

Hyosung Pumps – Application and Products

Hyosung Ebara


As is November, 2009



Where you are Where We are
Always by your side

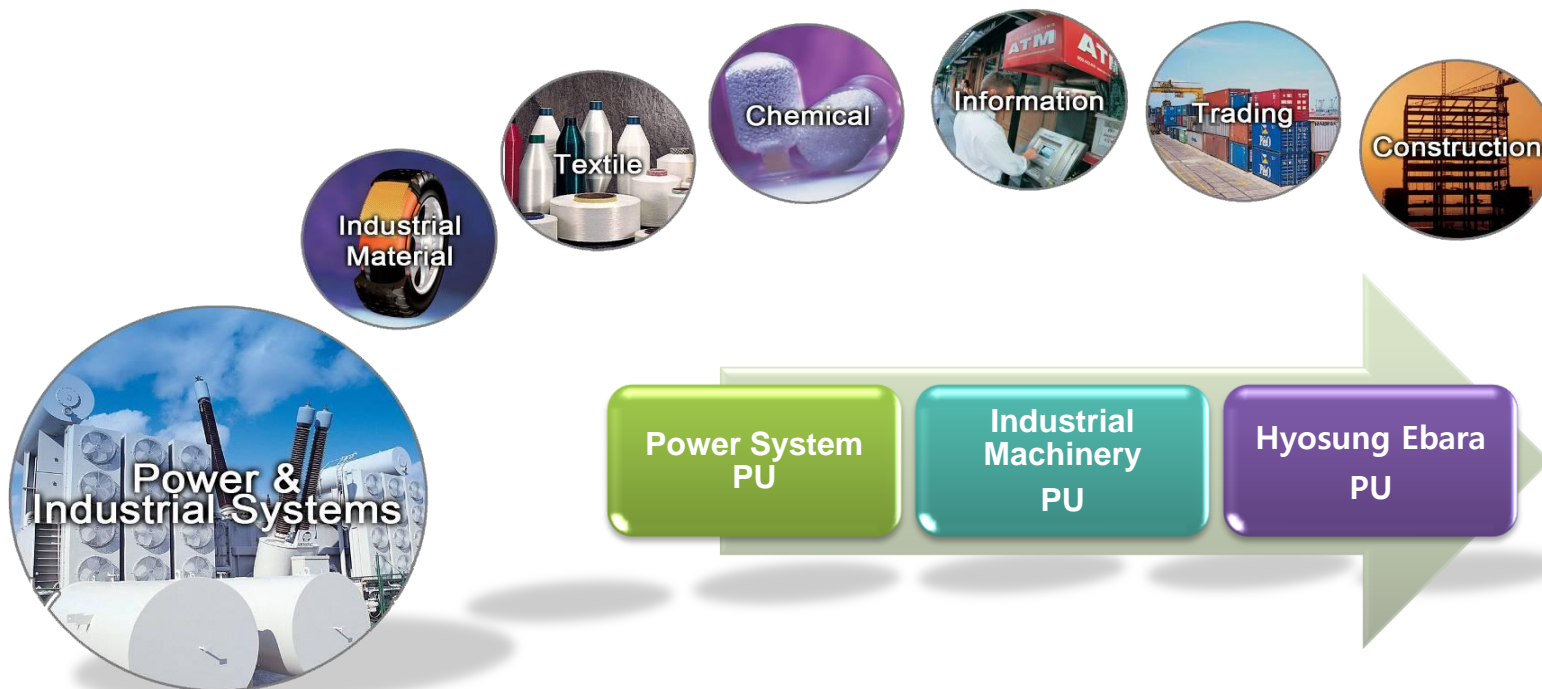
Our Honor to be here

Hyosung Ebara

 **HYOSUNG** is consist of 7 Performance Group (PG)

TOTAL : 7,352 employees

- └ Engineer :1051 employees
 - Electrical : 537 employees
 - Mechanical : 399 employees
 - Other : 115 employees



Sisters in Power & Industrial system PG

Hyosung Ebara



- Switchgear
- Power Transformer (HV/MV)
- Gas Insulated Switchgear

**Power System
PU**

**Industrial Machinery
PU**

- Electric Motor
- Gear Reducer
- Pressure Vessel
- Reactor
- Heat Exchanger



- Power Plant
- Oil & Gas
- Water Supply & Drainage
- Building & Industrial
- Desalination

**Hyosung Ebara
PU**

Where you are Where We are
Always by your side

Company Overview

Hyosung Ebara

**Name of
Company**

Hyosung Ebara Co., Ltd.

Established

**October 12, 1989. as named of Hyosung Ebara
(May 1962 as named of Hanyung)**

Capital

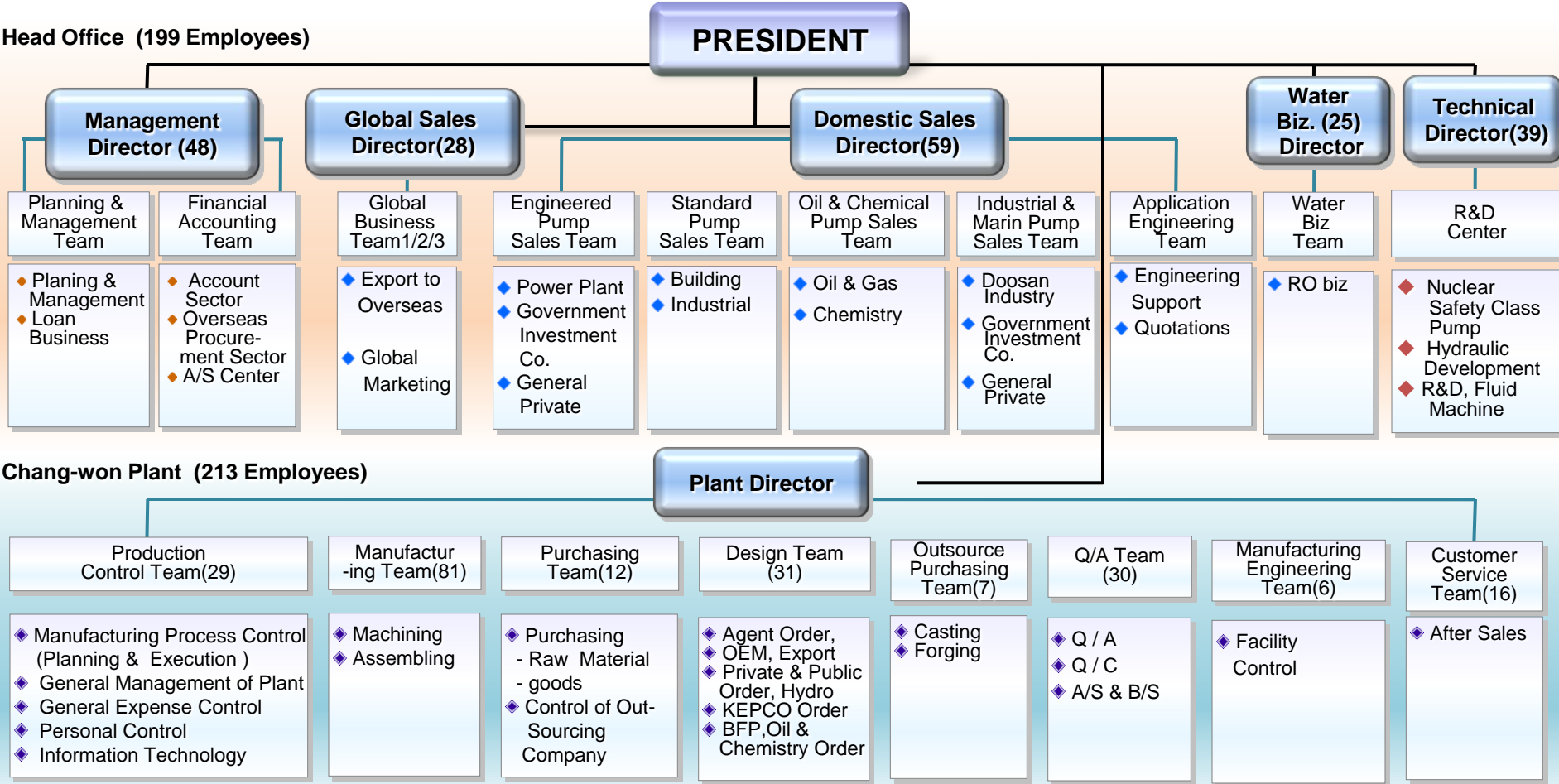
**Paid-Up Capital : 18,000 Million Korean Won
(Approx. 19 Million USD)**

**Sales Volume
(as of 2008)**

**Turn Over : 165,561 Million Korean Won
(Approx. 140 Million USD)**

Organization Chart

Hyosung Ebara



Where you are Where We are
Always by your side

What we've done

Hyosung Ebara

Year	Description
May 1962	Established under the name of "HANYUNG Pump Co., Ltd."
Oct 1975	Merged with the Hyosung Group
July 1977	Technical cooperation with "KSB, Germany" for industrial Pumps
Mar 1979	Supplied CWP & SLP, 8 sets for KEPCO(Korean Electricity & Power Co., Ltd) For "Pyong-Taek TPP, Korea" (Vertical Mixed Flow Pump)
Oct 1989	Established the Joint venture company with EBARA, Japan
Aug 1994	Acquired Certificate of ISO 9001
Year 1995	Supplied CWP 12 sets to Ulchin Nuclear Power Plant , Korea (Vertical Mixed Flow, Q=131,491gpm, H=31.5ft, Motor=1,610HP)
Year 1999	Supplied 66 sets of MCP & Sump pump to China For " Qin-Shan Nuclear Power Plant "
Apr 2001	Supplied ASME equivalent KEPIC Safety-Class II (High & Low pressure Safety Injection) 20 sets to "Ulchin 5 & 6 Nuclear Power Plant, Korea
2007	Supplied API 610 Pump 41sets (OH1, BB2, BB3, VS1, VS6) to "SAHARA Petrochemical" For "Basell PDH-PP Project" in Saudi Arabia
2007	Supplied API 610 Pump 32sets (OH1, OH2, OH6, BB1, BB2, VS1, VS4) to SABIC / IBN ZAHR For "PP-III Project" in Saudi Arabia

What we've done

Hyosung Ebara

Year	Description
2004 ~ 2008	Supplied 81 sets of Safety related (Class 2 & Class3) and Non-Safety related pumps For "SHIN-KORI Nuclear power plant, Korea" Unit 1 & 2 (1,000MW)
2006 ~ 2009	Supplied 106 sets of Safety related (Class 2 & Class3) and Non-Safety related pumps For "SHIN-WOLSUNG Nuclear power plant, Korea" Unit 1 & 2 (1,000MW)
2007	Supplied API 610 pumps 194 sets to SK energy For "NEW FCC Project, Korea"
2008	Supplied API 610 pump 22 sets to SABIC / KAYAN For "PC Project, Saudi Arabia"
2008	Supplied API 610 pump 19 sets (OH1, OH2, BB2) to SABIC / IBN ZAHR For "OCT Project, Saudi Arabia"
2008	Supplied API 610 pumps to ADMA, UAE For "Umm-Shaif Off-shore Gas Injection facilities"
2009	Supplied API 610 pumps 21 sets (OH2, BB2, BB5) to Gazprom / Sibur For "EB Project, Russia"
2009	Supplied API 610 pump 45 sets (OH2, BB1, BB5, VS6) to Chevron-Phillips For "NCP Polymer Project, Saudi Arabia"
Aug. 2009	Acquired ASME "N" & "NPT" stamp for Nuclear power plant pump
2009 ~ 2011	Plan to supply 60 sets of Safety related (Class 2 & Class 3) and Non-Safety related pumps For "SHIN-KORI Nuclear power plant, Korea" Unit 3 & 4 (1400MW)



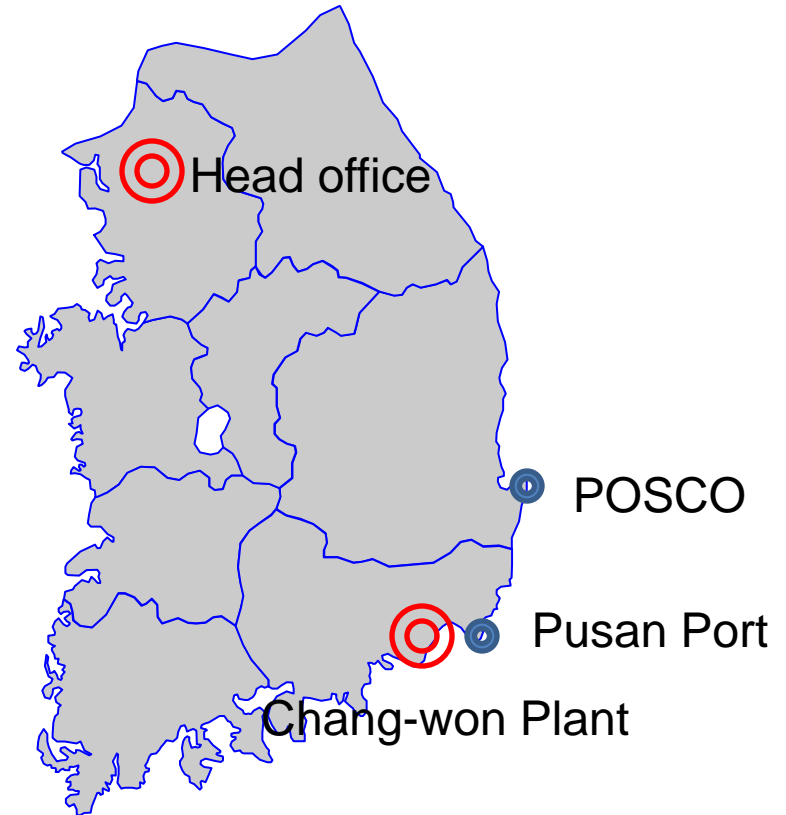
Hyosung Chang-Won Plant



**Hyosung Ebara PU
(Assembly Line)**

Where We are

Hyosung Ebara



- Ease access to main sea-port (40min distance by car)
- Integrated Industrial Area for
 - ✓ Heavy Industry
 - ✓ Precision Manufacturing
 - ✓ War Industry
- Superior sub-supplier's mill near our shop
 - ✓ POSCO – Global Top Steel manufacturer
 - ✓ Global leading M/seal vendor's Local facilities

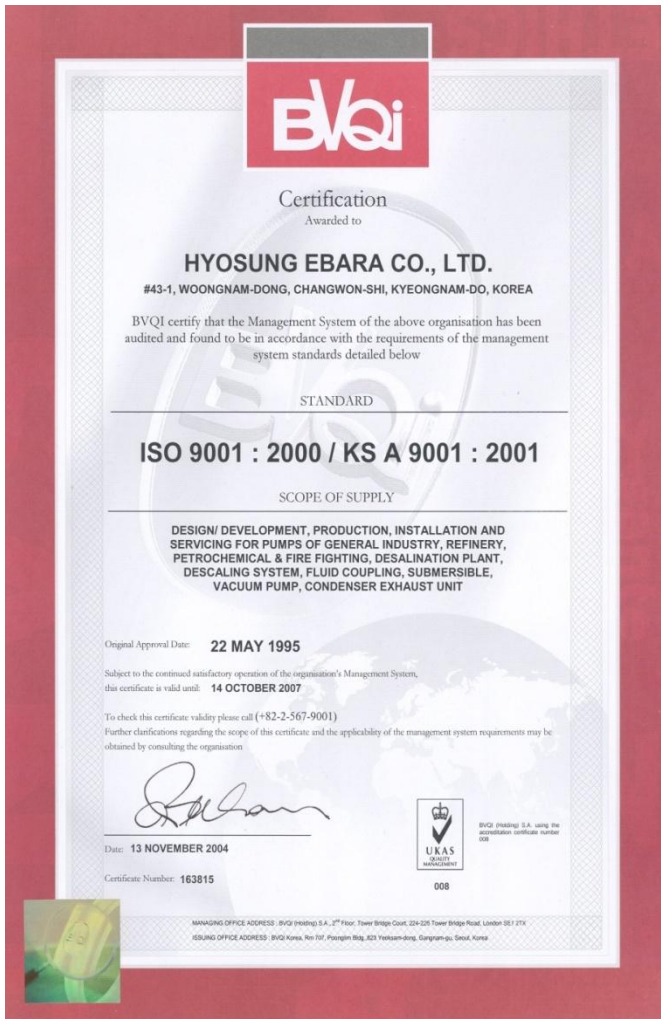
Our strength

- **Full compliance with HI standard/ API standard**
 - Long experiences in various markets
(Sea Water service, High pressure Service, Power plant Service
Water supply service, Chemical Process service)
- **Reliable Products**
 - Continuous Technology Improvement
- **Quick Delivery**
 - Enough Manufacturing & Test Facility Capacity
 - Optimization in Engineering and Manufacturing

“We do our best to achieve the customers’ required quality
and to maintain reliability for our customer”

Certification (ISO9001)

Hyosung Ebara



Every quality-related process is operated and managed in accordance with the procedures and rules specified in the QA manual approved by BVQI on May 22 1995 originally

Certification(KOSHA, OHSAS)

Hyosung Ebara



Certification(CE)

Hyosung Ebara

BUREAU VERITAS

EC Attestation of Conformity
Based on a voluntary testing corresponding with Council Directive 98/37/EC relating to machinery
Attestation No. : 95123-CE
Report No. : 95123-R
The Holder of Attestation

HYOSUNG EBARA CO., LTD.
#43-1, Ungnam dong, Changwon-si, Gyeongsangnam-do, Korea

has demonstrated that its
Product : Centrifugal Pump, Fabric Pattern Design Machine (not appendix IV)
Pump type : 150X100FWM-1614X, 150X100FWM-2015X, 150X100FWM-2515X, 150X100FWM-2515XA, 150X100FWM-3215X, 150X100FWM-3215XA, 150X100FWM-4015X, 150X100FWM-4015Y, 150X100FWM-5015Y, 150X100FWM-5015Y, 150X100FWM-4015Y, 150X100FWM-5015Y, 200X100FWM-2015, 200X100FWM-2515, 200X100FWM-3215, 200X100FWM-4015, 200X100FWM-5015, 250X100FWM-2015, 250X100FWM-2515, 250X100FWM-3215, 250X100FWM-4015, 250X100FWM-5015

Typical Serial No. : 2613101-1(150X100FWM-4015X), 2709133-1(200X100FWM-3215), 2617762-9(250X100FWM-5015)

is in conformity with all provisions of Annex I of Council Directive 98/37/EC, in its latest amended version, referred to as the EC machinery Directive.

This Attestation of Conformity is based on evaluation of a sample of the above mentioned product as documented in the Technical Report. It does not imply an assessment of the whole production and does not permit the use of a mark of conformity of Bureau Veritas.

The holder of attestation is authorized to use this Attestation of Conformity in connection with the EC-declaration of conformity according to Annex V of the Directive.

Date : September 28, 2007

YoonSuk Lee
I&F Deputy Chief Executive
Bureau Veritas Korea

The CE marking may be used if all relevant and effective EC Directive are complied with

Ref. No. 3.40.07

BUREAU VERITAS

EC Attestation of Conformity
Based on a voluntary testing corresponding with Council Directive 98/37/EC relating to machinery
Attestation No. : 95132-CE
Report No. : 95122-R

The Holder of Attestation
HYOSUNG EBARA CO., LTD.
#43-1, Ungnam dong, Changwon-si, Gyeongsangnam-do, Korea

has demonstrated that its
Product : Centrifugal Pump, Fabric pattern design machine (not annex IV)
Pump Series : LCM
Pump type : 40X25UCWM-16, 40X25UCWM-20, 80X40UCWM-13, 80X40UCWM-16, 80X40UCWM-20, 80X40UCWM-25, 80X40UCWM-29, 80X40UCWM-13, 80X40UCWM-16, 80X40UCWM-20, 80X40UCWM-25, 80X40UCWM-32, 80X40UCWM-35, 100X50UCWM-13, 100X50UCWM-16, 100X50UCWM-20, 100X50UCWM-25, 100X50UCWM-32, 150X80UCWM-40, 150X80UCWM-45, 150X100UCWM-16, 150X100UCWM-20, 150X100UCWM-25, 150X100UCWM-32, 150X100UCWM-35, 150X100UCWM-40, 150X100UCWM-45, 150X100UCWM-50, 200X150UCWM-20, 200X150UCWM-25, 200X150UCWM-32, 200X150UCWM-35, 200X150UCWM-40, 200X150UCWM-45, 200X150UCWM-50, 250X200UCWM-20, 250X200UCWM-25, 250X200UCWM-32, 250X200UCWM-35, 250X200UCWM-40, 250X200UCWM-45, 250X200UCWM-50

Typical Serial No. : 2619319-4(40X25UCWM-16), 2700001-1(150X100UCWM-40), 2700000-3(300X200UCWM-50)

is in conformity with all provisions of Annex I of Council Directive 98/37/EC, in its latest amended version, referred to as the EC machinery Directive.

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The holder of attestation is authorized to use this Attestation of Conformity in connection with the EC-declaration of conformity according to Annex V of the Directive.

Date : April 08, 2008

YoonSuk Lee
I&F Deputy Chief Executive
Bureau Veritas Korea

The CE marking may be used if all relevant and effective EC Directive are complied with

Ref. No. 3.40.07

BUREAU VERITAS

EC Attestation of Conformity
Based on a voluntary testing corresponding with Council Directive 98/37/EC relating to machinery
Attestation No. : 95108-CE
Report No. : 95108-R
The Holder of Attestation

HYOSUNG EBARA CO., LTD.
#43-1, Ungnam dong, Changwon-si, Gyeongsangnam-do, Korea

has demonstrated that its
Product : Centrifugal Pump (not appendix IV)
Pump type : 350X200CCN, 350X200CFN, 350X250CCN, 350X250CFN, 400X200CCN, 400X200CFN, 400X250CCN, 400X250CFN, 450X200CCN, 450X200CFN, 450X250CCN, 450X250CFN, 500X200CCN, 500X200CFN, 500X250CCN, 500X250CFN, 600X200CCN, 600X200CFN, 600X250CCN, 600X250CFN, 700X200CCN, 700X200CFN, 700X250CCN, 700X250CFN, 800X200CCN, 800X200CFN, 800X250CCN, 800X250CFN, 900X200CCN, 900X200CFN, 900X250CCN, 900X250CFN, 1000X200CCN, 1000X200CFN, 1000X250CCN, 1000X250CFN

Typical Serial No. : 2609466-1(1000X200CCN), 2609466-2(800X200CCN), 2616585-1(450X200CFN)

is in conformity with all provisions of Annex I of Council Directive 98/37/EC, in its latest amended version, referred to as the EC machinery Directive.

This Attestation of Conformity is based on evaluation of a sample of the above mentioned product as documented in the Technical Report. It does not imply an assessment of the whole production and does not permit the use of a mark of conformity of Bureau Veritas.

The holder of attestation is authorized to use this Attestation of Conformity in connection with the EC-declaration of conformity according to Annex V of the Directive.

Date : May 25, 2007

YoonSuk Lee
I&F Deputy Chief Executive
Bureau Veritas Korea

The CE marking may be used if all relevant and effective EC Directive are complied with

Ref. No. 3.40.07

BUREAU VERITAS

EC Attestation of Conformity
Based on a voluntary testing corresponding with Council Directive 98/37/EC relating to machinery
Attestation No. : 95123-CE
Report No. : 95123-R

The Holder of Attestation
HYOSUNG EBARA CO., LTD.
#43-1, Ungnam dong, Changwon-si, Gyeongsangnam-do, Korea

has demonstrated that its
Product : Centrifugal Pump, Fabric pattern design machine (not annex IV)
Pump Series : KS
Pump type : 150X100SM-32, 150X100SM-40, 200X150SM-32, 200X150SM-40, 250X200SM-32, 250X200SM-40, 250X200SM-45, 250X200SM-50, 300X250SM-32, 300X250SM-40, 300X250SM-45, 300X250SM-50, 350X300SM-32, 350X300SM-40, 350X300SM-45, 350X300SM-50, 400X350SM-32, 400X350SM-40, 400X350SM-45, 400X350SM-50, 450X400SM-32, 450X400SM-40, 450X400SM-45, 450X400SM-50, 500X500SM-32, 500X500SM-40, 500X500SM-45, 500X500SM-50, 600X600SM-32, 600X600SM-40, 600X600SM-45, 600X600SM-50

Typical Serial No. : 2700002-2(150X100SM-40), 2705341-1(200X150SM-40), 2700003-3(500X400SM-50)

is in conformity with all provisions of Annex I of Council Directive 98/37/EC, in its latest amended version, referred to as the EC machinery Directive.

This Attestation of Conformity is based on evaluation of a sample of the above mentioned product as documented in the Technical Report. It does not imply an assessment of the whole production and does not permit the use of a mark of conformity of Bureau Veritas.

The holder of attestation is authorized to use this Attestation of Conformity in connection with the EC-declaration of conformity according to Annex V of the Directive.

Date : May 27, 2008

YoonSuk Lee
I&F Deputy Chief Executive
Bureau Veritas Korea

The CE marking may be used if all relevant and effective EC Directive are complied with

Ref. No. 3.40.07

BUREAU VERITAS

EC Attestation of Conformity
Based on a voluntary testing corresponding with Council Directive 98/37/EC relating to machinery
Attestation No. : 95114-CE
Report No. : 95104-R

The Holder of Attestation
HYOSUNG EBARA CO., LTD.
#43-1, Ungnam dong, Changwon-si, Gyeongsangnam-do, Korea

has demonstrated that its
Product : Fabric Pattern Design Machine (not appendix IV)
Pump type : 40X25-IFWM-1312, 40X25-IFWM-1612, 40X25-IFWM-2012, 40X40-IFWM-1312, 40X40-IFWM-1612, 40X40-IFWM-2012, 50X50-IFWM-1314, 50X50-IFWM-1614, 50X50-IFWM-2014, 60X60-IFWM-1314, 60X60-IFWM-1614, 60X60-IFWM-2014, 80X80-IFWM-1314, 80X80-IFWM-1614, 80X80-IFWM-2014, 100X100-IFWM-1314, 100X100-IFWM-1614, 100X100-IFWM-2014, 150X150-IFWM-1314, 150X150-IFWM-1614, 150X150-IFWM-2014

Typical Serial No. : 2610501-1, 2610581-2, 2610581-3, 2610581-4, 2610581-5, 2610581-6

is in conformity with all provisions of Annex I of Council Directive 98/37/EC, in its latest amended version, referred to as the EC machinery Directive.

This Attestation of Conformity is based on evaluation of a sample of the above mentioned product as documented in the Technical Report. It does not imply an assessment of the whole production and does not permit the use of a mark of conformity of Bureau Veritas.

The holder of attestation is authorized to use this Attestation of Conformity in connection with the EC-declaration of conformity according to Annex V of the Directive.

Date : December 18, 2006

YoonSuk Lee
I&F Deputy Chief Executive
Bureau Veritas Korea

The CE marking may be used if all relevant and effective EC Directive are complied with

Ref. No. 3.40.07

Facility Features (Machining Line)

Hyosung Ebara



Where you are Where We are
Always by your side

Facility Features (Assembly Line)

Hyosung Ebara



Facility Features (Test Facility / Large Capacity)

Hyosung Ebara



◀ Test Weir
: 3m,5m,5m,7m

◀ Flow Rate
: Max 70,000m³/hr

◀ Voltage
:13,200V

◀ Power
: 14,000 KW



Under installation



▲ Shop Testing

Where you are Where We are
Always by your side

Facility Features (Test Facility / High Pressure, Temp)

Hyosung Ebara



◀ Max Flow Rate 2,000 m³/hr

◀ Max Pressure 350kg/cm²

◀ Max Temp. 180 deg.C

◀ Max Power 14,000 KW

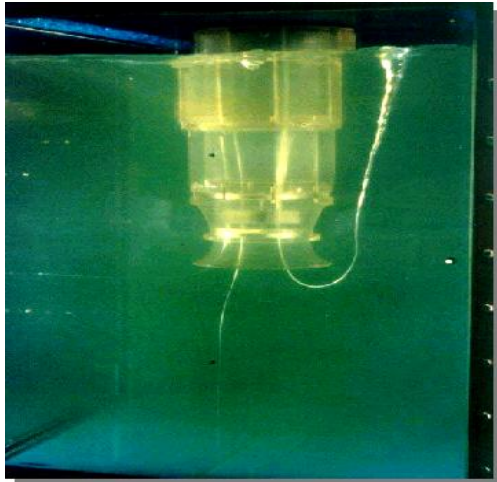


▲ Test Control Room

▲ Frequency Availability : 50Hz/60Hz

Sump model Facility (For CWP's stable operation)

Hyosung Ebara



**Facility for
Sump Model Study**



**Sump Model Study for
MACAO COLOANE-B CCPP Intake**

Our Main Markets

Hyosung Ebara



- Power Generation (Including Nuclear)
- Oil & Gas
- Water Supply
- Marine
- Waste Water
- Building & Housing



Where you are Where We are
Always by your side

Nuclear Power Generation in South Korea

Hyosung Ebara



Developed Nuclear Power Plant with

- 20 Plants (Reactor) are in Operation
- 6 Plants (Reactor) are under Construction

• Hyosung Ebara have been

- Supplied our pumps to NPP since 1995 (CEP, FWBP)
- Supplied Safety Class (2&3) since 2001 (HPSI & LPSI, CSP, SRCP)

Primary System to secure the safety of NPP

Safety Injection System (SIS) :

In an emergency of cooling water shortage (leakage), it sends boric acid to the cooling water system for reactor cooling.

Shutdown Cooling System (SCS) :

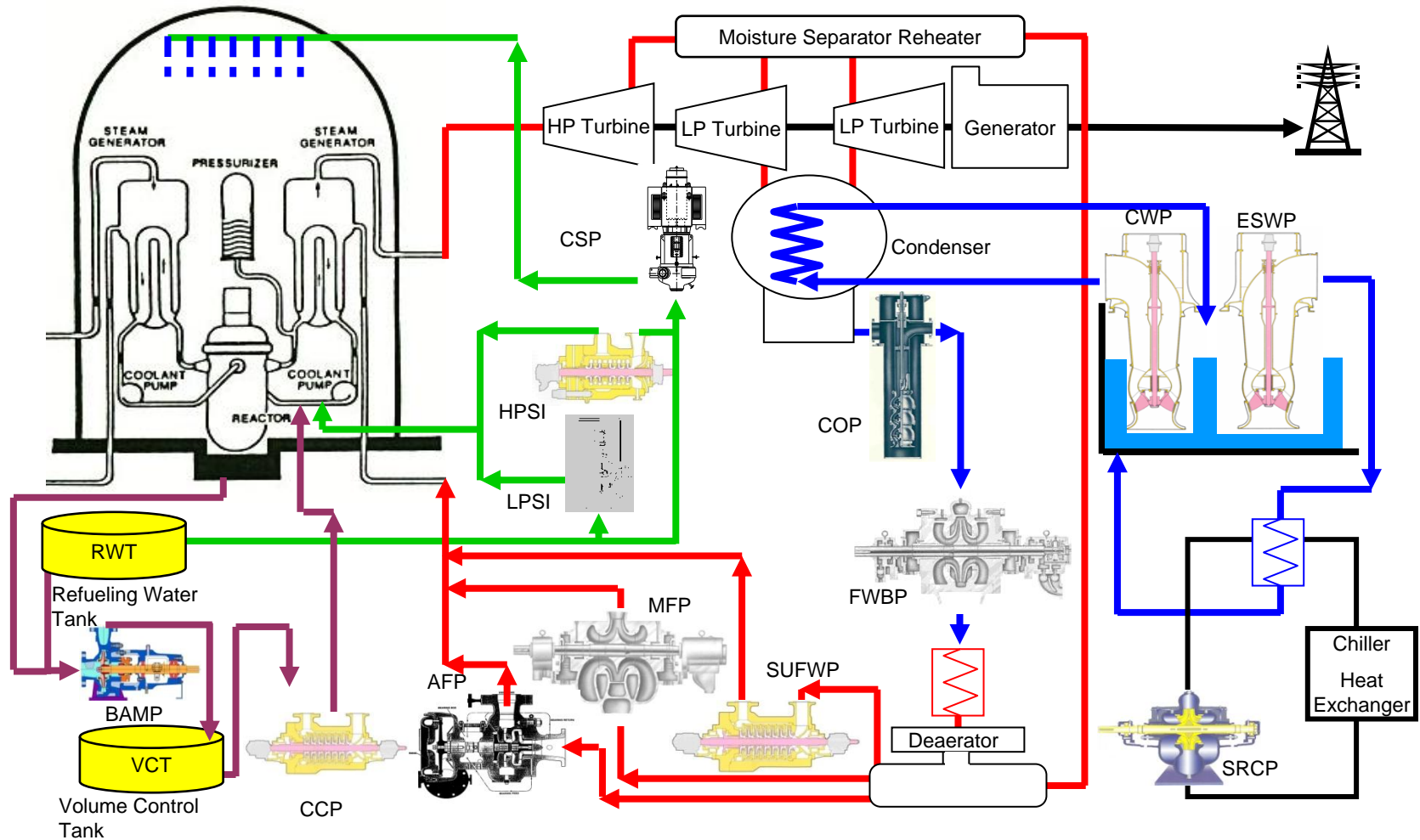
Remove remaining heat from the reactor, in case of reactor's non-operation.

Containment Spray System (CSS) :

Spray boric acid water in the containment, in case of the pressure rise, which can be caused by coolant leakage, etc.

Nuclear System & Pump Application

Hyosung Ebara



Safety Class Pump

Class 1 Pump (Not available)

- Reactor Coolant Pump

Class 2 Pump

- HPSI (High Pressure Safety Injection) Pump
- LPSI (Low Pressure Safety Injection) Pump
- CSP (Containment Spray Pump)
- Charging Pump (Not available)

Class 3 Pump

- ESWP (Essential Service Water Pump)
- ESWSWP (ESW Screen Wash Pump)
- CVCS (Chemical & Volume Control System Pump)
- SRCP (Safety Related Centrifugal Pump)
- AFP (Auxiliary Feedwater Pump)
- CCWP (Component Cooling Water Pump)
- SFPCWP (Spent Fuel Pool Cooling Water Pump)

Non-Safety Related Pump

- Boiler Feed Water Pump
- Cooling Water Pump
- Condensate Extraction Pump

Safety Class Pump's General Requirement

Hyosung Ebara

Division	Class II for Safeguard Pump, UI-chin
Service Condition	<ul style="list-style-type: none"> - Duration : 40 Years - Max. Temp : 400°F (204°C) - Radiation : 1x10⁷ rad
Design Approach	<ul style="list-style-type: none"> - Thermal Analysis & Thermal Shock Test - Fatigue Analysis - Design for seismic - Operability Analysis
Qualification	<ul style="list-style-type: none"> - Environment Qualification - Dynamic Qualification - Performance Test - Data Report by ASME sec. III
Applicable Standards	<ul style="list-style-type: none"> - Main : ASME sec. III - Reference : ASME sec. II, V, VIII - ASME NQA-1

High Pressure Safety Injection Pump (HPSI) – Class 2

Hyosung Ebara

- Send boric acid water from Refueling water tank, in case of the shortage of coolant.
- Capable of continuing operation for more than one year after the “Runout” condition.

• Features

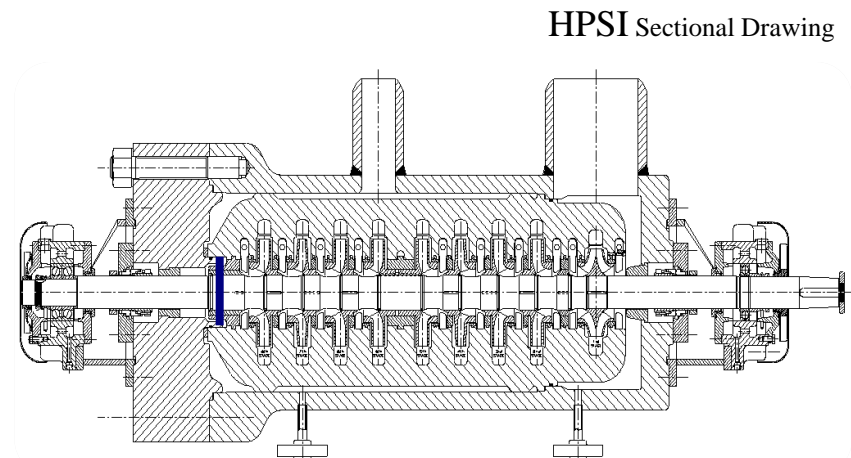
No	HPSI	
1	Liquid handled	Reactor Coolant & Refueling Water
2	Design pressure (psig); (Discharge pressure)	2050
3	Suction pressure (psig)	Max.:100, Min:30
4	Design temperature (F/C)	350 / 177
5	Flow - Rated/Run Out(GPM) (M ³ /hr)	815 / 1130 185 / 257
6	Head-Rated/Run Out/Shut off(ft) (m)	2850 / 2250~1580 / 4530~4100 869 / 686~482 / 1381~1250
7	NPSH _{av} -Run Out (ft / m)	20 / 6
8	Pump type	Horizontal/ Multistage
9	Impeller stage/rpm/power rating	9Stages / 3560rpm / 1000HP



High Pressure Safety Injection Pump (HPSI) – **Class 2**

Hyosung Ebara

- High tem/press : Material - Austenite Stainless steel
- Thermal Transient Test : Temperature rise from 4°C to 180°C in 5 min.
- Environmental Qualification (anti-radioactive material)
- Dynamic Qualification (Seismic, Operability, Heat Stress Deformation)
- Compact design (small place for installation)



Where you are **Where We are**
Always by your side

Low Pressure Safety Injection Pump (LPSI) – Class 2

Hyosung Ebara

- Send boric acid water from Refueling Water Tank, in case of the shortage of coolant.
- Capable of continuing operation for more than one year after the “RUNOUT” condition.

• Features

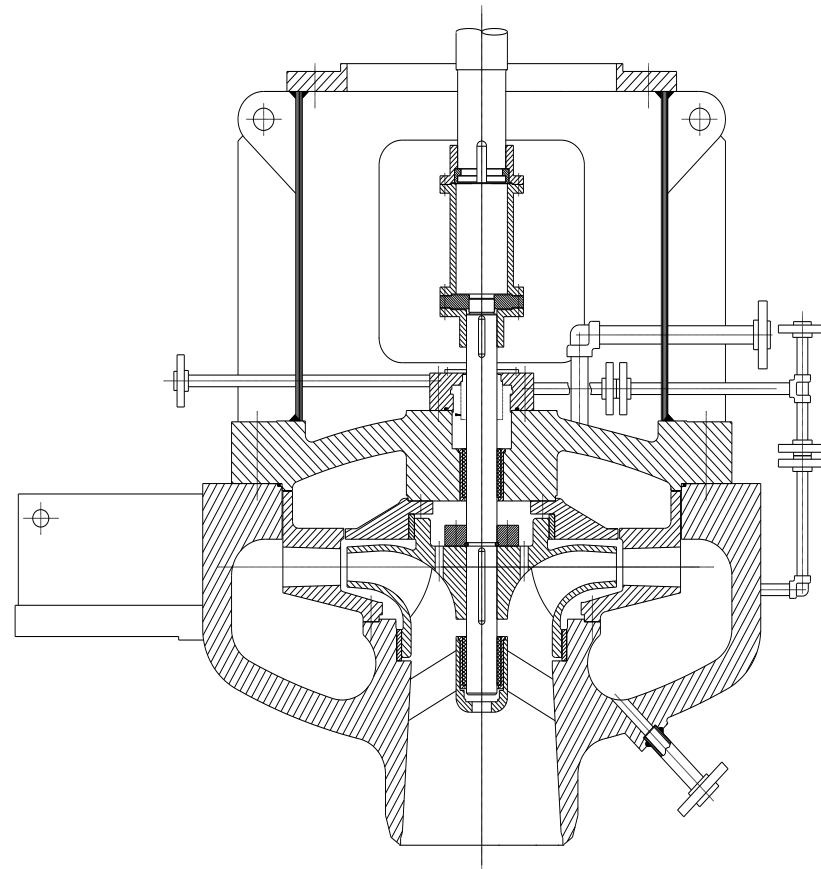
No	LPSI	
1	Liquid handled	Reactor Coolant & Refueling Water
2	Design pressure (psig); (Discharge pressure)	900
3	Suction pressure (psig)	Max.:590, Min:30
4	Design temperature (F/C)	400 / 204
5	Flow - Rated/Run Out(GPM) (M ³ /hr)	3850 / 4670 874 / 1061
6	Head -Rated/Run Out/Shut off (ft) (m)	335 / 320~290 / 470~410 102 / 98~88 / 143~125
7	NPSH _{av} -RunOut (ft / m)	20 / 6
8	Pump type	Vertical, Overhung
9	Impeller stage/rpm/power rating	1 Stage / 1760rpm / 700HP



Low Pressure Safety Injection Pump (LPSI) – Class 2

Hyosung Ebara

- High tem/press : Material - Austenite Stainless steel
- Thermal Transient Test : Temperature rise from 4°C to 200°C in 5 min.
- Environmental Qualification (anti-radioactive material)
- Dynamic Qualification (Seismic, Operability, Heat Stress Deformation)



LPSI Sectional Drawing

Containment Spray Pump (CSP) – Class 2

Hyosung Ebara

- Spray boric acid water into the containment, in case of the LPSI's non operation

• Features

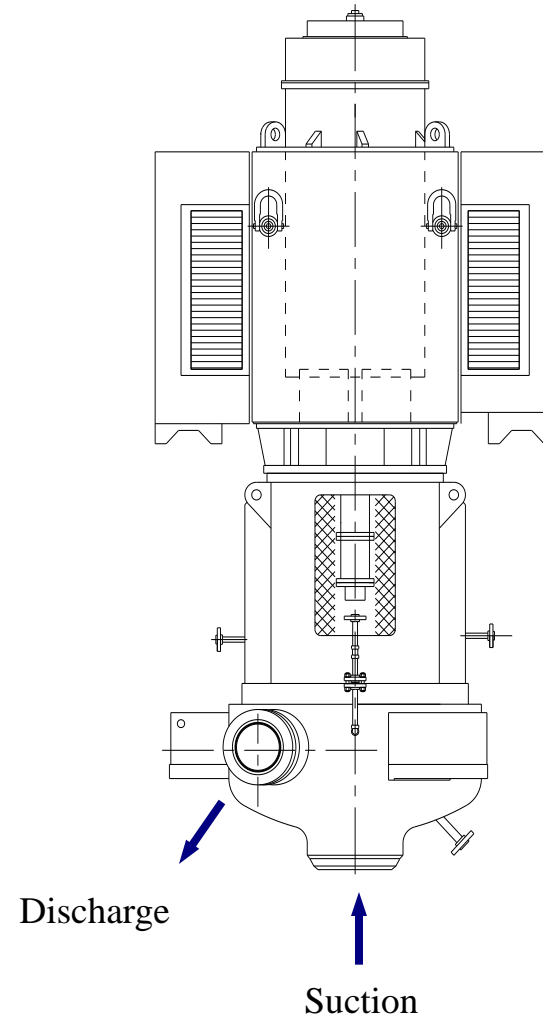
No	Containment Spray Pump	
1	Liquid handled	boric acid solution
2	Design pressure (psig) ; discharge pressure	710
3	Suction pressure (psig)	505
4	Design temperature (F/C)	350 / 177
5	Suction temperature -min/nor/max (F) (C)	60 / - / 350 16 / - / 177
6	Flow - Rated/ Run Out (GPM) (M ³ /hr)	4240 / - 963 / -
7	Head - Rated/Run Out (ft) (m)	550 / - 168 / -
8	NPSH _{av} -Run Out (ft / m)	24 / 7
9	Pump type	Vertical, Overhung
10	Impeller stage/rpm/ power rating	1 / 1760rpm / 800HP



Containment Spray Pump (CSP) – Class 2

Hyosung Ebara

- Pump material : Austenite Stainless Steel
- Mechanical Seal(Durametallic)
- It works for containment shut-down, under the situation of impossibility to control the temperature in the reactor



Pictorial View (Delivered **Class 2 Pumps**)

Hyosung Ebara

1. Customer : KEPCO (Korea)

2. Project : Shin-Wolsong Nuclear Power Project

3. Service: High Pressure Safety Injection Pump

4. Delivery Schedule : 2006

5. Technical Specification

- 1) Model: 6x10 ¼-9stg
- 2) Flow: 204m³/hr
- 3) Head: 869m
- 4) Power: 746kW, 60Hz
- 5) Temperature: 180 °C

1. Customer : KEPCO (Korea)

2. Project : Shin-Wolsong Nuclear Power Project

3. Service: Low Pressure Safety Injection Pump

4. Delivery Schedule : 2006

5. Technical Specification

- 1) Model: 8x14x24
- 2) Flow: 977 m³/hr
- 3) Head: 102m
- 4) Power: 448kW, 60Hz
- 5) Temperature: 200 °C



ASME N & NPT

Hyosung Ebara

The American Society of Mechanical Engineers



CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Hyosung Ebara Co., Ltd
43-1, Ungnam-Dong
Changwon-Si, Gyeongsangnam-Do 641-290
South Korea

SCOPE:

Construction of Class 2 & 3 pumps; and Class 2 & 3 shop assembly at the above location only

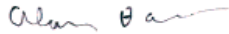
AUTHORIZED: July 17, 2009

EXPIRES: July 17, 2012

CERTIFICATE NUMBER: N-3372



Chairman of The Boiler
And Pressure Vessel Committee



Director, Accreditation and Certification



CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Hyosung Ebara Co., Ltd
43-1, Ungnam-Dong
Changwon-Si, Gyeongsangnam-Do 641-290
South Korea

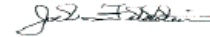
SCOPE:

Class 2 & 3 fabrication without design responsibility and with design responsibility for appurtenances and as material organization supplying ferrous & nonferrous material at the above location only

AUTHORIZED: July 17, 2009

EXPIRES: July 17, 2012

CERTIFICATE NUMBER: N-3373



Chairman of The Boiler
And Pressure Vessel Committee



Director, Accreditation and Certification

The American Society of Mechanical Engineers



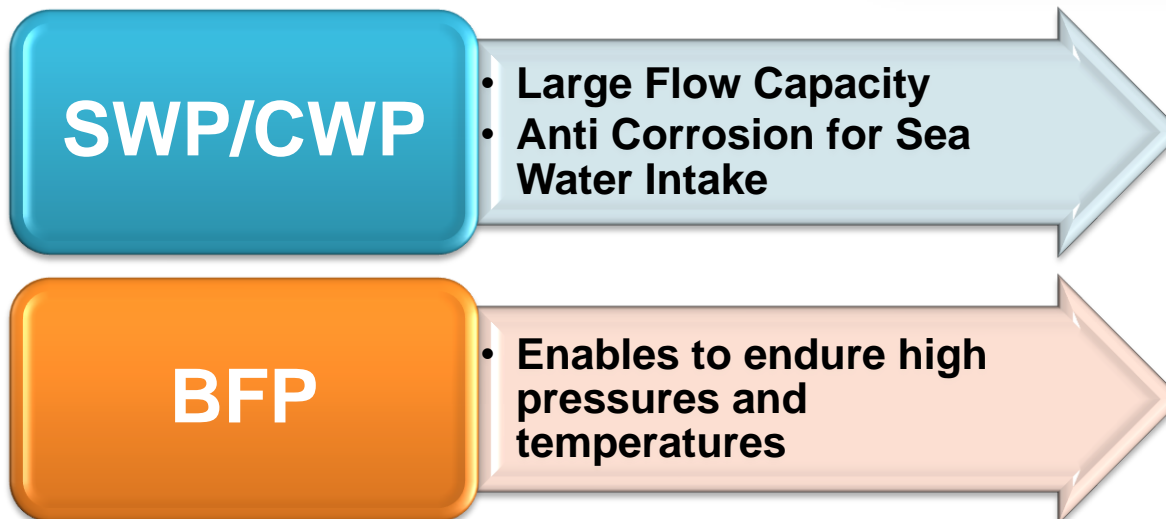
Acquired ASME N & NPT in 2009 for Nuclear Power Plant Pump supply

Thermal Power Plant

Hyosung Ebara

◆ Generally supplied types of pump

- Sea Water Lifting Pump (SWP)
- Circulating Water Pump (CWP)
- Boiler Feed Water Pump (BFP)
- Condensate Extraction Pump (CEP)



Our Pumps for SWP/CWP

Hyosung Ebara



- ◆ Capacity is up to 60,000m³/hr(264,200GPM) as standard
- ◆ All Kind of Materials are applicable (Super Duplex)



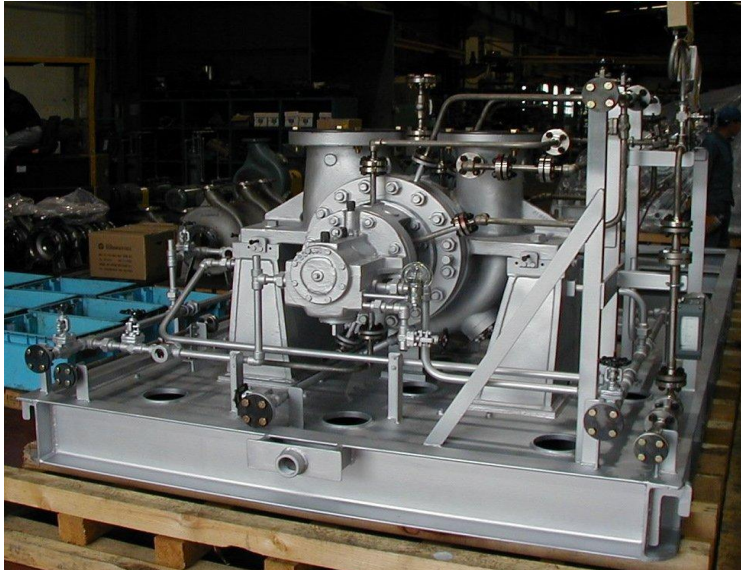
Customer ; KEPCO
Project ; UI-Chin NPP 5&6
Service ; Circulating Water Pump
Model ; VMF2000-1750
Spec ; **29864m³/hr**, 9.6m, 1194kW
Shipping ; 1995



Customer ; NTPC, India
Project ; Ramagundam Super TPP
Service ; Circulating Water Pump
Model ; VMF2200-1620
Spec ; **30000m³/hr**, 26m, 2800kW
Shipping ; 2003

Pictorial Views

Hyosung Ebara



Customer ; Hitachi
Project ; EPCOR/Genesee Phase 3, Canada
Service ; Boiler Feed Booster Pump
Model ; 300x200
Spec ; 810m³/hr, 1.1MPa, 185 °C, 410kW
Shipping ; 2002



Customer ; Hitachi
Project ; EPCOR/Genesee Phase 3, Canada
Service ; Boiler Feed Water Pump
Model ; 12x12x14-6Stg
Spec ; 810m³/hr, 309kg/Cm², 185 °C, 11000kW
Shipping ; 2002

Pictorial Views

Hyosung Ebara



Customer ; KEPCO
Project ; Tang-Jin TPP #1~4
Service ; Boiler Feed Pump
Model ; 14x14x16-5Stg
Spec ; 1077.8m³/hr, 3554m, 176 °C, 10204kW
Shipping ; 2000



Customer ; KEPCO
Project ; Tang-Jin TPP #1~4
Service ; Circulating Water Pump
Model ; VMF1650-1490
Spec ; 23440m³/hr, 6.5m, 600kW
Shipping ; 1999

Pictorial Views

Hyosung Ebara



Customer ; KEPCO
Project ; UI-Chin NPP 5&6
Service ; Circulating Water Pump
Model ; VMF2000-1750
Spec ; 29864m³/hr, 9.6m, 1194kW
Shipping ; 1995



Customer ; NTPC, India
Project ; Ramagundam Super Thermal Power/P
Service ; Circulating Water Pump
Model ; VMF2200-1620
Spec ; 30000m³/hr, 26m, 2800kW
Shipping ; 2003

Pictorial Views

Hyosung Ebara



Customer ; KEPCO
Project ; Yongkwang NPP.#5,6
Service ; Circulating Water
Pump Model ; 108x78YDDVRM
Spec ; 38,949m³/hr, 14m, 1999kW
Shipping ; 1999



Customer ; KEPCO
Project ; UI-Chin NPP 5&6
Service ; Condensate pump(COP)
Pump Model ; 40D x 28C CKxH-7stg VMT
Spec ; 2,164m³/hr, 335m, 2,700kW
Shipping ; 1999

Let's move to the Oil & Gas field !

Product Range

Hyosung Ebara

Pump Model	Description	Type Code	Model Q'ty	Remarks
U - series	Centerline Mount, Single stage, Single suction, Horizontal Pump	OH2	47	API610
K - series	Centerline Mount, Single stage, Double suction, Horizontal Pump	BB2	26	API610
R - series	Centerline Mount, Two stage, Double bearing, Horizontal Pump	BB2	9	API610
V2 - series	Multi stage, Vertical Pump with a suction can	VS1, VS6	13 x stage	API610
S - series	Multi stage, Single Case, Horizontal Split Pump	BB3	8 x stage	API 610
S2 - series	Multi stage, Single Case, Horizontal Split, Double Volute Pump	BB3	4 x Stage	API 610
D - series	Multi stage, Double Case, Ring section, Horizontal Pump	BB5	5 x stage	API 610
H1 - series	Multi stage, Double Case, Horizontal Split Pump	BB5	Special Design (Case by case)	API 610

Hyosung Ebara in Oil & Gas

Hyosung Ebara

- S.Korea doesn't have a drop of crude oil

- But S. Korea is

4th Ethylene Production capacity

5th Refinery capacity

2nd, 3rd largest unit refinery plant

* SK energy – 840,000bbl/d

GS Caltex – 700,000bbl/d

(Oil & Gas Journal)



Major delivered to Domestic Customers

Hyosung Ebara

SK Energy

- Having two refinery plants in S. Korea
- Ulsan Plant with 850,000bbl/d, Incheon Plant with 275,000bbl/d

We supplied our API 610 pumps to their

- NEW FCC (200 Sets including OH2, BB2, VS6, 2007)
- SDA Project (10 sets including OH2, BB3, BB5)
- NRC (46 sets, 2005) , 2nd LBO (30 sets, 2003), BDO (31 sets, 2007)
- No.1 CDU, No.5 CDU, No.2 FCC and etc...



GS-Caltex

- As Chevron (U.S.A)'s invested company
- Having one refinery plants in Yeo-Su Plant with 700,000bbl/d
- We supplying our pumps as fixed vendor (Outline purchase agreement)

We supplied our API 610 pumps to their

- No.2, HOU (BFP Pump package), No.3 HOU (86 sets of OH2, BB3, OH6)
- No.3 P-X (19 Sets, 2002),
- No.2, 3, 4 CDU Debottlenecking
- Alkylation Expansion



Major delivered to Domestic Customers

Hyosung Ebara

S-OIL

- As "ARAMCO" owned it's 100% ownership right
- Having one plant in Ulsan with 500,000bbl/d

We supplied our API 610 pumps to their

- Alkylation Project (38 sets of OH2, BB1, BB2)
- SEP Project (150 sets of OH2, BB2, BB3, BB5, VS1, VS6)
- P-X Project (33 sets)



Hyundai Oil Bank

- Having a plant in Daesan with 275,000bbl/d

We supplied our API 610 pumps to their

- No.2 HOU Project (166 sets of OH2, VS1, VS6 and BFP Package)



Many experiences and opportunity

Hyosung Ebara



Where you are Where We are
Always by your side

Customer Approved Status

Hyosung Ebara

◆ API 610 Pumps delivered to below customer

- ARAMCO (Saudi Arabia)
- SABIC (Saudi Arabia)
- Chevron Phillips (U.S.A)
- Gazprom – Sibur (Russia)
- ADMA (Abu Dhabi Marine, U.A.E)
- GASCO (U.A.E)
- And Many of Refinery & Petrochemical Company in Korea and Oversea

Aramco Overseas Company B.V. Tel: (03) 5563-0552
Ark Mori Bldg, P.O. Box 529 Fax: (03) 5563-0544
No. 12-32, Akasaka 1-chome,
Minato-ku, Tokyo 107-6016, Japan

April 17, 2008
Letter Ctrl # 3RT-015-08

HYOSUNG EBARA CO LTD
ATTN: MR. J.Y. PARK, SALES
460 GONGDUK DONG,
MAPO-GU, SEOUL
SOUTH KOREA 121-720

Subject: Quality Management System Approval

Survey/Assessment/Desk Review Date: **21 and 22 August, 2007**

Next Evaluation Date: **2012**

Reference: Vendor ID: **10036643**; Plant ID: **30004607**

Dear Sirs,

As a result of the **Survey** conducted by AOC Tokyo Inspection, AOC is pleased to advise you that your company's Quality Management System (QMS) is **APPROVED** to supply the attached list of Commodity Classification Code(s) (9COM) (see Attachment 1) that have been linked to your Plant ID No. **30004607**.

This approval is granted for your manufacturing plant, **HYOSUNG EBARA CO LTD, 43-1 WOONGNAM-DONG, CHANGWON, SOUTH KOREA 641-290** and your company is expected to continue complying with Saudi Arabian and Saudi Aramco Standards.

This approval, however, should not be construed as a commitment by Saudi Aramco to purchase from you. However, your company will have the opportunity along with other approved suppliers to respond to requests for submitting proposals in accordance with Saudi Aramco's established policies and procedures.

AOC would like to take this opportunity and thank you for your interest in doing business with Saudi Aramco. Please use the above referenced vendor ID and Plant ID on all future written correspondence.

Sincerely yours,

 APR 17 2008

Sami M. Bukhari
Asia Pacific Representative
Aramco Overseas Company B.V. Tokyo

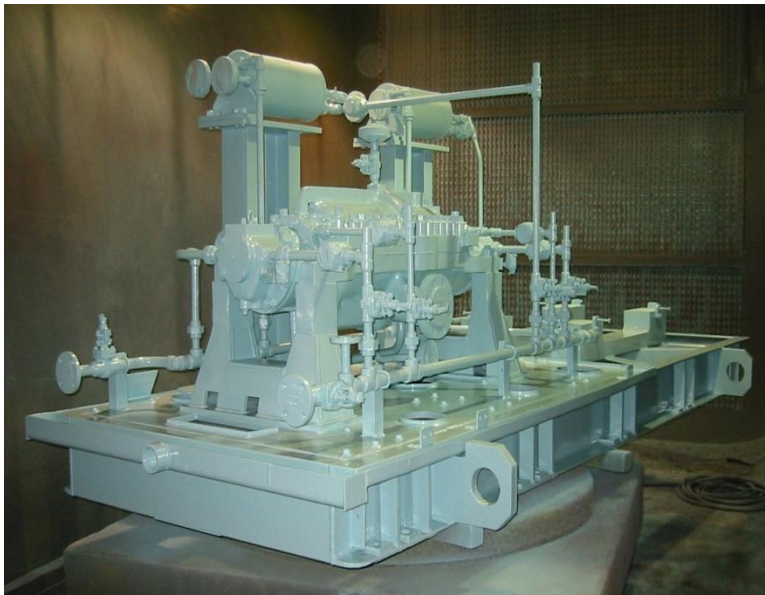
It is the responsibility of the manufacturer to notify AOC Tokyo Supplier Relations Unit of the following:

1. *Change of Name/Address*
2. *Any change of manufacturing location (sub sourcing fabrication of major components)*
3. *Discontinuance of fabrication of approved 9COMs*

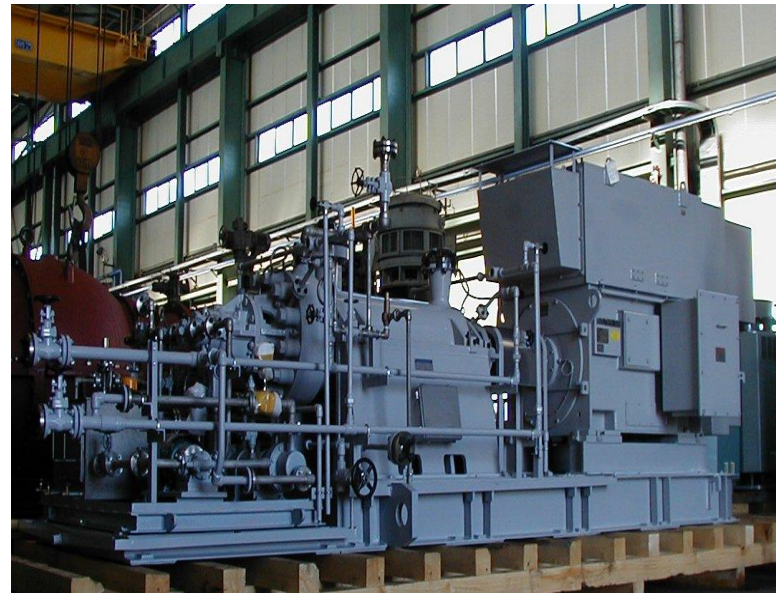


Pictorial Views

Hyosung Ebara



Customer : LG E&C/CAPRO Corp.
Project : CAPRO CE2 Project
Service : Boiler Feed Water Pump
Size & Stage : 100x80 /10M (BB3)
Spec : 78m³/hr, 701m, 120 °C, 245kW
Shipping : 2003



Customer : LG Petrochemical Co., Ltd.
Project : LGPC E-BA1115
Service : High Pressure Boiler Feed Pump
Size & Stage : 150x100 /13M (BB5)
Spec : 142m³/hr, 146.2kg/Cm², 890kW
Shipping : 2002

Pictorial Views

Hyosung Ebara



Customer : SKEC/SK CORPORATION
Project : 2nd LBO Project
Service : Vacuum Tower Bottoms Pump
Size : 150x80 (OH2)
Spec : 67.2m³/hr, 236m, 350°C, 110kW
Shipping : 2003



Customer : SK Corporation
Service : Propane Feed Pump
Size & Stage: 250x150 / 5M (VS6)
Spec : 218.2m³/hr, 190m, 150kW, Viscosity : 0.1cP
Shipping : 2002

Pictorial Views

Hyosung Ebara



Customer : Korea Oil Pipeline Co., Ltd.
Project : TKP/SNP Piping Connection
Service : JP-8 Boosting Pump
Size : 150x100 (BB2)
Spec : 200m³/hr, 401.5m, 350kW
Shipping : 2002



Customer : LG Chemical Co., Ltd.
Project : 2AA IPA Plant
Service : Demi Water Supply Pump
Size & Stage : 80x50 /12M (BB3)
Spec : 18m³/hr, 45.52kg/Cm², 75kW
Shipping : 2002

Pictorial Views

Hyosung Ebara



Customer : LG-Caltex Oil Corporation
Project : No.3 PX Project
Service : P/X Transfer Pump
Size : 200x150(OH2)
Spec : 588m³/hr, 102m, 220kW
Shipping : 2002



Customer : SK Corporation
Project : No.1 CDU HAC Project
Service : Circulating LGO Pump
Size : 100x80 (OH2)
Spec : 110.2m³/hr, 146.2m, 75kW, 307 °C
Shipping : 2002

Major Delivery Records (Power Plant)

Hyosung Ebara

Project Name / Site	Customer	Service	Description	Year
Ramagundam STPP, India	NTPC	CWP 3 Sets	Q : 30,000m ³ /h H : 26m Motor : 2800KW	2003
Sohar Power Plant, Oman	Doosan	BFP 4 Sets & CEP 2 Sets	Q : 475m ³ /h H : 1,075m Motor : 1900KW	2005
Colone-B CCPP, Macau	CEM	CWP 2 Sets	Q: 12,500m ³ /h H : 15m Motor : 1,500KW	2002
MAPNA HRSG Facilities, Iran	MAPNA	CEP 44 Sets	Q: 850m ³ /h H : 230m Motor : 745KW	2004~2007
FARS Power Plant, Iran	-	CEP 6 Sets	Q : 538m ³ /h H : H : 73m Motor : 150KW	2000
Baria CCPP, Vietnam	-	BFP 4 Sets	Q : 81.1m ³ /h H : 1,012m Motor : 350KW	2002
Rehap Power Plant, Jordan	Doosan	BFP 6 Sets & CEP 2 Sets	Q : 95m ³ /h H : 1,381m Motor : 620KW	2004
Servern CCPP, U.K	Siemens	BFP 4 Sets & CEP 4 Sets	-	2009
Seraya CCPP, Singapore	Siemens	BFP / DP / CEP 4 Sets each	-	2008 ~ 2009
Incheon II CCPP, Korea	Siemens	BFP / CEP 3 Sets each	-	2007
EPOCOR Power Plant, Canada	Hitachi	BFP 4 Sets	81.1m ³ /h H : 1,100m Motor : 410KW	2002
Lares Power Plant, Portugal	Cobra	GSP		2008

Major Export Orders In Hand (Power Plant)

Hyosung Ebara

Project Name / Site	Customer	Service	Description
Farakka STPP, India	NTPC	Lift Pump / VMF 5 Sets	Q : 44,500m ³ /h H : 7m Motor : 1,100KW
Surgut CCPP, Russia	GAMA	GSP 10 Sets	-
Mapna Boiler Company, Iran	Mapna	HRSG (BFP 48 Sets)	Q : 350m ³ /h H : 1,200m Motor : 1,400KW
Marafiq IWPP, Saudi	Jubail Water & Power	IP FWP / SS 6 Sets	Q : 103.2m ³ /h H : 569.8m Motor : 250KW
KIA Assembly Plant, USA	-	General Service Pumps Total 25 Sets	-
Ambatovy Power Plant, Madagascar	-	BFP 9 Sets	-
Aravali Power Plant, India	NTPC	CWP 2 Sets	Q : 30,000m ³ /h H : 27m Motor : 2,800KW
Suwaihat S2 IWPP, UAE	SIEMENS, Doosan, Samsung Consortium	BFP, CEP, GSP, Intake Pump, Process Pump 104 Sets	SIEMENS, Doosan, Samsung Consortium

Major Delivery Records (Oil & Gas)

Hyosung Ebara

Customer / Project Name	Description & Q'ty	Site	Year
SABIC(KAYAN) / PC Project	API Pumps 22 Sets	Saudi Arabia	2008
SABIC(IBN ZAHR) / PP & OCU Project	API & Non API Pumps 47 sets	Saudi Arabia	2007
SAHARA Petrochemical / PDH-PP Project	API & Non API Pumps 43 sets	Saudi Arabia	2007
GS Caltex / No.2 & 3 HOU Project	BFP Package (API) 12 sets	By Technip USA (LA) / Korea	2008 2009
Gazprom(Sibur) / EB Project	API Pumps 21 sets	Russia, Perm	2009
Chevron Phillips / NCP Polymer Project	API Pumps 45 sets	Saudi Arabia	2008
SA Kentz / Jubail Acetyles CLX Project	AP Pumps 14 sets	Saudi Arabia	2006
ADMA (UAE) / Umm Shaif Gas Injection Facilities (Offshore)	API Pumps 21 Sets	U.A.E	2008
Ghana RFCC	API Pumps 35 sets	Ghana	2000
BST C4 Project	API Pumps 25 sets	Thailand	1994
PT. PATRA (J.V : SK & Pertamina) / L-Project	API Pumps 42 sets	Indonesia	2007
Qatar Petroleum / Ras Laffan Refinery	API Pumps 15 sets	Qatar	2007

Critical Specification

Hyosung Ebara

Description		Customer	Typical Specification	Q'ty	Delivery
Maximum Head & Power	Horizontal	Tangjin T.T.P	BFP 1,078m ³ /hr, 3554m , 12,000kW	8sets	1999
	Vertical	Ulchin N.P.P	COP 2,164m ³ /hr, 338m , 2,700kW	6sets	2000
Maximum Flow	Horizontal	KOWACO	Intake 13,781m³/hr , 80m, 3,920kW	9sets	1998
	Vertical	Tangjin T.T.P	SLP 46,880m³/hr , 13.3m, 2,350kW	2sets	2002
Max. Temp.	Vertical	SK	Lube Oil 67.2m ³ /hr, 236m, 366°C	2sets	2004
Lightest Specific Gravity	Horizontal	LG	Light Gas Oil 139m ³ /hr, 205m, S.G.0.46	4sets	1992
	Vertical	SK	Propane Feed 240m ³ /hr, 190m, S.G. 0.4	1sets	2002

Thank you.