of the ship.

2. The approval and the contents of Ballast Water Management Plan(BWMP) (Reg. B-1)

: Each ship shall have the BWMP on board which was approved by This classification society or Administrations in accordance with Guideline 4(Res.MEPC.127(53)).

※ If BWMP is approved only in accordance with the standard of Res.A868(20), it is not an official Plan complying with the requirements of BWM Convention. Therefore, BWM Certificate(or Statement of Compliance for BWM) can not be issued.

※ If "BWMP for BW exchange standards" only had been approved, "BWMP for Ballast Water Management System" shall be approved additionally prior to installation of BWMS.

2.1 The application date for approval of Ballast Water Management Plan

1) For existing ships(Constructed before 2009),

⇒ For the existing ships, when the convention is in effective, it will be retroactively applied to the existing ships, therefore BWMP shall be approved not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship.

2) For new ships(Constructed on or after 2009),

a) Ships carrying ballast water capacity less than 5,000㎥ which are constructed on or after 01 January 2009 or Ships carrying ballast water capacity more than 5,000㎥ which are constructed on or after 01 January 2012

⇒ BWMP complying with D2 requirement shall be approved at the time of the construction of the ships.

b) Ships carrying ballast water capacity more than 5,000㎥ which are constructed between 1 January 2009 and 31 December 2011

⇒ BWMP shall be approved at the time of the construction of the ships because D1 requirement shall be applied as soon as the convention enters into force.

2.2 The composition of BWMP (Reg. B-1)

.1 detail safety procedures for the ship and the crew associated with Ballast Water Management as required by this Convention;

.2 provide a detailed description of the actions to be taken to implement the Ballast Water Management requirements and supplemental Ballast Water Management practices as set forth in this Convention;

.3 detail the procedures for the disposal of Sediments:

i) at sea; and

ii) to shore;

.4 include the procedures for coordinating shipboard Ballast Water Management that involves discharge to the sea with the authorities of the State into whose waters such discharge will take place;

.5 designate the officer on board in charge of ensuring that the plan is properly implemented;

.6 contain the reporting requirements for ships provided for under this Convention; and

.7 be written in the working language of the ship. If the language used is not English, French or Spanish, a translation into one of these languages shall be include

3. The three methods described in the convention for Ballast water exchange standard(D-1) (Refer to the convention Guideline 11 para.2 and para.3.5)

: the three methods which are described in the convention are as follows. Among them Flow-through method and Sequential method are used more often.

※ Attention:

If the existing ships use Flow-through method to comply with D1, additional works may be necessary(such as installation of new air vents) to avoid over-pressure. In this case, the prior consideration should be necessary before D1 requirement is applied to the ship especially when the work only can carry out during Dry Docking for the ships. If Sequential method is used, a particular attention should be given to the calculation of ship's longitudinal strength.

3.1 Flow-through method

a) “Flow-through Method” means a process by which the replacement ballast water is pumped into a ballast tank intended for the carriage of ballast water, allowing water to flow through overflow or other arrangements.

b) Consideration: where the flow through method is to be used adequate provision should be made to avoid the risk of over pressurization of ballast tanks or ballast piping. The installation of additional air pipes, access hatches (as an alternative to deck manholes), internal overflow pipes (to avoid flowing over the deck) and interconnecting ballast trunks between tanks where applicable and possible may be considered. Water on decks and/or direct contact posses a safety and occupational health hazard to personnel. The design should, where possible, be such that it avoids water overflowing directly on to decks to avoid the direct contact by personnel with the ballast water;

3.2 Sequential method

a) “Sequential Method” means a process by which a ballast tank intended for the carriage of ballast water is first emptied and then re-filled with replacement ballast water to achieve at least a 95 percent volumetric exchange.

b) Consideration: where the sequential method is to be used, particular attention should be given to the ballast tank layout, total ballast capacity, individual tank configuration and hull girder strength. If the plan requires simultaneously emptying and refilling closely matched diagonal tanks then consequential torsional stresses should be considered. In addition, particular cautions should be required to the longitudinal strength, dynamic load, excessive stress, propeller immersion, intact stability and bridge visibility for the ship.

3.3 Dilution method

a) “Dilution Method” means a process by which replacement ballast water is filled through the top of the ballast tank intended for the carriage of ballast water with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange system.

b) Consideration: where the dilution method is to be used adequate provision should be made for appropriate piping arrangements to facilitate the ballast water pumping into the previously ballasted tanks through the top of the ballast tank and, simultaneously,

discharging the ballast water through the bottom of the tank at the same flow rate while maintaining a constant ballast water level in the tank throughout the exchange operation. Adequate provision should also be made to avoid the risk of over pressurization of ballast tanks or ballast piping. The hydrodynamic performance of the ballast tank is crucial to ensure full water exchange and sediment scouring. - the end -

Lim Sam-Taek
Executive Vice President
Statutory Survey Division
Korean Register of Shipping

Distributions : Ship owners, Shipyards and KR surveyors

C.在纽约关于压载水处理系统的要求

Port Rule Information

No. 2010006/port 5th July 2010

Subject : New York State Ballast Water Standards

Statutory Zone	New York three mile territorial sea or inland waters
Regulatory	Port Rule
Applicability	All ship owners

This is to inform to ship owners/operators additional detailed information in accordance with Ballast Water Standards included in Vessel General Permit of Environmental Protection Agency.

As we previously informed through the KR technical information No. 2009003/ETC, 2010002/ETC, on 6 February 2009, all commercial vessels with discharges of pollutants incidental to their normal operation, including but not limited to ballast water discharges, into the US three mile territorial sea or inland waters became subject to the Environmental Protection Agency's (EPA) Vessel General Permit (VGP) requirements and needs permit coverage for all vessels with their length of 24 meters (79 feet) or longer, except fishing vessels.

In this regard, the supplement 2.2.3(Discharges of Ballast Water) of Vessel General Permit (VGP) provides the instruction to ship owners/operators in respect of caution points for implementation of Ballast Water Standards as below.

1. Maintain a vessel-specific ballast water management plan.
   - Master and crew must understand and follow plan.
   - Plan must be available to EPA, upon request.
2. Clean ballast tanks regularly(no sediment discharge allowed).
3. Treat ballast water onshore, if available and economically practicable, and achievable or use onboard ballast water treatment system approved by U.S Coast Guard.

On a basis of VGP, especially Ballast Water Management, New York State notifies that each vessel covered under the VGP that operates in New York waters shall have a ballast water treatment system that meets the standards prescribed by the states by not later than 1 January 2012.
Furthermore, new ships which are constructed on or after 1 January 2013 covered under the VGP that operates in New York waters shall have a ballast water treatment system that meets more stringent standards prescribed by the state.

The Requirements of New York State Ballast Water Standards are as following.

Organisms, microbes	New York State		IMO's standard (Regulation D-2)
	Year 2012 (All)	Year 2013 (New Ship)	
Organisms 50μm or over	<0.1 / m³	0 / m³	<10 / m³
Organisms 10μm-50μm	<0.1 / ml	<0.01 / ml	<10 / ml
Toxicogenic vibrio cholerae (0 1, 0 139)	< 1 cfu / 100ml	< 1 cfu / 100ml	< 1 cfu / 100ml
Escherichia coli	< 126 cfu / 100ml	< 126 cfu / 100ml	< 250 cfu / 100ml
Intestinal Enterococci	< 33 cfu / 100ml	< 33 cfu / 100ml	< 100 cfu / 100ml
Bacteria	N.A.	< 1,000 / 100ml	N.A.
Viruses	N.A.	< 10,000 / 100ml	N.A.

(cfu : colony forming unit)

There are the relevant information written in original document of VGP including overall content of Ship Ballast Water Discharges and instruction of Marshall Islands and ICS (International Chamber of Shipping) explaining approval procedure and extension request of Ship Ballast Water Discharges in New York State.

The original document of VGP and Marine Guideline No.2-11-10 issued by the Marshall Islands and MC(10)43 issued by ICS can be available through the following URL respectively and attached files on this port information.

http://www.epa.gov/npdes/pubs/vessel_vgp_permit.pdf

Marine Guideline No.2-10-11

http://www.register-iri.com/forms/upload/MG-2-11-10.doc

MC(10)43

http://www.marisec.org/icsorange/icscirculars10/MC_10_43%20-%20NYState%20BW%20Requirements.pdf

Ship owners/operators are kindly requested to be noticed and pay attention to the above information against checking for basis compliance with New York State Ballast Water Standards in the VGP at the time of arriving at New York port.

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D.进入澳大利亚港口的压载水管理系统的验证手段

Port Rule Information

No. 2010007/port 11th October 2010

Subject : Verification tools of Ballast Water Management System for the ships berthing in the Australia Port

Statutory Zone	Australia inland waters
Regulatory	Port Rule (PSC)
Applicability	All ship owners

This Port Rule Information is to inform to ship owners/operators the Guideline for the Port State Control of Australia State, even though the Ballast Water Management Convention is not effective, some ships already installed and operated onboard the type-approved Ballast Water Management System, therefore, the Australia State have plans to verify whether the ship complies with the specifications and instruction of manufacturer or not, for the ships which installed onboard the Ballast Water Management System, berthing in the Australia Port. Therefore, Korean-Register would like to provide the detailed information as follows in accordance with verification tools for the Ballast Water Management System and PSC inspection items on a basis of the document which was submitted by Australia State(MEPC 61/INF.19).

- Contents -

1.1 Australia has applied ballast water management requirements in Australia waters since 2001 and is currently working towards the ratification of the Ballast Water Management(BWM) Convention. Australia is progressing development of new legislation, supporting tools and procedures to assist the effective implementation, compliance and enforcement of the Convention.

1.2 In recognizing that some ships are being fitted or retrofitted with type-approved ballast water management systems (BWMS), the development of tools to facilitate the verification of the operation of these new systems is of particular interest. These tools will assist compliance activity to verify that the system meets Australia's current requirements and also for when the BWM Convention is in force.

1.3 These tools include a Treatment System Particular (TSP) document on individual BWMS detailing its function and relevant aspects specific to the system (e.g., treatment

on uptake and discharge, flow rates or retention periods, etc.). These TSPs are being developed in consultation with BWMS manufacturers, local governments and industry.

1.4 The TSP and associated verification procedure is designed to provide inspection officers with information to verify that the particular system has been operated in accordance with the manufacturer's instructions and the ship's ballast water management plan. The TSP and verification procedure will complement port state control guideline under the Convention. An example of a TSP and verification checklist is provided at the annex.

Also, Australia invites Member States to consider the benefit of using these tools and procedures to assist in the inspection and verification of the operation of BWMS, this is already mentioned through the Marine Environment Protection Committee 61st session Agenda item 2.

1.5 At the time of MEPC 61st session, on the Treatment System Particulars (TSP) attached on the document of MEPC 61/INF.19 submitted by Australia State, verification check items of BWMS which were made for PSC inspection officers are as below.

	Verification Check Items
Sterilisation	The number of AOT units should correspond to the BW pump capacity (1 unit[AOT] = 250 m³/h)
	Request crew to open the AOT unit control box to ascertain operational activity with no warning lights
Control Panel, Storage in BW tanks and discharge, Cleaning in Place Unit	Request maintenance log to examine records of routine crew checks (note every 3 months) Cleaning solution should be pH 3 or lower
	Note CIP fluid levels which should be replaced/refilled whenever pH is > 3, or level is low
Maintenance	How often is filter inspected or replaced?
	What is minimum number of UV lamps that can be faulty in a reactor? (all lamps need to be operational)
	How often are UV lamps checked? (lifetime expectancy is 1500 hours of operation)
	What is pH of the cleaning solution in the CIP unit, and how often is it checked?
Data	Compare the recent ballast activity (total volume and pump capacity) with the Ballast Water Record Book and the Ballast Water Management Plan
	Identify if any system alarms have been triggered (Note that the system will be shut down automatically when a problem occurs)

	Ascertain that no components of the system have been bypassed Ascertain that the system has not shutdown during ballasting and/or deballasting.(If it has, then it is important to ascertain that any problems have been fixed)
* If all the verification checks are positive then the ballast water management system should be considered to be operating effectively.	

In addition, attached files are Treatment System Particular (TSP) including functional details of Ballast Water Management System designed by a specific manufacturer and verification check items. Accordingly, ship owners/operators are kindly requested to be noticed and pay attention to the above information against checking for compliance with Treatment System Particular (TSP) and verification checklists in accordance with PSC inspection of BWMS.

-The end-

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E.有关生产商的调查表

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 30 April 2011 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
E-mail : krmac@krs.co.kr
(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jang Jae-shik, KR Machinery Team by phone: +82-42-869-9456 or E-mail: krmac@krs.co.kr

1. Please describe about your company

Company name	Techcross
Person in Charge	Mr. J. W. Lee
Telephone No.	02 3775 7777
Fax. No.	02 3775 7788
E-mail	mike@techcross.net

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

- ECS (Electro-Cleen ^{TM} System)

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

- Electrolysis Disinfection

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

Proven Technology	• IMO approval & Type approval • Patented Electrolysis technology
No filtration	• No pressure loss (Max. 0.2bar) • No loss of ballasting time • Maintaining ship flexibility
Easy Installation	• Installing in between seawater pipelines • System equipments can be installed at any idle space • Minimum Space (Installed in 8,300GT container ship and 27k bulk carrier) • No changes in ship design
Automatic Operation	• Feedback control of each component with HMI • Automatic/Manual operation • Monitoring and recording at ballasting and deballasting situation
Low Oper. Cost	• 0.3cent /1,000m3 for Fuel Cost only • Long lifetime of electrodes • $4.00 for neutraliser to treat 1,000m3 of ballast water with TRO 4ppm
Convenient Maintenance & A/S	• Modular type system • Easy replacement by engineer / ship crew • Worldwide A/S network
Continuing R&D	• Continuing research and development to provide more competitive products and to preserve marine environment • Online monitoring system

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.
   1) Consider the maintenance space for ECS components
   2) Consider the electric consumption of ECS components
   3) Consider the equal flow rate when the ECU(Electro-Chamber Unit)s are operated in parallel

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

1) ECU300 Model

Technical Data for Various System Capacity depending on ECU300

Ballast pump Capacity		Total capacity	Overall Dimension			Total Footprint area	Total Power consumption		Total Consumption				Total Pressure drop	Total Weight (kg)	
									Cooling water (m3/h)		Compressed air	Steam			
㎥/h	set	㎥/h	L(m)	W(m)	H(m)	㎡	kw/h	kw/h (15% Loss)	FW	SW	㎥/h	kg/h	Bar	Dry	Wet
300	2	600	Refer to Footprint		2.0	5.30	69.0	79.4	5.0	8.0	NO	NO	0.2 ~ 0.4	5,499	6,122
600	2	1,200	Refer to Footprint		2.0	7.88	135.0	155.3	10.0	16.0	NO	NO	0.2 ~ 0.4	7,419	8,344
900	2	1,800	Refer to Footprint		2.0	10.03	202.5	232.9	15.0	24.0	NO	NO	0.2 ~ 0.4	9,619	10,846
1,200	2	2,400	Refer to Footprint		2.0	12.61	268.5	308.8	20.0	32.0	NO	NO	0.2 ~ 0.4	11,539	13,068
1,500	2	3,000	Refer to Footprint		2.0	15.74	336.0	386.4	25.0	40.0	NO	NO	0.2 ~ 0.4	13,739	15,570
1,800	2	3,600	Refer to Footprint		2.0	17.34	402.0	462.3	30.0	48.0	NO	NO	0.2 ~ 0.4	15,659	17,792
2,100	2	4,200	Refer to Footprint		2.0	20.47	469.5	539.9	35.0	56.0	NO	NO	0.2 ~ 0.4	17,859	20,294
2,400	2	4,800	Refer to Footprint		2.0	23.04	535.5	615.8	40.0	64.0	NO	NO	0.2 ~ 0.4	19,779	22,516
2,700	2	5,400	Refer to Footprint		2.0	25.20	603.0	693.5	45.0	72.0	NO	NO	0.2 ~ 0.4	21,979	25,018
3,000	2	6,000	Refer to Footprint		2.0	27.77	669.0	769.4	50.0	80.0	NO	NO	0.2 ~ 0.4	23,899	27,240
3,300	2	6,600	Refer to Footprint		2.0	30.91	736.5	847.0	55.0	88.0	NO	NO	0.2 ~ 0.4	26,099	29,742
3,600	2	7,200	Refer to Footprint		2.0	32.50	802.5	922.9	60.0	96.0	NO	NO	0.2 ~ 0.4	28,019	31,964
3,900	2	7,800	Refer to Footprint		2.0	35.64	870.0	1,000.5	65.0	104.0	NO	NO	0.2 ~ 0.4	30,219	34,466
4,200	2	8,400	Refer to Footprint		2.0	38.21	936.0	1,076.4	70.0	112.0	NO	NO	0.2 ~ 0.4	32,139	36,688
4,500	2	9,000	Refer to Footprint		2.0	40.37	1,003.5	1,154.0	75.0	120.0	NO	NO	0.2 ~ 0.4	34,339	39,190
4,800	2	9,600	Refer to Footprint		2.0	42.94	1,069.5	1,229.9	80.0	128.0	NO	NO	0.2 ~ 0.4	36,259	41,412
5,100	2	10,200	Refer to Footprint		2.0	46.07	1,137.0	1,307.6	85.0	136.0	NO	NO	0.2 ~ 0.4	38,459	43,914
5,400	2	10,800	Refer to Footprint		2.0	47.67	1,203.0	1,383.5	90.0	144.0	NO	NO	0.2 ~ 0.4	40,379	46,136

2) ECU600 Model

Technical Data for Various System Capacity depending on EUC600

Ballast pump Capacity		Total capacity	Overall Dimension			Total Footprint area	Total Power consumption		Total Consumption				Total Pressure drop	Total Weight (kg)	
									Cooling water (m3/h)		Compressed air	Steam			
㎥/h	set	㎥/h	L(m)	W(m)	H(m)	㎡	kw/h	kw/h (15% Loss)	FW	SW	㎥/h	kg/h	Bar	Dry	Wet
600	2	1,200	Refer to Footprint		2.0	6.90	113.0	130.0	10.0	16.0	NO	NO	0.2 ~ 0.4	3,449	4,074
1,200	2	2,400	Refer to Footprint		2.0	11.63	224.5	258.2	20.0	32.0	NO	NO	0.2 ~ 0.4	5,929	6,858
1,800	2	3,600	Refer to Footprint		2.0	15.39	336.0	386.4	30.0	48.0	NO	NO	0.2 ~ 0.4	8,409	9,642
2,400	2	4,800	Refer to Footprint		2.0	20.12	447.5	514.6	40.0	64.0	NO	NO	0.2 ~ 0.4	10,889	12,426
3,000	2	6,000	Refer to Footprint		2.0	24.85	559.0	642.9	50.0	80.0	NO	NO	0.2 ~ 0.4	13,369	15,210
3,600	2	7,200	Refer to Footprint		2.0	28.60	670.5	771.1	60.0	96.0	NO	NO	0.2 ~ 0.4	15,849	17,974
4,200	2	8,400	Refer to Footprint		2.0	33.33	782.0	899.3	70.0	112.0	NO	NO	0.2 ~ 0.4	18,329	20,778
4,800	2	9,600	Refer to Footprint		2.0	38.06	893.5	1,027.5	80.0	128.0	NO	NO	0.2 ~ 0.4	20,809	23,562
5,400	2	10,800	Refer to Footprint		2.0	41.82	1,005.0	1,155.8	90.0	144.0	NO	NO	0.2 ~ 0.4	23,289	26,346

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	ECU (Electro-Chamber Unit)	O	O		O		Y
	ANU (Auto Neut. Unit)	O			O		N
	PRE (Power Ref. Equip)	O			O		N
Control and Monitoring Equipment	TRO Sensor Unit	O			O		N
	Gas Sensor Unit	O			O		N
	Flow Meter Unit	O			O		N
	Conductivity Sensor Unit	O	O		O		N
	Power Distributor Equip.	O	O		O		Y
	Power Control Unit	O			O		N

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit ■ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes ■ No
3	Where is the monitoring equipment installed?	■ E/R □ (Ballast or Cargo)Pump Room ■ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	■ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		■ TRO Sensor Unit	□ Yes ■ No
		■ Gas Sensor Unit	□ Yes ■ No
		■ Flow Meter Unit	■ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		■ Pressure Sensor Unit	■ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly) NaOcl, Ocl-, OBr-, HoBr
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	■ Gas Detection ■ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	■ E/R ■ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	■ Mechanical Vent. (Air change rate : /H) ■ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

The operation range of ECS is from 10% to 110%. In case of the operation range from 100% ~ 110%, the alarm is activated. In case that the operation range over 110%, ECS shut down automatically.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

TRO Sensor Unit

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

The sampling is carried out with a manhole in ECS.

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	■ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	
3	What are properties of the by- product?	□ Toxic ■ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	ECS300(1set) : H_2 0.7m^3/Hr, 63g
5	Is the gas detection unit an explosion-proof type?	□ Yes ■ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	- Monitor H_2 continuously - Vent H_2 to poop deck by mechanical vent. system

Questionnaire about

Ballast Water Treatment System

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Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
E-mail : krmac@krs.co.kr
(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jang Jae-shik, KR Machinery Team by phone: +82-42-869-9456 or E-mail: krmac@krs.co.kr

1. Please describe about your company

Company name	NK
Person in Charge	Mr. S. J. Park
Telephone No.	051-200-0810
Fax. No.	051-207-2208
E-mail	Sjpark1@nkcf.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

- NK-O3 BlueBallast System

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

- Onzone : Side Stream Ozone Injection

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Applicable all kinds of vessels
2) To install on new/existing vessels without correction of design
3) No head loss
4) Low operating cost (0.8 cent/m^3)

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) To design an inserting line in ballast discharge lines

2) To consider the installation space

3) To arrange an injection piece at the side of a pump discharge in case that ballast pumps are installed in dangerous area or underwater

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

용량(m^3/h)	소비전력(kW)	설치공간(L x B x H)m
250	36.2	4.2
300	36.5	4.2
600	60.4	6.6
800	68.4	9.1
1000	86.9	8.3
1500	123.2	10.6
2000	148.4	14.5
3000	243.5	17.0
4000	317.6	20.3
5000	385.8	23.9
6000	438.3	25.3
기타 : 8000	613.8	36.8

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	O			O		N
	Neutralization Unit	O			O		
	기타 : Side Stream Ozone Injection	O	O	O	O		Y
Control and Monitoring Equipment	TRO Sensor Unit	O			O		
	Gas Sensor Unit	O	O	O	O		Y
	Conductivity Sensor Unit						
	Flow Meter Unit	O	O	O	O		Y
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit ■ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes ■ No
3	Where is the monitoring equipment installed?	■ E/R □ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	■ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	■ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	■ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	■ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	■ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	■ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) ■ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes ■ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

To activate alarm in excess of its capacity or control flow rate

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

TRO Sensor

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast discharge line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes ■ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	
5	Is the gas detection unit an explosion-proof type?	■ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	Natural vent. space

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

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1. Please describe about your company

Company name	PANASIA CO., LTD.
Person in Charge	Hyun-O, Kim
Telephone No.	051-970-1537
Fax. No.	051-831-1399
E-mail	lab@worldpanasia.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : GloEn-Patrol™

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filter + UV Disinfection

The 1st stage is a filter that was specially designed for ballast water applications. It significantly reduces the sediment load of the ballast water and also removes some of the microorganisms. The UV unit employs high-intensity, medium-pressure ultra violet (MPUV) lamps to destroy living microorganisms present in the liquid being treated.

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	
De-ballasting	
Ballasting and De-ballasting	○
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Automatic cleaning, Easy maintenance.
2) No biocide chemicals are required.
3) No toxic by-products are formed. No corrosion problems in ballast tanks.
4) The process requires little maintenance and easy handling.
5) Optimized design for each sizes and type of ship.

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Installation of Filter back-flushing pump (It depend on ship's design) : Option

2)

3)

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100		
200		
300		
400		
500		
600		
700		
800		
900		
1000		
1500		
2000		
2500		
3000		
3500		
4000		
4500		
5000		
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	○	○	○	○		○ (2010.06)
	Neutralization Unit						
	Others :						
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit						
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions. : There are no devices which take samples from ballast pipe lines in our BWMS.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		☑ Flow Meter Unit	☑ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		☑ Pressure Sensor Unit	☑ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns. None

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)
Alarm: over 20%
Automatic shut down: over 32%

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?
None.

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast water discharge line. (after BWMS)

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows. None

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. $1m^3$/hr, etc) Please use a separate sheet if needed.	
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	

Questionnaire about

Ballast Water Treatment System

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Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

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(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

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1. Please describe about your company

Company name	SAMGONG VOS CO., LTD
Person in Charge	Cho, Young Mook
Telephone No.	051-200-3080
Fax. No.	051-200-3046
E-mail	mooki@sam-gong.co.kr

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : *VOS (Venturi Oxygen Stripping) System*

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

De-oxygenation

This system injects Inert Gas which is generated by an IGG (Inert Gas Generator) into ballast water through a Ventury Injector to maintain the rate of dissolved oxygen in the ballast water to a certain level (7ppm → 1ppm) to sterilize micro-organisms in the ballast water and consequently meet the requirements of IMO D-2.

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) User friendly equipment (Similar to inerting equipment for cargo tanks)

2) Effective for ballast tank corrosion protection

3) Can be used in hazardous areas

4) Does not make use of dangerous active substances

5) Easy to assess system performance (Simply by measuring the rate of dissolved oxygen (below 1ppm))

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Riser loop piping coupled to a ballast pump need to be installed on main deck level.

2) The system requires secondary deck piping for an inert gas system inside the ballast tank.

3) Since the I.G.G. burns DMA, relevant fire safety protection and ventilation (E/R only) should be considered.

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100	*17.3*	*2.5x0.9x1.9 (4.8x3.4x2.4)*
200	*17.3*	*2.5x0.9x1.9 (4.8x3.4x2.4)*
300	*17.3*	*2.5x0.9x1.9 (4.8x3.4x2.4)*
400	*24.3*	*2.5x0.9x1.9 (4.8x3.4x2.4)*
500	*24.3*	*2.5x0.9x1.9 (4.8x3.4x2.4)*
600	*24.3*	*2.7x1.5x2.2 (5.0x4.0x2.7)*
700	*24.3*	*2.7x1.5x2.2 (5.0x4.0x2.7)*
800	*24.3*	*2.7x1.5x2.2 (5.0x4.0x2.7)*
900	*24.3*	*2.7x1.5x2.2 (5.0x4.0x2.7)*
1000	*40.3*	*2.7x1.5x2.2 (5.0x4.0x2.7)*
1500	*62.3*	*3.2x1.8x2.6 (5.5x4.3x3.1)*
2000	*62.3*	*3.2x1.8x2.6 (5.5x4.3x3.1)*
2500	*92.3*	*3.8x2.1x3.0 (6.1x4.6x3.5)*
3000	*92.3*	*3.8x2.1x3.0 (6.1x4.6x3.5)*
3500	*112.3*	*4.0x2.2x3.4 (6.3x4.7x3.9)*
4000	*152.3*	*4.0x2.2x3.4 (6.3x4.7x3.9)*
4500	*152.3*	*5.0x2.6x3.6 (7.3x5.1x4.1)*
5000	*152.3*	*5.0x2.6x3.6 (7.3x5.1x4.1)*
6000	*182.3*	*5.0x2.6x3.6 (7.3x5.1x4.1)*
7000	*224.5*	*3500 Model x 2 sets*
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water	Treatment Unit		O	O			N/A
	Others : SGG (Stripping Gas Generator)	O				*SGG can be installed in E/R, Engine Casing or Steering gear room*	NO
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit						
	Others : - Control Panel - Alarm Monitor Panel - Recorder	O				*Control Panel - Ballast control room* *AMP - E/R* *Recorder - W/house*	NO

Machinery Team of KR

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others : *Dissolved Oxygen Monitoring*
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No (I.S. Type)
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others : N/A

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 : *Dissolved Oxygen Sensor*	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

This system controls ballast water flow rate by using a Throttle valve inside the Venturi Injector.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

The system is equipped with 2 sets of air blowers (each 50% of system requirement)

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Sounding pipe

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	*Low Oxygen Inert Gas (N2, CO2)*
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	*Ballast pump design capacity X 1.25*
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	*N/A*

Questionnaire about

Ballast Water Treatment System

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Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
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(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

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1. Please describe about your company

Company name	HYUDAI HEAVY INDUSTRY CO., LTD
Person in Charge	Kim, Ha Jong
Telephone No.	052-202-6327
Fax. No.	052-202-6330
E-mail	bogoos@hhi.co.kr

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : *HiBallast*

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Electrolysis type

During ballasting operation, filter unit removes particles or organisms larger than 50㎛ and disinfectant produced by Electrolysis Unit is injected to the main ballast pipe to kill micro-organisms in ballast water.

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O (Neutralization during de-ballasting)
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) *Low cost*
2) *Easy to install*
3) *Easy to maintenance*
4) *Low electric power consumption*
5) *Automatic and remote control using PLC*

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) To install a booster pump for the operation of the system.

2) Not suitable for hazardous area (Explosion proof type to be developed later)

3) Require a mechanical vent. system

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption(kW)**	**Required Space (L x B x H)m**
100		
200		
300	*< 33 kW*	
400		
500	*< 48 kW*	
600		*4000x3500x2000*
700		
800		
900		
1000	*< 92 kW*	*4000x3500x2000*
1500	*< 133 kW*	
2000	*< 176 kW*	*7000x3500x2000*
2500	*< 216 kW*	
3000		
3500		
4000		
4500		
5000	*< 430 kW*	*8000x3500x2000*
6000	*< 507 kW*	
7000		
Others :	* Base on the maximum electric consumption of each system * Models with blank spaces are under development.	

Machinery Team of KR

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit				O		NO
	Neutralization Unit				O		NO
	Others : (PDE, PRE), Sampling Tank				O		NO
Control and Monitoring Equipment	TRO Sensor Unit				O		NO
	Gas Sensor Unit				O		Yes
	Conductivity Sensor Unit				N/A		NO
	Flow Meter Unit				N/A		NO
	Others : (LOP, AVU)				O		NO

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit □ Gas Sensor Unit □ Others : *Dissolved Oxygen Monitoring*
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room ■ Others : Require additional cabinet on deck
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	■ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		■ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes ■ No
		■ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		■ Pressure Sensor Unit	■ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	To be installed in a dedicated room for BWTS installation which is arranged in a non-hazardous space.	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	HOCl (hypochlorite) OCl^- (hypochlorite ion)
2	Characteristics of active substances	■ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	■ Gas Detection ■ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	■ E/R □ Pump Room ■ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	■ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes ■ Use the stainless steel □ Use all welding joints ■ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Alarm and recording in the event of excessive flow

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

Gas Leak Detector

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast water discharge line(50A)

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	■ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	Hydrogen (H2), Chlorine (Cl)
3	What are properties of the by- product?	■ Toxic ■ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	Varies with treatment capacity. To be informed later
5	Is the gas detection unit an explosion-proof type?	■ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	*To a safe area outside the installation space.*

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 30 April 2011 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
E-mail : krmac@krs.co.kr
(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jang Jae-shik, KR Machinery Team by phone: +82-42-869-9456 or E-mail: krmac@krs.co.kr

1. Please describe about your company

Company name	21st Century Shipbuilding Co., Ltd
Person in Charge	Moon, Sung Won
Telephone No.	055-715-1600
Fax. No.	055-715-1604
E-mail	Wdr_wondybest@21csb.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : *ARA Ballast*

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filter + Plasma + MPUV

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	
De-ballasting	
Ballasting and De-ballasting	O (MPUV only in de-ballasting)
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Compact size (2.1 ㎡ - 350(㎥/h))

2) Low power consumption (less than 30 kW)

3) Easy installation

4) Easy Maintenance

5) Low cost

6) Fully automated system

7) Environmentally friendly (does not use any chemical substances)

8) The system offers continuous sterilization.

9) Does not produce sediments during treatment.

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Select a model according to the treatment capacity.

2) Check installation space to verify whether the system need to explosion-proof type or not

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Model of system	Flow rate (m^3/h)	Power consumption(kW)	Footprint	Dimension summary (L x B x H)㎜
ARA-350	350	30	1.79㎡	1860 x 964 x 1865
ARA-500	500	60	2.74㎡	2650 x 1035 x 2540
ARA-750	750	85	2.78㎡	2684 x 1035 x 2540
ARA-1000	1000	125	5.06㎡	4098 x 1235 x 2680
ARA-1500	1500	170	5.19㎡	4204 x 1235 x 2875
ARA-2000	2000	250	10.12㎡	4098 x 2470 x 2680
ARA-3000	3000	350	10.38㎡	4204 x 2470 x 2875

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit		O	O	O		Yes
	Neutralization Unit						
	Others : (PDE, PRE), Sampling Tank						
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit		O	O	O		Yes
	Conductivity Sensor Unit						
	Flow Meter Unit		O	O	O		Yes
	Others : (LOP, AVU)						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit ■ Gas Sensor Unit ■ Others : *Dissolved Oxygen Monitoring*
2	Is the monitoring equipment an explosion-proof type?	■ Yes □ No
3	Where is the monitoring equipment installed?	■ E/R □ (Ballast or Cargo)Pump Room ■ Others : ECR, CCR, Up Decker
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	■ Mechanical Ventilation ■ Gas Detection & Alarm ■ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		■ Gas Sensor Unit	■ Yes □ No
		■ Flow Meter Unit	■ Yes □ No
		■ Level Sensor Unit	■ Yes □ No
		■ Temp. Sensor Unit	■ Yes □ No
		■ Pressure Sensor Unit	■ Yes □ No
		□ Other 1 : Throttle valve	■ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	N/A
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

In the event of excessive flow, the flow will be controlled by a throttle valve and an alarm will activate.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

N/A

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

At suction side of a filter and ballast water discharge line.

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes ■ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	*Low Oxygen Inert Gas (N2, CO2)*
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. $1m^3$/hr, etc) Please use a separate sheet if needed.	
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	

Questionnaire about

Ballast Water Treatment System

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Korean Register of Shipping

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Machinery Team of KR

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1. Please describe about your company

Company name	Techwineco
Person in Charge	Lim, Jae-dong
Telephone No.	043-271-8191
Fax. No.	043-271-8193
E-mail	jdlim@techwineco.co.kr

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : Purimar^{TM}

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Electrolysis

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Space-saving design

2) Non toxic by-products

3) Corrosion and coating protection

4) Cost saving

5) Automatic operation

6) Global support

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

   1) Explosion-proof type should be considered when installed in pump room.

   2) Vent pipes for Hydrogen gas should be installed in a safe space.

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

No.	Flow Rate (m^3/h)	Install dimension and weight						Power Consumption (kW)
		Electrolysis Unit		Neutralization Unit		Sensor Unit		
		Dimension (LxWxH)	Weight (Kg)	Dimension (ΦxH)	Weight (Kg)	Dimension (LxWxH)	Weight (Kg)	
1	200	1950x1530x1800	900	1100x1400	60	900x300x1600	80	14.4
2	500	2000x2000x2050	1030	1400x1900	150	900x300x1600	80	25.6
3	700	2150x2000x2040	1120	1500x2100	210	900x300x1600	80	32.5
4	1,000	2600x2400x2130	1610	1700x2200	300	900x300x1600	80	46.9
5	1,500	2800x2500x2400	1850	2000x2500	450	900x300x1600	80	64.2
6	2,000	3100x2600x2560	2390	2100x2800	600	900x300x1600	80	81.5
7	2,500	3200x2600x2560	2600	2200x2500	750	900x300x1600	80	99.6
8	3,000	3300x2700x2600	3120	2400x2800	900	900x300x1600	80	117.0
9	3,500	4300x2900x2650	3640	2500x3500	1050	900x300x1600	80	134.3
10	4,000	4600x3200x2700	3930	2600x3200	1200	900x300x1600	80	151.6
11	4,500	4650x3300x2800	4500	2700x3200	13510	900x300x1600	80	168.9
12	5,000	4700x3300x2800	4830	2800x3200	1500	900x300x1600	80	188.3
13	6,000	5000x3300x3000	5550	3000x3300	1800	900x300x1600	80	223.7
14	7,000	5200x3500x3200	6000	3000x4000	2100	900x300x1600	80	258.3

* Power consumption for auto back-flush pump not included.

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	O			O		No
	Neutralization Unit	O	O	O	O		Yes
	Others : Filter	O	O				Yes
Control and Monitoring Equipment	TRO Sensor Unit	O	O	O	O		Yes
	Gas Sensor Unit	O			O		Yes
	Conductivity Sensor Unit	O			O		Yes
	Flow Meter Unit	O	O		O		Yes
	Others : Control Panel	O			O		

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit □ Gas Sensor Unit □ Others : *Dissolved Oxygen Monitoring*
2	Is the monitoring equipment an explosion-proof type?	■ Yes □ No
3	Where is the monitoring equipment installed?	■ E/R ■ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		■ Flow Meter Unit	■ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		■ Pressure Sensor Unit	■ Yes □ No
		□ Other 1 : Throttle valve	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	NaOCl
2	Characteristics of active substances	■ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	■ Gas Detection ■ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	■ E/R □ Pump Room ■ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	■ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints ■ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Alarm → Shut-down

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

TRO Sensor Unit, Flow meter, Hydrogen gas dilution fan, Pressurization pump, Control panel (network system)

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast water discharge Line, Over board line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	■ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	*Hydrogen, Chlorine*
3	What are properties of the by- product?	■ Toxic ■ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. $1m^3$/hr, etc) Please use a separate sheet if needed.	Under 2%
5	Is the gas detection unit an explosion-proof type?	■ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	*Safe area on upper deck*

Questionnaire about

Ballast Water Treatment System

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1. Please describe about your company

Company name	Aquaeng. Co. Ltd
Person in Charge	Song, Jae-keong
Telephone No.	051-728-1270~2
Fax. No.	051-728-1273
E-mail	jksong@aquaeng.kr

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : AquaStar^{TM} BWMS (Ballast Water Management System)
In-line Electrolysis Type

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) : *Electrolysis*

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	O
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) *Directly installed in ballast pipe line, Easy installation (compact size)*
2) *Low power consumption*
3) *No filter system, no plugging*
4) *Automatic operation*

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

Machinery Team of KR

1) *Interconnectivity with ballast pump*

2) *Availability of shipboard GPS*

3) *Location of gas vent.*

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100		*Ballasting, / De-ballasting*
200		
300		
400		
500	*[~55(max.)]x2*	*(3x3x1)x2, / (2x2x2)*
600		
700		
800		
900		
1000	*[~121(max.)]x2*	*(3x3x1)x2, / (2x2x2)*
1500		
2000	*[~158(max.)]x2*	*(3x3x1)x2, / (2x2x2)*
2500		
3000	*[~264(max.)]x2*	*(4x4x1.5)x2, / (2x2x2)*
3500		
4000		
4500		
5000		
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water	Treatment Unit		O				Yes
	Neutralization Unit		O				-
	Others :		O				-
Control and Monitoring Equipment	TRO Sensor Unit		O				Yes
	Gas Sensor Unit		O				Yes
	Conductivity Sensor Unit						
	Flow Meter Unit		O				Yes
	Others : - Master Control	O					-

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit □ Gas Sensor Unit □ Others : *Dissolved Oxygen Monitoring*
2	Is the monitoring equipment an explosion-proof type?	■ Yes □ No (I.S. Type)
3	Where is the monitoring equipment installed?	□ E/R ■ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	■ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door ■ Others : N/A

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		■ TRO Sensor Unit	■ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		■ Flow Meter Unit	■ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		■ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 : *Dissolved Oxygen Sensor*	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	NaOCl
2	Characteristics of active substances	■ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	■ Gas Detection ■ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R ■ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) ■ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints ■ Others : Supply line not required (In-Line type)

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

- Controls TRO production suitable for ballast water flow.
- If out of control, the system first activates alarm and then shut-down the system.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

- The BWMS is installed in each ballast pump so as to give redundancy to the system.
- Pressure indicator (transmitter)

- Temperature indicator (transmitter), etc

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast Water Discharge Line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	■ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	*Hydrogen*
3	What are properties of the by- product?	□ Toxic ■ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	*[0.7m3/hr of H2 treats 200on/hr of ballast water]* *1,000 ton/hr – 3.5m^3/hr* *2,000 ton/hr – 7.5m^3/hr* *3,000 ton/hr – 10.5m^3/hr*
5	Is the gas detection unit an explosion-proof type?	■ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	*Safe area on upper deck*

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jee Jae-hoon, KR Machinery Team by phone: +82-42-869-9474 or email: krmac@krs.co.kr

1. Please describe about your company

Company name	Electrichlor Hypochlorite Generators Inc.
Person in Charge	M. Barrie Bentley
Telephone No.	574 304-5060
Fax. No.	574 773-5889
E-mail	mbb@electrichlor.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

Electrichlor EL BWTS

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Hypochlorination from seawater during ballasting.

Dechlorination during de-ballasting

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	x
De-ballasting	x
Ballasting and De-ballasting	x
In the ballast tank	
Others (describe in detail)	Chlorination into ballast piping after ballast pump

3. Please list strengths of your BWTS.

1) Known process (has been used successfully for over 80 years)
2) 99.9% effective on micro organisms
3) Automatic during ballast water charging & discharging
4) Small footprint
5) Very low installation & running cost

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Small piping installation from sea chest to unit and into upstream of ballast pump piping
2) Whether to install on deck on in machinery space
3) Hydrogen discharge to be piped upwards to atmosphere

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100	.45	
200	.9	
300	1.35	
400	1.8	
500	2.25	
600	2.7	
700	11.25	
800	3.6	
900	4.05	
1000	4.5	
1500	6.75	
2000	9	
2500	11.25	
3000	13.5	
3500	15.75	
4000	18	
4500	20.25	
5000	22.5	
6000	27	
7000	31.5	
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit		x	x	x		Class1, Div 2 Groups C&D
	Neutralization Unit		x	x	x		
	Others :						
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit		x				
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others : Total Chlorine Analyzer
2	Is the monitoring equipment an explosion-proof type?	Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others : At the ballast water discharge point
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly) Sodium Hypochlorite
2	Characteristics of active substances	□ Toxic NO □ Flammable NO □ Asphyxiant NO □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others : There is a drip tray that directs any leaks to drain
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others : Can be installed anywhere
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : 800m^3/H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others : PVC Lined Steel Pipe

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

No the unit is sized for the maximum ballast water flow rate

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

Redundant dosing pumps and blowers

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	Hydrogen
3	What are properties of the by- product?	□ Toxic □ Flammable - Hydrogen □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	.03 m^3/h
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	Safety area on exposed weather deck

Questionnaire about

Ballast Water Treatment System

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Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

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1. Please describe about your company

Company name	Severn Trent De Nora
Person in Charge	William Burroughs
Telephone No.	+1 281 274 8472
Fax. No.	+1 281 240 6762
E-mail	bburroughs@severntrentdenora.com

2. Please describe briefly about the Ballast Water Treatment System (hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : BalPure®

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

UPTAKE: 40μm pre-filtration + electrolysis (NaHOCl)

DISCHARGE: TRO neutralization

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	○
De-ballasting	Neutralization only – Sodium Bisulfite
Ballasting and De-ballasting	
In the ballast tank	Optional – to prevent reqrowth/can circulate & redoes in the ballast tanks.
Others (describe in detail)	○ DISCHARGE – TRO Neutralization only

3. Please list strengths of your BWTS.

1) Meets current interim California performance standards & current MEPC D-2
2) Meets USCG Phase 1 & Phase 2 proposed standards
3) Will meet California Final performance standards (CY 2020)

Machinery Team of KR

4) Filtration provides improvement to sediment control (Regulation B-5). Also, provides compliance with MEPC 150(55) Guidelines

5) Fully automated/integrated into ships' ballast water control system. Instant on-instantaneous production of sodium hypochlorite for disinfection of uptake ballast water. Electronic compliance with Regulation B-2 & Appendix II, Form of Ballast Water Record Book.

6) Very low maintenance – approximately 4 hours per month.

7) Specialized/revolutionary DSA® electrode coating allows full-power at reversed current – totally eliminating any/all electrolyzer cleaning requirements. Automatic self-cleaning system.

8) Slip-stream bypass feed to electrolytic generator. BalPure® is installed in engine room/machinery room – to avoid added capital expense for hazardous area costs. Can be single-skid mounted or modularized for retrofit in spaces available.

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Filter can be provided as Atex/Hazardous location/Ex-Proof for hazardous cargo applications when needed.

2) BalPure® system can be installed single skid or multiple/modularized for retrofit applications

3) Requires salt water at > 10 psu. This can be taken from the harbor or carried in a small ballast tank. Requirement is 1% of total ballast volume rate.

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
250 - 750	40 MAX Discharge ~ 250 W	4.8 x 1.8 x 2.8
750 – 1150	72 MAX (uptake only) Discharge ~ 250 W	4.8 x 1.8 x 2.8
1150 – 1550	104 MAX (uptake only) Discharge ~ 250 W	4.8 x 1.8 x 2.8
1550 – 2500	189 MAX (uptake only) Discharge ~ 500 W	6.2 x 2.0 x 3.2
2500 – 3500	231 MAX (uptake only) Discharge ~ 500 W	6.6 x 2.0 x 3.2

3500 – 4500	275 MAX (uptake only) Discharge ~ 750 W	6.6 x 2.0 x 3.2
4500 - 5800	343 MAX (uptake only) Discharge ~ 750 W	6.6 x 2.0 x 3.2
6000	360 MAX (uptake only) Discharge ~ 1 kW	6.6 x 2.0 x 3.2
7000	420 MAX (uptake only) Discharge ~ 1.25 kW	6.6 x 2.5 x 3.2
8000	480 MAX (uptake only) Discharge ~ 1.50 kW	6.6 x 2.5 x 3.2
9000	540 MAX (uptake only) Discharge ~ 1.75 kW	7.0 x 3.0 x 3.2
Others :	Each specified size is optimized with DC power source (transformer/SCR-based rectifier) & specialized electrolytic cells.	

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	○	○	○	○	Reduced Capex when installed in E/R	○
	Neutralization Unit	○	○	○	○	Reduced Capex when installed in E/R	○
	Others :						
Control and Monitoring Equipment	TRO Sensor Unit		○	○			○
	Gas Sensor Unit	○	○	○	○	Hydrogen gas detector	○
	Flow Meter Unit	○	○	○	○		○
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A X TRO Sensor Unit X Gas Sensor Unit (hydrogen) □ Others :
2	Is the monitoring equipment an explosion-proof type?	X Yes □ No
3	Where is the monitoring equipment installed?	X E/R X (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	X Mechanical Ventilation X Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others : Hydrogen byproduct is diluted to less than 1% H_2 in air & vented to safe location. H_2 detector is adjacent to equipment

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line? Flow meter is outside the ballast line; no penetration needed	□ N/A	
		X TRO Sensor Unit	X Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		Flow Meter Unit	Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		X Other 1 : ORP bisulfite	X Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	Electronics are intrinsically safe	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	Sodium hypochlorite generated from electrolysis of seawater.
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	X E/R □ Pump Room □ Dedicated space X Others : Can be installed anywhere on ship to accommodate space available
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	X Mechanical Vent. Hydrogen produced (byproduct) is known/Faraday's laws & dilution blowers to remove all hydrogen safely from the degas separation vessel. □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints X Others : skid equipment has PVC/CPVC piping assemblies. Slip stream is small (75mm dia typical) PVC/CPVC pipe.

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ? BalPure® is sized to match the ships' ballast water capacity/flow rate, etc. Design will prevent shortage of generation capacity. System is designed to treat during ballasting for most efficient operation but active substance can be added to each ballast tank as a post fill operation. Therefore this is not an issue.
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

    Dual TRO sensors, dual dilution blowers, dual dechlorination (neutralization) pumps, dual booster pumps, dual flow meters. Reliability study's over 30 years of similar manufacturing used to formulate accurate failure analysis of components.

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
    (e.g; Ballast Water Discharge Line, etc.)

    Ballast discharge line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	X Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	Hydrogen gas (byproduct) is generated during the electrolytic generation of sodium hypochlorite in seawater. Gas is separated at the BalPure® equipment/skid & diluted to less than 25% of LEL (approx 1% hydrogen in air) & vented safely. Once diluted, the hydrogen/air mixture can never be ignited/it is not flammable.
3	What are properties of the by- product?	□ Toxic X Flammable □ Asphyxiant X Others : Hydrogen is flammable in air at concentrations above 4%.
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	Faraday's laws govern production of sodium hypochlorite & hydrogen (byproduct). For 1000m3/h treatment, production of hydrogen gas is 5.22 Nm3/h. Blowers dilute hydrogen to less than 1% hydrogen in air (LEL of H_2 in air is 4%).
5	Is the gas detection unit an explosion-proof type?	X Yes □ No

6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	Gasses are wholly contained in the process. 2-phase (liquid/gas) is separated in degas vessel & hydrogen is directed to a vent duct. Dilution air is added & the entire hydrogen/air mixture is directed via a vent duct outside the engine room. Detection unit is installed adjacent to the hydrogen vent duct to detect any unintentional duct failure/piping breaks at the BalPure® unit.

Questionnaire about

Ballast Water Treatment System

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Korean Register of Shipping

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1. Please describe about your company

Company name	RWO GmbH, Marine Water Technology
Person in Charge	Mr Steffen Schlöricke
Telephone No.	0049-421-53705225
Fax. No.	0049-421-53705442
E-mail	steffen.schloericke@veoliawater.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : CleanBallast®

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filtration plus advanced electrolysis Ectosys®

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	
De-ballasting	
Ballasting and De-ballasting	X
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) High reduction of sediment loads
2) Low pressure loss
3) Low power consumption
4) No increase in corrosion or material damage
5)

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1)

2)

3)

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	Power Consumption (kW)	Required Space (L x B x H)m
100		
200		
300		
400		
500	Installed total power: 170 kW Power consumption: 10 - 55 kW/h	3 Disc filters, each: ø=980; depth=1080; height=1300 EctoSys, each: ø700; height=1100 Electrical cabinet: width=1200; height=2000; depth=700 Rectifier: width=600; height=2000; depth=750 Flushing pump: ø600; height=2200 All in mm indication
600		
700		
800		
900		
1000		
1500		
2000		
2500		
3000		
3500		
4000		

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4500		
5000		
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	X				In non hazardous area	
	Neutralization Unit	X				In non hazardous area	
	Others :	X				In non hazardous area	
Control and Monitoring Equipment	TRO Sensor Unit	X				In non hazardous area	
	Gas Sensor Unit	X				In non hazardous area	
	Flow Meter Unit	X				In non hazardous area	
	Others :	X				In non hazardous area	

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A X TRO Sensor Unit X Gas Sensor Unit X Others :algae monitor, salinity meter
2	Is the monitoring equipment an explosion-proof type?	□ Yes X No
3	Where is the monitoring equipment installed?	X E/R □ (Ballast or Cargo)Pump Room X Others : at BWTS
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door X Others : no safety measures are taken

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		X TRO Sensor Unit	□ Yes X No
		X Gas Sensor Unit	□ Yes X No
		X Flow Meter Unit	□ Yes X No
		□ Level Sensor Unit	□ Yes X No
		□ Temp. Sensor Unit	□ Yes X No
		X Pressure Sensor Unit	□ Yes X No
		X Other 1 : salinity meter	□ Yes X No
		X Other 2 : algae monitor	□ Yes X No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	BWTS: current design is not suitable for hazardous area	

Machinery Team of KR

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	Hydroxyl Radicals, OH* Hypochloric acid, HOCL Hypochlorite, OCL^-
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant X Others : electrochemical oxidation
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None X Others : N/A
4	Where is the generating unit of active substances installed on board ship ?	X E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) X Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints X Others : N/A

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Alarm

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

No redundancy in case of standard equipment

Machinery Team of KR

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

There are any recommendation by manufacture. Installation of sampling equipment has to be installed acc. to G2.

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	X Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	HOBr, OBr^-, $CHBr_2CL$
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant X Others : oxidation
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. $1m^3$/hr, etc) Please use a separate sheet if needed.	Less than 2% H_2 of the lower explosion limit (LEL)
5	Is the gas detection unit an explosion-proof type?	□ Yes X No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	To open deck

Machinery Team of KR

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jee Jae-hoon, KR Machinery Team by phone: +82-42-869-9474 or email: krmac@krs.co.kr

1. Please describe about your company

Company name	MAHLE Industriefiltration GmbH
Person in Charge	Ralph Michael
Telephone No.	+49 (0)40 - 53 00 40-24110
Fax. No.	+49 (0)40 - 53 00 40-24193
E-mail	ralph.michael@mahle.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

Ocean Protection System (OPS)

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filtration + UV (low-pressure lamps)

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	
De-ballasting	
Ballasting and De-ballasting	○
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) no chemicals, energy efficient UV disinfection
2) minimum operating cost, low power consumption
3) low pressure drop, can use already installed BW-pumps
4) system can be supplied as modular, skid mounted or installed in a container
5) no holding time in tanks necessary, no reaction nor chemical tanks

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) nothing

2)

3)

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m** **Variable construction (m^3)**
100		
200	~ 19	~ 12
300	~ 25	~ 18
400		
500	~ 37	~ 26
600	~ 49	~ 32
700	~ 54	~ 35
800	~ 60	~ 40
900		
1000	~ 77	~ 49
1500	~ 120	~ 65
2000	~ 159	~ 93
2500		
3000		
3500		
4000		
4500		
5000		
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit						
	Neutralization Unit						
	Others :						
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit						
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Not intended but possible.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

Not intended but possible.

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast Water Discharge Line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	

Questions 6 and 7: The OPS can be safely installed on-board ships with hazardous areas such as tankers. However there are limitations as to the location of the individual system components. By modifying system components, it can be made into an explosion proof system, such as required for use on oil and gas carriers and chemical tankers.

Questions 8 and 12: The OPS uses no chemicals and produces no by-products. The treatment is a physical system only. It emits light with a primary wavelength of 253.7 nm, which reaches organisms in the water and affects their DNA directly.

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

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Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jee Jae-hoon, KR Machinery Team by phone: +82-42-869-9474 or email: krmac@krs.co.kr

1. Please describe about your company

Company name	Siemens Water Technologies
Person in Charge	Louis Lombardo
Telephone No.	+1 908 851 6930
Fax. No.	+ 1 908 851 6906
E-mail	louis.lombardo@siemens.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

SiCURE™ Ballast Water Management System

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filtration and electrochlorination with proprietary control logic.

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	○
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) The production of active substance in a side stream generates several advantages as: Low pressure drop, flexible footprint, easy to install

2) Treatment only on uptake of ballast water results in low operating expenses

3) No need of handling or storage of chemicals due to in-situ production of active substance, no need for de-chlorination chemicals and self cleaning design (no cleaning chemicals)

4) Based on more than 35 years proven Chloropac technology guarantees for safety and reliability

Machinery Team of KR

5) Dual Action option: The SiCURE System can be customized to be used for BWT while ballasting and for Biofouling control of sea water pipelines for cooling water circuits during voyage

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

No special requirements

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100	15	Flexible footprint ca. 9.5 m^2
200	21	Flexible footprint ca. 9.5 m^2
300	28	Flexible footprint ca. 9.5 m^2
400	33.7	Flexible footprint ca. 9.5 m^2
500	41	Flexible footprint ca. 10.1 m^2
600	46	Flexible footprint ca. 10.1 m^2
700	53	Flexible footprint ca. 10.1 m^2
800	60	Flexible footprint ca. 10.1 m^2
900	69	Flexible footprint ca. 10.1 m^2
1000	73	Flexible footprint ca. 12.7 m^2
1500	107	Flexible footprint ca. 15.2 m^2
2000	145	Flexible footprint ca. 15.8 m^2
2500	190	Flexible footprint ca. 15.8 m^2
3000	216	Flexible footprint ca. 23.0 m^2
3500	265	Flexible footprint ca. 23.0 m^2
4000	292	Flexible footprint ca. 30.7 m^2
4500	339	Flexible footprint ca. 30.7 m^2
5000	368	Flexible footprint ca. 30.7 m^2
6000	440	Flexible footprint ca. 42.8 m^2
7000	513	Flexible footprint ca. 44.8 m^2
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	○					
	Neutralization Unit					Not applicable with SiCURE	
	Others : Filter Unit		○				
Control and Monitoring Equipment	TRO Sensor Unit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Gas Sensor Unit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Flow Meter Unit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Others : ORP sensor					As by-pass of the ballast water main	

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit x Others : ORP sensor
2	Is the monitoring equipment an explosion-proof type?	□ Yes x No
3	Where is the monitoring equipment installed?	X E/R □ (Ballast or Cargo)Pump Room Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door x Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	x N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	Not applicable	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	hypochlorite
2	Characteristics of active substances	x Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None x Others :
4	Where is the generating unit of active substances installed on board ship ?	x E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None x Others : No special requirement
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints x Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Not necessary with SiCURE design

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

Redundancy can be provided if requested

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

In the ballast water discharge line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes x No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	Hydrogen is produced as a by-product when generating hypochlorite. Hydrogen is removed before the ballast water treatment process (Before introducing the hypochlorite into the ballast water main)
3	What are properties of the by- product?	□ Toxic x Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	0.3 Nm^3 Hydrogen gas is produced per every 100 m^3 treated ballast water
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	Hydrogen is degassed and diluted constantly during the process. No accumulation can occur. Gas detection not necessary.

Questionnaire about

Ballast Water Treatment System

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As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

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Oh Joo-won / General Manager of Machinery Team

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Machinery Team of KR

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1. Please describe about your company

Company name	OptiMarin AS
Person in Charge	Pal Sanner
Telephone No.	+47 51 11 45 33
Fax. No.	+47 51 12 31 03
E-mail	info@optimarin.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : OptiMarin Ballast Water Treatment System.

The patented OptiMarin Ballast System is based on solid separation (filter) as pre-treatment and high doses of UV irradiation for inactivation of marine organisms, viruses and bacteria, without affecting the normal operation of the ship. Ballast water is treated both during ballasting and de-ballasting to ensure a dual effect.

The OptiMarin Ballast System can be fitted in new ships and retrofitted in older ships. The MicroKill Medium Pressure UV can handle almost any flow when multiple chambers are built into a manifold system. The components in the OptiMarin system are flexible; the filter can be installed either horizontally or vertically. The installation is normally in the pump room or engine room and in close proximity to the ballast pumps. Being flexible in design, the various components do not need to be side by side but can be installed wherever they will fit.

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

One Filter plus UV lamps/chambers based on flow rate.

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	Filtering and UV
De-ballasting	UV only
Ballasting and De-ballasting	√ (filter & UV for ballast / UV for deballast)
In the ballast tank	None

Machinery Team of KR

Others (describe in detail)	None

3. Please list strengths of your BWTS.

1) Environmentally friendly – chemical free (no chemicals stored or made)
2) Simple and flexible design – modular, pieces can be placed where they fit
3) Few movable parts – 1 filter with 1 movable part, lamps are cleaned by flow – no moving parts
4) Highly effective (99.999% removal of zoo plankton, 99.99% of phytoplankton)
5) Exceeds IMO Reg D-2. Type approval certificate issued by DnV
6) Low need for maintenance
7) No extra noise
8) Low weight / small foot print
9) Relatively low cost.

The OptiMarin Ballast System has been tested successfully according to the INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004, D2 standard by NIVA (Norwegian Institute for Water Research). Verified by DNV:
Based on these results we have also received confirmation from the California State Land Commission that we meet their standard for best available technologies to be implemented starting 2010. We meet current New York state regulations and the proposed US Coast Guard Regulations.

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) UV chambers must be installed horizontally
2) Service area for filter and UV chambers
3) Max distance between UV power cabinets and UV chambers should not exceed 25 meters. (Pls contact Optimarin if longer distance is needed)

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Please note that the system requires 1 x UV lamp/chamber for every 167m3/hr. Each uses approximately 38kw of power. We added numbers in parenthesis in the first column which represents the maximum flow an OptiMarin system can handle for the requested flow.

Treatment Capacity (m^3/h)	Power Consumption (kW)	Required Space (L x B x H)m
100 (167)	38	See attached table

200 (334)	76	See attached table
300 (334)	76	See attached table
400 (500)	114	See attached table
500 (501)	114	See attached table
600 (668)	152	See attached table
700 (835)	190	See attached table
800 (835)	190	See attached table
900 (1,002)	228	See attached table
1000 (1,002)	228	See attached table
1500 (1,503)	342	See attached table
2000 (2,004)	456	See attached table
2500 (2,505)	570	See attached table
3000 (3,006)	684	See attached table
3500	Etc.	
4000		
4500		
5000		
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

We are currently not EX certified, but we are in the process of completing a feasibility study, and hope to have this completed by summer of 2010. In the meantime, the filter is EX rated, so can be placed anywhere. The UV chambers and control/power system must be located in non-hazardous areas.

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit						
	Neutralization Unit						
	Others :						
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit						

	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

See above. We do not have any ex certified equipment at the moment.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	x Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	x Yes □ No
		□ Pressure Sensor Unit	xYes □ No
		□ Other 1 : UV intensity measurement	x□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	Not Applicable	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns. We do not use any active substances, yet we exceed the IMO Ballast Water Standards from Reg D-2.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	None
2	Characteristics of active substances	None
3	What means are provided to protect crews from the leak of active substances ?	No substances, so no leakage
4	Where is the generating unit of active substances installed on board ship ?	No active substances
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	No gases or chemicals, so no venting needed
6	What measures are considered to protect the supplying pipe of active substances ?	No active substances.

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Installed on all systems is a flow & pressure control valve (FPV). Should the limit be reached this valve will restrict flow so as not to exceed the limit of the ballast water treatment system.

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

In case of break-down/failure of the system, the OBS will shut-down and the bypass will open. This will ensure continued safe operation of the vessel.

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

The sampling points are located within the Ballastwater lines before and after treatment.

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	None
3	What are properties of the by- product?	None
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	No gases, so not applicable
5	Is the gas detection unit an explosion-proof type?	No need for such a unit
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	No gases, so not applicable

Questionnaire about

Ballast Water Treatment System

Korean Register of Shipping, with the objective of GLOBAL TOP+, will always do our best to provide the costumers with quicker and better quality services.

As the implementation of the Ballast Water Management Convention is imminent, consideration is being given to the ship's design changes in relation to the installation of Ballast Water Treatment System (hereinafter referred to as 'BWTS'), which is now put in place on board some new ships.

The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

The KR's BWTS Guidance is intended to assist shipyards and ship owners in selecting appropriate BWTS by describing the physical and mechanical properties of the BWTS, technical aspects to be considered at the time of installation, and specific considerations per each ship type.

In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jee Jae-hoon, KR Machinery Team by phone: +82-42-869-9474 or email: krmac@krs.co.kr

1. Please describe about your company

Company name	Nutech O3, Inc.
Person in Charge	Joel C. Mandelman
Telephone No.	703-288-4694
Fax. No.	301-277-7496
E-mail	joelm@nutech-o3.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

Nutech O3 Ballast Water Treatment System

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Ozone Injection

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	x
De-ballasting	
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Meets proposed and more stringent United States Treatment Standard and IMO Standard
2) Cost of system recovered in as little as 1 year
3) Toxicity of discharged water is within acceptable levels
4) No corrosion to ship or human exposure to ozone

Machinery Team of KR

5) No toxic consumables are stored on ship

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

1) Ballast loading rate/frequency of ballasting

2) Space Available in engine room for installation/can be modular installation

3) Layout of ballast tanks

optimal location of system will be determined after engineering survey

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100		
200	36.2	4.2 m2
300	36.5	4.2 m2
400		
500		
600	60.4	6.6 m2
700		
800	68.4	9.1 m2
900		
1000	86.9	9.1 m2
1500	123.2	10.6 m2
2000	148.4	14.5 m2
2500		
3000	243.5	17.0 m2
3500		
4000	317.6	20.3 m2
4500		
5000	385.8	23.9 m2
6000	438.3	25.3 m2
7000		
Others : 8000	613.8	36.8 m2

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	x					yes
	Neutralization Unit	x					yes
	Ozone injector & Pumps		x				yes
Control and Monitoring Equipment	TRO Sensor Unit	x	x				yes
	Gas Sensor Unit	x	x				yes
	Flow Meter Unit	x	x				yes
	Others :						

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A x TRO Sensor Unit □ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	x Yes □ No
3	Where is the monitoring equipment installed?	x E/R x (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	x Mechanical Ventilation x Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		x TRO Sensor Unit	x Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		□ Flow Meter Unit	□ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	All will be explosion proof	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly) ozone
2	Characteristics of active substances	x Toxic □ Flammable □ Asphyxiant x Others : oxidant
3	What means are provided to protect crews from the leak of active substances ?	x Gas Detection x Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	x E/R □ Pump Room x Dedicated space x Others : on deck in container all 3 options available
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	x Mechanical Vent. (Air change rate : /H) x Natural Vent. □ None Vent and blower will be sized to accommodate whatever air change rate is required
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes x Use the stainless steel x Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Flow rate sensors will trigger alarms and automatic shut down of system

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

Essential spare parts will be supplied with system, (ozone electrodes,sensing, units, flow meters, etc)

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Ballast water discharge line

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes x No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	N/A
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	N/A
5	Is the gas detection unit an explosion-proof type?	x Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	N/A

Questionnaire about

Ballast Water Treatment System

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The Machinery Team of this Society is planning to publish a Guidance for Installation of the BWTS.

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In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 31 March 2010 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
Email : krmac@krs.co.kr
(Contact : Jee Jae-hoon, +82-42-869-9474)

Machinery Team of KR

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1. Please describe about your company

Company name	Alfa Laval
Person in Charge	Per Warg, Business Manager
Telephone No.	+46 8 530 654 33
Fax. No.	
E-mail	per.warg@alfalaval.com

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name : PureBallast

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) : Advanced Oxidation Technology

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	
De-ballasting	
Ballasting and De-ballasting	0
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) Free of chemicals
2) Modular design and small footprint, which means easy installation
3) Ballast & deballast as you do today
4) Experienced marine supplier with global sales and service network

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.
   1) Space
   2) Availability of power
   3) Ballast pump pressure head

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	**Power Consumption (kW)**	**Required Space (L x B x H)m**
100		
200		
300		
400		
500	120	7
600		
700		
800		
900		
1000	240	12
1500	360	15
2000	480	20
2500	600	25
3000		
3500		
4000		
4500		
5000		
6000		
7000		
Others : 250	60	4

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	0	0	0	0		
	Neutralization Unit	na	na	Na	na		
	Others : Filter Cleaning-in-place unit	0	0	0	0		
Control and Monitoring Equipment	TRO Sensor Unit						
	Gas Sensor Unit						
	Flow Meter Unit	0	0	0	0		

	Others : Control& power distribution	0			0		

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	X N/A □ TRO Sensor Unit □ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	□ Yes □ No
3	Where is the monitoring equipment installed?	□ E/R □ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	□ Mechanical Ventilation □ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		□ TRO Sensor Unit	□ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		X Flow Meter Unit	X Yes □ No
		X Level Sensor Unit	X Yes □ No
		X Temp. Sensor Unit	X Yes □ No
		X Pressure Sensor Unit	X Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?		

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)
Alarm

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure ?

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.) PureBallast is equipped with sampling equipment.

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	□ Yes X No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	
3	What are properties of the by- product?	□ Toxic □ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. $1m^3$/hr, etc) Please use a separate sheet if needed.	
5	Is the gas detection unit an explosion-proof type?	□ Yes □ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	

Questionnaire about

Ballast Water Treatment System

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In order for us to be able to complete the BWTS Guidance, we would highly appreciate it if you could fill the questionnaire in as much as possible, and submit to us the completed questionnaire by 30 April 2011 at the latest.

Your responses to the questionnaire are required for guidance purposes only and will not be disclosed partly or wholly if specifically requested by the respondents.

Oh Joo-won / General Manager of Machinery Team

Korean Register of Shipping

Please return completed questionnaire to ;
Fax : +82 42-862-6016
E-mail : krmac@krs.co.kr
(Contact : Jang Jae-shik, +82-42-869-9456)

Machinery Team of KR

Thank you for participating in the BWTS Guidance questionnaire. If you have any questions about how to complete it, please contact Jang Jae-shik, KR Machinery Team by phone: +82-42-869-9456 or E-mail: krmac@krs.co.kr

1. Please describe about your company

Company name	**SunRui Marine Environment Engineering Company**
Person in Charge	**Mr Yu Jiangshui**
Telephone No.	**+86 (0)532-68725831**
Fax. No.	**+86 (0)532-68725001**
E-mail	**yujs@sunrui.net**

2. Please describe briefly about the Ballast Water Treatment System(hereinafter referred to as 'BWTS') manufactured by your company.

1) Product Name :

BalClor™

2) Treatment Type (e.g. electrolysis, UV, ozone, ozone+electrolysis, etc.) :

Filtration + Electrolysis +Neutralization

3) In which process does the ballast water treatment occur ?

Treatment process	Put a mark(○) in the relevant row
Ballasting	○
De-ballasting	○
Ballasting and De-ballasting	
In the ballast tank	
Others (describe in detail)	

3. Please list strengths of your BWTS.

1) **side-stream**
2) **low power consumption**
3) **low maintenance cost**
4) **flexible modular design**
5) **function unaffected by water condition**

Machinery Team of KR

4. Please describe what needs to be specially considered when your BWTS is installed on board ships.

None

5. Please fill in all applicable columns of the following table about the power consumption and the required space.

Treatment Capacity (m^3/h)	Power Consumption (kW)	Required Space (L x B x H)m
100	**15**	**2500×1800×2200**
200	**15**	**2500×1800×2200**
300	**15**	**2500×1800×2200**
400	**25**	**2600×1800×2300**
500	**25**	**2600×1800×2300**
600	**50**	**2900×2300×2200**
700	**50**	**2900×2300×2200**
800	**50**	**2900×2300×2200**
900	**50**	**2900×2300×2200**
1000	**50**	**2900×2300×2200**
1500	**75**	**3000×2600×2100**
2000	**100**	**3300×2500×2200**
2500	**125**	**3500×2900×2400**
3000	**150**	**3500×2900×2400**
3500	**175**	**3900×2800×2500**
4000	**200**	**3800×2400×2600**
4500	**250**	**4000×2800×2600**
5000	**250**	**4000×2800×2600**
6000		
7000		
Others :		

6. In case of ships carrying dangerous cargoes (such as Oil / Chemical Tanker, Gas Carrier), please indicate the spaces where each part and equipment of your BWTS are installed.[Put (○) or description in all relevant rows and columns]

(e.g. ECU, UV chamber)		Installed Spaces					Explosion Proof Type
		E/R	(Cargo/Ballast) Pump Room	On-deck (Hazardous Area)	On-deck (Non-Hazardous Area)	Other Space [If applicable, fill out the belows]	
Ballast Water Treatment Equipment	Treatment Unit	✓					
	Neutralization Unit	✓					
	Others :		✓				
Control and Monitoring Equipment	TRO Sensor Unit		✓				
	Gas Sensor Unit	✓					
	Flow Meter Unit		✓				
	Others :						

Machinery Team of KR

7. In case where the BWTS is installed on board Oil/Chemical Tankers and if it is equipped with monitoring devices which take samples from ballast pipe lines, please answer the following questions.

No.	Question	Answer
1	What sampling type of monitoring equipment is used?	□ N/A ■ TRO Sensor Unit ■ Gas Sensor Unit □ Others :
2	Is the monitoring equipment an explosion-proof type?	■ Yes □ No
3	Where is the monitoring equipment installed?	■ E/R ■ (Ballast or Cargo)Pump Room □ Others :
4	If the monitoring equipment of sampling type is installed in safety areas (e.g. E/R, Dedicated space) outside the cargo dangerous area, what kind of safety measures is taken against the risk of toxic or flammable gas?	■ Mechanical Ventilation ■ Gas Detection & Alarm □ Self-closing Gas-tight Door □ Others :

7-1. In the above case and where components are directly fitted in ballast pipe line, please answer the following questions.

No.	Question	Answer	Explosion Proof Type
1	What components are directly fitted in ballast pipe line?	□ N/A	
		■ TRO Sensor Unit	■ Yes □ No
		□ Gas Sensor Unit	□ Yes □ No
		■ Flow Meter Unit	■ Yes □ No
		□ Level Sensor Unit	□ Yes □ No
		□ Temp. Sensor Unit	□ Yes □ No
		□ Pressure Sensor Unit	□ Yes □ No
		□ Other 1 :	□ Yes □ No
		□ Other 2 :	□ Yes □ No
2	If the components are not of an explosion-proof type, what kind of safety measures is taken against the expected hazard?	/	

8. If your BWTS uses active substances (e.g. Ozone, hydrogen peroxide), please fill in relevant rows and columns.

No.	Question	Answer
1	Type of active substances (e.g. Ozone, hydrogen peroxide, etc)	(Please describe briefly)
2	Characteristics of active substances	□ Toxic □ Flammable □ Asphyxiant □ Others :
3	What means are provided to protect crews from the leak of active substances ?	□ Gas Detection □ Mechanical Vent □ None □ Others :
4	Where is the generating unit of active substances installed on board ship ?	□ E/R □ Pump Room □ Dedicated space □ Others :
5	Is ventilation unit to be provided to the location where the BWTS is installed ?	□ Mechanical Vent. (Air change rate : /H) □ Natural Vent. □ None □ Others :
6	What measures are considered to protect the supplying pipe of active substances ?	□ Use double pipes □ Use the stainless steel □ Use all welding joints □ Others :

9. Are any measures put in place for the case where the volume of ballast water exceeds the maximum rated capacity of the BWTS ?
(e.g; Alarm, Automatic shut-down, Auto slow down, etc.)

Alarm

10. Does your BWTS have any redundancy for essential equipment and parts (e.g. TRO sensing units, flow meter unit, etc) to keep the system running in case of failure?

No

11. Where are the spaces that you recommend to install sampling equipment according to BWM Convention/Guideline G2 ?
(e.g; Ballast Water Discharge Line, etc.)

Near de-ballasting pipe outlet

12. Regarding the bi-products that are generated from the ballast water treatment process, please fill in all relevant rows.

No.	Question	Answer
1	Are dangerous gases generated as by-products after ballast water treatment process?	■ Yes □ No
2	What type of dangerous gases is generated? (e.g; Hydrogen, chlorine, etc.)	**Hydrogen**
3	What are properties of the by- product?	□ Toxic ■ Flammable □ Asphyxiant □ Others :
4	What is the generation rate of dangerous gases per each type of BWTS ? (e.g. 1m^3/hr, etc) Please use a separate sheet if needed.	/
5	Is the gas detection unit an explosion-proof type?	□ Yes ■ No
6	Where are the residue gases ventilated to after gas detection? (e.g. installation location of the gas detection unit, or safety area on the exposed weather deck)	**On Deck**