

# **Development of Eco-friendly High-pressure water blasting technique “Konki-Jet” to meet the PSPC requirements**

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## 1. Introduction

Coating of ship water ballast tank more stringent

2000 Guide line by TSC  
10years,15years,20years

2002 IMO Started PSPC study

2006 IMO Adopted PSPC at MSC 82  
15years target life

Surface treatment Sand blasting

Poor working environment , increase industrial waste

Allow intact shop primer to be retained

subject to

cleaned by sand sweeping or high-pressure water washing

## 2. PSPC requirements

- Secondary surface preparation

- Surface treatment

Damaged shop primer & welds : Sa2 1/2

Intact shop primer pre-qualified :  
sweep blasting or **high- pressure  
water washing**

Dust size class 3,4,5 quantity rate 1  
class 1,2 removed if visible

- Surface treatment after erection

Butts & small damages up to 2% :St 3  
Continuous damages over 25 m<sup>2</sup> or over 2% :Sa2.5

### 3. Research & Development

#### 3.1 Conventional high-pressure water blasting

UHP blasting unit



NLB Corp. Ultra Clean 36K (USA)  
Max. capacity of 2500 bar

For cleaning purpose



WOMA HTS 200/4 D (FRG) Max. capacity of 2000 bar

Wet Blasting for de-rusting and profile of welds



#### 3-2 Tasks for developments

UHP(Ultra High Pressure water blasting)

Removal of heat scale impossible

Make profiles(roughness) of 30-75  $\mu$  impossible

needs abrasives(media) for making profiles



### 3.3 Process of development

Cleaning technique for land use Konki-Jet  
(Air mixed high-pressure water blasting)

2006 F.S confirmed

Cleaning & Surface treatment one unit

Nippon Foundation

ClassNK

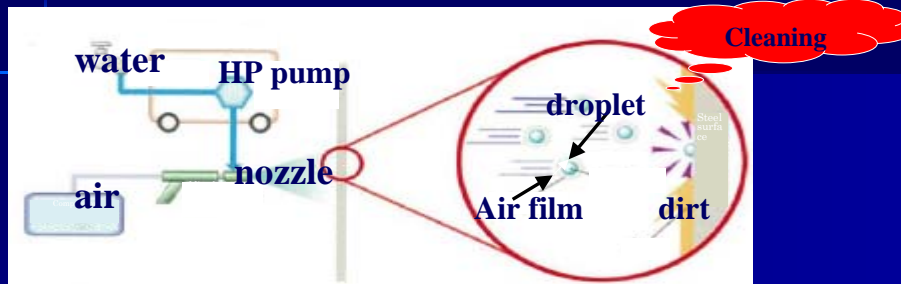
Phase 1 (2007.4~2009.3)  
Fundamental

Phase 2 (2009.8~2010.10)  
Application

Development of Nozzles  
Development of collecting unit  
Prevention of flash rust

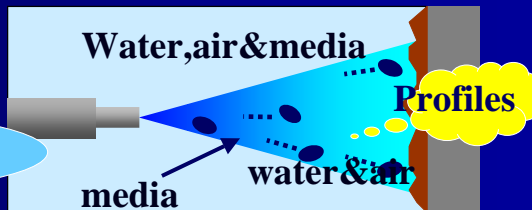
Completion of units for shipyard use  
Photographic standard

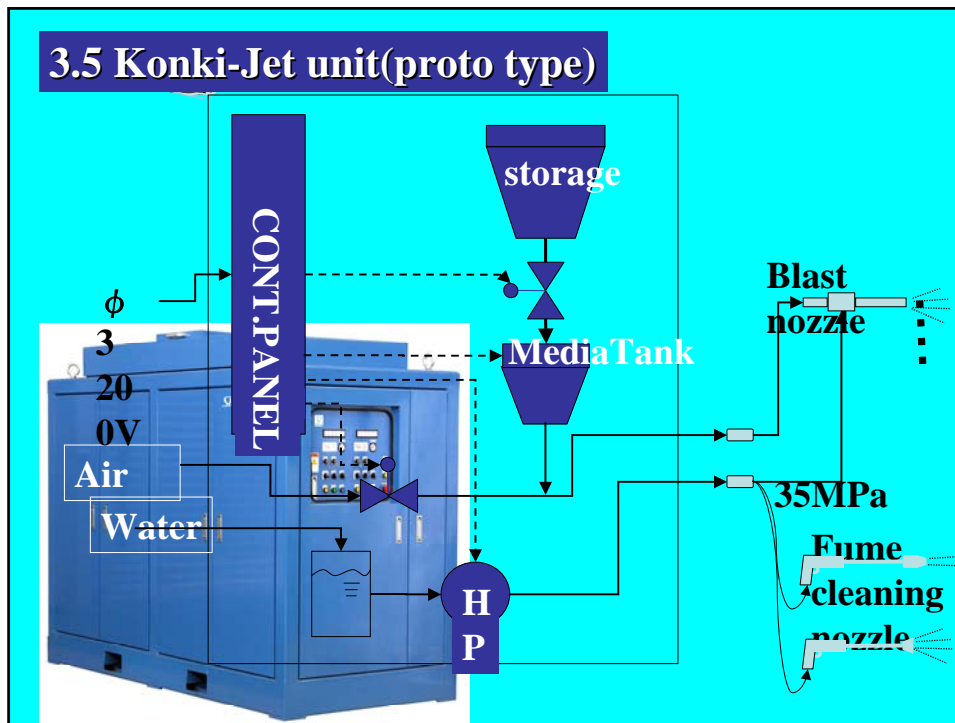
### 3-4.Principle of cleaning by Konki-Jet



Water + Air

Water+Air+Media





### 3.6.Characteristics of Konki-Jet

- Cleaning & Surface treatment in one unit
- Less water & media
- Possible to work on outdoor
- Improvement of work environment
- Less industrial waste
- Relatively low pressure
- Minimize facility & investments

### 3.7Konki-Jet unit

14Mpa

35Mpa

100Mpa



Land use

Phase1  
Prototype

Phase 2 Shipyard  
use

F.S

Sa2.5 satisfied  
fume not satisfied

Sa2.5 & Cleaning  
fume satisfied

Konki-Jet  
main unit



Collecting unit

## Series tests for removal of fixed fume



### Results

75~100Mpa

Rotary Nozzle

## 3.8 Development of Nozzles

Blast nozzle straight



Cleaning Nozzle(for fume) rotary



Washing Nozzle



Air blow  
nozzle(multi)

### 3.9 Selection of media



Garnet

| hardness | recovery | cost |
|----------|----------|------|
| 7.5~8    | Good     | △    |



Copper slag

|       |      |   |
|-------|------|---|
| 6.5~7 | Good | ○ |
|-------|------|---|



NS sand

|     |     |   |
|-----|-----|---|
| 5~6 | mud | × |
|-----|-----|---|

### Countermeasure for Flash rust

Media with cathodic protection materials\*

\*patent

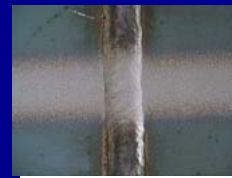
Example of Flash rust test



Immediately  
After blasting



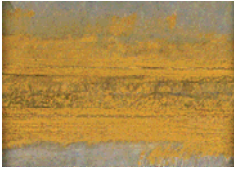







After 1 hour



After 2 hour



| Surface treatment results by Konki-Jet  |   |  |   |
|---|---|--|---|
| Konki-Jet cleaning  | Before  |  | Konki-Jet blasting  |
|  |  |  |  |
| <b>After</b>  |   |  |   |
|  |  |  |  |
| <b>Intact shop primer</b>   | <b>Fume</b>   | <b>Butt weld</b>   | <b>Corner weld</b>  |

## 4.Application Test

**April 28, 2010**

**Demonstration**



For steel block of  
new ship



**August 23, 2010**

**Demonstration**



**For outside shell of  
new ship**

## **Results**

**Workability in booth:**

**5~10 % increase of work time than dry blast.**

**Workability on outdoor**

**10 % less work time than dry blast**

**Media Consumption:**

**1/5~1/10 of total amount of dry blast.**

**Work process:**

**HP water cleaning →Blasting→LP water cleaning  
→Drying**

## 5. Summary

- (1) Surface treatment grade on welds **Sa2.5 & profile 30~75  $\mu$**  established
- (2) Established high-pressure water washing for fume sufficiently with **75MPa~100MPa**
- (3) Media for blasting **Copper slag**
- (4) Flash rust prevention **Established(patented media)**
- (5) Collecting unit **Commercial type equipment**
- (6) Investment for blasting booth **Not necessary**

## 6. Future Prospects

- Further improvement of workability
- Establishment of Media supply chain
- Publication of photographic standard
- Application for ship repair painting  
Removal and surface treatment for  
outside shell paintings
- Application for other industries  
Ship recycle, bridge etc.,

## Photographic Reference for Secondary Surface Preparation

### Guideline for the Preparation of Steel Substrate for PSPC



**ClassNK**  
R&D PROJECT

Damaged shop primer and welds (Mixed air high pressure water blasting)



C1.3 Automatic fillet weld



C1.3 Sa2 1/2

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**ClassNK**  
R&D PROJECT



This project is being carried out jointly by ClassNK and JSTRA in cooperation with the following project members as part of ClassNK's ongoing practical R&D development program, which provides research support for cutting edge R&D projects that address the needs of the maritime

#### Members

IHI Amtec Co., Ltd

Naikai Shipbuilding Co., Ltd

Mikami Marine Engineering Co., Ltd

Chugoku Marine Paints Co., Ltd

Shibuya Machinery Co., Ltd.

Nippon Kaiji Kyokai (ClassNK)

Japan Ship Technology Research Association (JSTRA)

**Thank you for your attention!**