PK Valve & Engineering
Controls the flow

Pre-Qualification

Rev.49 / SEP. 01. 2023

Contact Point

Website **www.pkvalve.co.kr**

Tel
Strategic Planning Team 82-55-268-3770
Strategic Sales Team 82-55-268-3755
Global Sales Team 82-55-268-3740
Project Sales Team 82-55-268-3780

E-mail mst@pkvalve.co.kr
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Project Sales Team ljy@pkvne.com

Fax 82-55-286-0281

Contents

1. Company Overview

1. Company Overview

1-1. Outline

General Information

Name of Company

PK VALVE & ENGINEERING CO.,LTD.

CEO

YOUNG CHAN CHUN

Products

Cast Steel & Forged Steel Valves, Gas Valve Unit (GVU)
Fuel Train Valve (FTV), Tube Support & Cast products

Head Office & Factory

Gongdan-ro 80, Seongsan-gu, Changwon-si, Gyengsangnam-do,
Republic of Korea
+82-55-268-3740 +82-55-286-0281

Seoul Sales Office

1318, Myeongdong MFirst Place, 15-1, Samil-daero 8-gil, Jung-gu,
Seoul, Republic of Korea
+82-55-260-5795 / 5796

Total employee

330

Area

Premises size land	69,124㎡
Work shop	18,697㎡
Contract power plant	6,990 KVA

Contact E-mail

Strategic Planning Team	jh77k@pkvne.com
Strategic Sales Team	jypark@pkvne.com
Global Sales Team	sky@pkvne.com
Project Sales Team	ljy@pkvne.com

Production capacity

Monthly output*

1100 T/M
Total (Ton/Month)

700 T/M
Cast Carbon Steel Valves

400 T/M
Cast Stainless Steel Valves

1-2. Management Policy

On the basis of "Base on Reliability" as a fundamental management philosophy, all employees at PK VALVE & ENGINEERING. respect human life and worker's health care before all production activities, provide satisfactory products and services that meet the requirements of customers by means of management activities in harmony with environment and continuing technological development and quality innovations, and further make every efforts to fulfill our social responsibilities and obligations with the realization of human happiness as our top priority, including the policies specified below.

Realization of human happiness

Recognize the Safety, Health, Environment & Quality (SHEQ) management as key factors in accomplishing our continuous stability and growth, and comply with all legal and regulatory requirements, other applicable requirements as agreed and internal regulations that relate to safety, health, environment, and quality aspects.

Providing satisfactory products and services

Improve and upgrade management system continuously through process improvement and technological development so that all the factors impeding safety, health, environment, and quality activities can be minimized.

Continuing tech, development Quality innovation development

Establish and implement the management objectives and targets to accomplish our SHEQ management policy, and review and improve the continuing suitability of the management policy and system.

Harmony with environment Worker's health care Respect human life

Give careful consideration to safety, health, environment, and quality over the whole process ranging from product development, design, production, servicing, and disposal.
Make every efforts to prevent accidents by taking precautions to eliminate harmful and dangerous factors involving safety, health, and environment activities, and where an accident occur, take a proper measure to minimize the damage.

Base on reliability

Do our best to earn customer's trust and love by grasping accurately the quality requirements of customer and furnishing the best quality products that always satisfy customer's expectations and requests.
Continuously give training to all PK VALVE & ENGINEERING employees and other representatives who perform safety, health, environment and quality related activities to inspire awareness and induce active participation.

1-3. History

PK Process of Growth

Present-2016 Vision | **2015-2006** Take Off | **2005-1998** Growth | 1997-1985 Hardship | 1984-1977 Challenge | 1976-1946 Beginning

Present-2016 VISION

2023
- Verification Test for LH2 Valve
- 1st shipment for Gas Valve Unit
- 1st Contract Award for FVT (Fuel Valve Train)

2022
- Awarded an Industrial Commendation
- Awarded a certificate from Korea Atomic Industrial Forum (KAIF)
- Renamed to PK Valve & Engineering
- Development for LH2 Valve

2021
- Certified as corporation as casting, components, equipment
- Merged subsidiary of PKSCS

2019
- Minister's prize of Korean Ministry of Trade, Industry and Energy for the Shin-Kori 3、4 Nuclear Power plant
- Designation of favorable workplace as a grass root industry

2018
- Established ESS system

2017
- Certified Excellent Employment Company
- Acquired UA Valve for Ball Valves

2016
- Certified as Performance Verification Organization
- Awarded grand prize in 'Arts & Business'

2015-2006 TAKE OFF

2015
- Shipped largest 92 inch Gate
- Awarded a prize for "Man of Merit'

2014
- Awarded a prize for "Man of Merit' by Korea President

2013
- Awarded a prize for best Labor - Management Relationship
- Awarded a prize for fair trade

2012
- Established 2nd foundry shop
- Appointed a corporation as best employment
- Appointed best company for Labor-Management relationship

2011
- Expansion of R&D Center
- Awarded Industrial prize in 48th Trade Day
- Awarded best management

2009
- Appointed best performance sharing corporation by 'KHNP
- Selected best R&D Center

2008
- Appointed as excellent company for productivity improvement

2007
- Awarded "New Technology Practicality Promotion"

2006
- Renamed to PK Valve Co.,Ltd.

2005-1998 GROWTH

2005
- Obtained ISO 14001, OHSAS 18001 by BVQI

2002
- Obtained EM mark for high pressure Triple Offset Butterfly valve

2001
- Obtained CE by SGS U.K
- Listed Innovation business company (INNO-BIZ)

1999
- Awarded a prize for best Labor - Management Relationship
- Awarded a price for excellent development for capital goods by Korea President

1998
- Obtained TUV certificate

1-3. History

PK Process of Growth

Present-2016 Vision | 2015-2006 Take Off | 2005-1998 Growth | **1997-1985 Hardship** | **1984-1977 Challenge** | **1976-1946 Beginning**

1997-1985 HARDSHIP

1997
- Obtained Quality Assurance Qualification Certificate by KEPIC

1994
- Established R&D Center

1993
- Obtained ISO 9001 by BVQI

1989
- Listed as a manufacturer for thermal & Hydroelectric power plant at KEPCO
- Listed as a manufacturer for nuclear power plant at KEPCO

1988
- Listed a manufacturer at KEPCO
- Obtained certificate of manufacturer for Nuclear valves
- Listed Cryogenic Valves in Korea
- Gas Corporation

1987
- Approved Fire Safe Ball Valve

1986
- Listed as specialized installation of power plant at KHIC
- Approved a manufacturer by BV

1985
- Developed Cryogenic Valve

1984-1977 CHANLLENGE

1983
- Approved a manufacturer by DNV

1981
- Approved Steel Casting Manufacturer by NK
- Designation of specialized Installation
- of Power plant

1980
- Approved Steel Casting Manufacturer by Lloyd's Register of Shipping
- Renamed to Pan-Korea Metal Ind. Co. ,Ltd.

1979
- Obtained "KS" certificate for Cast Bronze Valves (2 Items)

1978
- Approved manufacturer by Korean Register of Shipping & API

1976-1946 BEGINNING

1975
- Obtained "KS" certificate for Cast Steel and Marine Valves (10Items)

1974
- Relocation to Changwon Industrial Complex

1971
- Obtained "KS" for Bronze & Cast Iron Valves (5 Items)

1968
- Reorganized Busan Pokum Ind. Co.,Ltd

1946
- Established Busan Pokum Ind. Company

1-4. Commendation

No.	DESCRIPTION	ISSUER	DATE
1	Grand Prize for Industrial Peace from Korean Government	Gyeongsangnam-do	2022. 12
2	Industrial Commendation from the Minister of Trade	Ministry of Trade, Industry and Energy	2022. 10
3	Appreciation letter from the President of Korea	President award	2022. 10
4	Commendation for the 50th anniversary of the Korea Nuclear In dustry Association	Minister of Science and ICT	2022. 10
5	Commendation for the completion of Shin-Kori Nuclear Power Plant Units 3 and 4	Ministry of Trade, Industry and Energy	2019. 12
6	Certificate of Excellent employment company	Gyeongsangnam-do	2017. 12
7	Commendation for The 1st Mid-sized Entrepreneur's Day	Ministry of Trade, Industry and Energy	2015. 07
8	Presidential citation for the 40th anniversary of Changwon Industrial Complex designation	President award	2014. 04
9	The 12th Fair Trade Day Government Award for Men of Merit	Fair Trade Commissioner	2013. 04
10	Excellent labor-management culture company in 2012	Ministry of Employment and Labor	2012. 06
11	Excellent employment company in Gyeongsangnam-do in 2012	Gyeongsangnam-do	2012. 06
12	Grand prize for excellent employee's stock ownership plan	Ministry of Employment and Labo	2009. 11
13	New technology commercialization promotion contest Govern ment award	Prime Minister	2007. 12
14	Commendation for outstanding capital goods development	President award	1999. 10
15	Encouragement Award in the nuclear sector at the Energy Awards	Ministry of Trade, Industry and Energy	1999. 06

1-4. Commendation


포 장 증

피 케 이 밸 브 (주)

대표이사 박 헌 근

귀하는 [illegible] 방산에 크게 이바지하였으므로 대한민국헌법 의 규정에 따라 다음 포장을 수여합니다.

산 업 포 장

2007년 11 월 30 일

대 통 령 노 무 현

Appreciation letter from the President of Korea


2010년

대한민국 최고기업대상

피케이밸브 주식회사

귀사는 (사)한국경영인협회가 주관[illegible] 대한상공회의소, 한국경제신문사가 후원하는 2010년 '대한민국 최고기업대상' 심사결과 조립금속/기계부문 최고기업으로 선정되었기에 이를 인증하고 상패를 드립니다.

2010. 6. 22.

심사 한국경영인협회

회장 고 병 우

Award of Top Corporate Brand by Korea Enterprises Federation

Top Management Award by the Korea Chamber of Commerce & industry


포 장 증

피케이밸브앤엔지니어링(주)

대표이사 진 영 찬

귀하는 기계 조립금속기업진흥을 통하여 국가 산업 발전에 크게 이바지하였으므로 대한민국 헌법에 따라 다음 포장을 수여합니다.

산 업 포 장

2022년 10 월 18 일

대 통 령 윤 석 열

Appreciation letter from the President of Korea


제 138811 호

표 창 장

피케이밸브앤엔지니어링(주)

위는 평소 맡은 바 직무에 정려하여 왔으며 특히 에너지 수요관리 및 효율향상 유공을 통하여 국가사회발전에 기여한 공이 크므로 이에 표창합니다.

2022년 11월 17일

산업통상자원부장관

이 창 양

Industrial Commendation from the Minister of Trade


경상남도 산업평화상

제 3073 호

대 상

피 케 이 밸 브(주)

대표이사 진 영 찬

귀하께서는 노사화합을 통한 생산성 향상과 산업평화 정착에 크게 기여하였으므로 이 상패를 드립니다.

2022년 12월 7일

경상남도지사 박 완 수

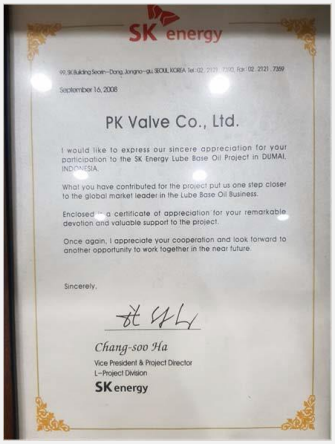
Grand Prize for Industrial Peace from Korean Government

1-5. Customer Appreciation Letter

No.	DESCRIPTION	ISSUER	DATE
1	Appreciation Letter from EAGLESTAR (MISC 174k CBM Mark III Flex Plus Project)	EAGLESTAR	2023.04.03
2	Certificate of Reliability from KOSHIPA & KOMEA	KOSHIPA & KOMEA	2023.02.23
3	Appointment Letter for Best Performance Partner	Hyundai Heavy Industries	2022.01.21
4	Appreciation plague from Eni S.p.A (Coral-Sal FLNG)	Eni S.p.A	2021.11.15
5	Appreciation plague from Samsung Heavy Industry	Samsung Heavy Industry	2020.10.19
6	Appreciation plague from Hyundai E & C (HDO Revemp Project)	Hyundai E & C	2020.07.22
7	Appreciation plague from KEPCO (Barakah Nuclear Power Plant)	KEPCO	2020.03.03
8	Appreciation Letter from Hyundai LNG Shipping (HDO Revemp Project)	Hyundai E&C	2020.07.22
9	2017 Vendor of the year by CTCI	CTCI	2017
10	Appreciation plague from Samsung Engineering	Samsung Engineering	2015.03.20
11	Certificate of Reliability from KIMM	Korea Institute of Machinery & Material	2012.02.23
12	Appreciation plague from DSME (Pazflor Project)	DSME	2010.01.15
13	Appreciation letter from SK Energy (Lube Base Oil Project in DUMAI, INDONESIA)	SK Energy	2008.09.16
14	Certificate of Commendation from CHIYODA (QATARGAS II Development Project)	Chiyoda Corporation	2007.02.01

1-5. Customer Appreciation Letter

Certificate of Commendation from CHIYODA (QATARGAS II Development Project)



Appreciation letter from SK Energy (Lube Base Oil Project in DUMAI, INDONESIA)

Appreciation plague From DSME (Pazflor Project)

Certificate of Reliability from KIMM

Appreciation plague from Samsung Engineering

2017 Vendor of the year By CTCI

1-5. Customer Appreciation Letter


HYUNDAI LNG SHIPPING
현대LNG해운주식회사

Appreciation Letter from
Hyundai LNG Shipping
(174K Sabine Pass LNG)


감 사 패
PK밸브㈜
대표이사 이 중 율
사장 김 종 인

Appreciation plague
From KEPCO
(Barakah Nuclear Power
Plant)


HYUNDAI
감 사 패
피케이밸브㈜
귀사는 2020 HDO Revamp Project의 배관자재 공급업체로 선정되어 촉박한 납기 일정에서도 적극적인 협조와 지원으로 당 Project의 공기 준수를 위해 기여한 공로가 크므로 본 패를 수여합니다.
2020. 7. 22
현대오일뱅크 2020 Revamping Project
현대건설 현장소장 김 종 인

Appreciation plague from
Hyundai E & C
(HDO Revemp Project)


SAMSUNG
공 로 패
삼성중공업주식회사

Appreciation plague from
Samsung Heavy Industry


PLAQUE OF APPRECIATION

Appreciation plague from
Eni S.p.A
(Coral-Sal FLNG)


현대중공업
HYUNDAI HEAVY INDUSTRIES
품질우수협력회사
APPOINTMENT LETTER FOR
BEST PERFORMANCE PARTNER
피케이밸브㈜
PK VALVE
귀사는 투철한 품질관리와 납기준수 노력으로 당사 경쟁력 강화에 기여한 공이 크므로 2021년 품질우수협력회사로 선정하여 이 상을 드립니다.
2022년 1월 21일
현대중공업주식회사
대표이사 사 장 이 상 균

Appointment Letter for Best
Performance Partner

1-5. Customer Appreciation Letter

Certificate of Reliability

- Certificate No. : KQ-2023-05
- Date of Certificate : February 23, 2023
- The term of Validity : 3 Years
- Company Name : PK Valve & Engineering Co.,Ltd.
- Representative : Jeon, Yeong Chan
- Address : 80, Gongdan-ro 30-gil, Seongsangu, Changwon-si, GN, Korea

We Certify that the company named above is reliable marine equipment manufacturer & supplier, based on a transparent and global-standard process of evaluation and our records of doing business with the company.

February 23, 2023

Ko, Sam H
Chairman
Korea Offshore & Shipbuilding Association(KOSHIPA)

Kang, Ho-il
Chairman
Korea Marine Equipment Association(KOMEA)

Certificate of Reliability
from KOSHIPA & KOMEA

CERTIFICATE OF APPRECIATION

This serves as our sincerest appreciation to **PK Valve** for your professionalism and good efforts that lead to the successful completion of MISC 174k CBM Mark III Flex Plus project (Hull No. 2364 & 2365) at SHI.

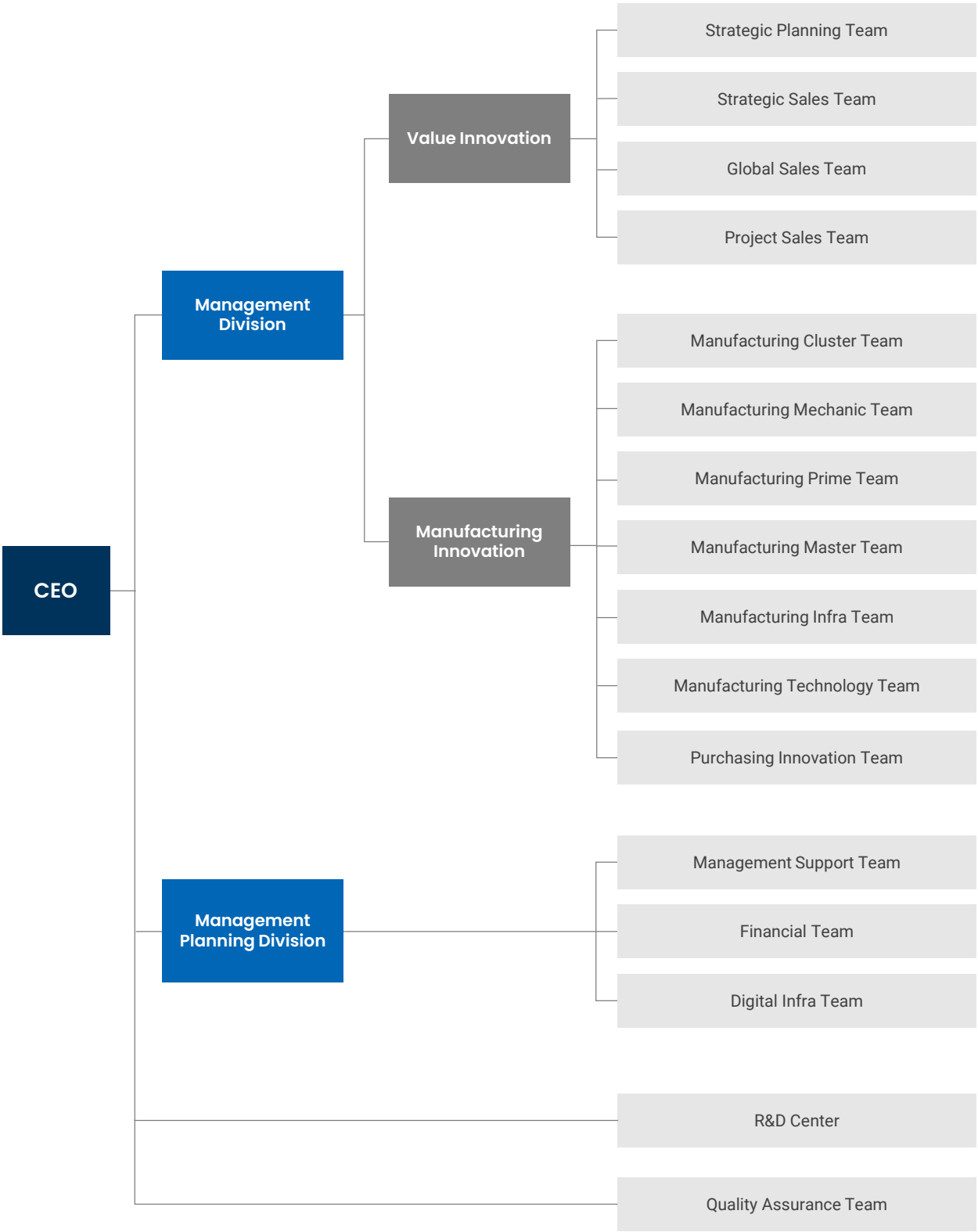
Your relentless support and performance in respect to the professionalism, quality and management is remarkable. We value your contribution and good efforts for quality control and co-operation for the supply of cryogenic butterfly valve.

We would like to take this opportunity to express our special thanks to you and looking forward for future good cooperation.

Mohd Asahar bin Alias
EAGLESTAR
Project Manager

Appreciation Letter
From EAGLESTAR
(MISC 174k CBM Mark III
Flex Plus Project)

1-6. Organization



1-7. Human Resource

(1) Number of Employee

Total 330

R & D CENTER	QC / QA	OFFICE WORKER	PRODUCTION WORKER	In-house Sub Supplier
12	49	64	156	49

※ **In-house Sub Supplier** : NDE, Painting, Packing

(2) Level of Education

	University/ Graduate School	College	High School	Remarks
OFFICER	110	15	0	
WORKER	0	50	155	
Total	110	65	155	

(3) Experience

	Over 25 years	Over 20 years	Over 15 years	Over 10 years	Over 5 years	Over 3 years	Below 3 years
OFFICER	20	24	40	28	8	3	2
WORKER	40	50	30	30	30	17	8
Total	60	74	70	58	38	20	10

(4) Number of Engineer

Total 58

Casting	Machinery	QC, QA	Design, R&D	Paint, Packaging
6	7	18	21	6

(5) Number of NDE Personnel(Resident)

Level 3	Level 2	Total
2	7	9

(6) Number of Painting and Packing Personnel(Resident)

Painting	Packing	Total
29	20	49

2. Business Field

2-1. Business Field

LNG

- LNG Carrier
- LNG DF Service
- LNG Terminal

OFFSHORE

- FPSO
- Flat-form
- TLP
- Drill ship

OIL & GAS

- Refinery

PETROCHEMICAL

- Ethane
- Fertilizer
- BTX
- NCC
- Others

POWER

- Nuclear
- Thermal
- CCPP
- HRSG
- Boiler

WATER

- Desalination

2. Business Field

2-1. Business Field

Techfiical Guidafice

With technologies and know-how accumulated over several decades, PK VNE gives technical guidance and consulting to the valve manufacturers and customers that require our technology.

New Product Developmefit

PK VNE has a very valuable experience that has developed the products applied to several domestic and foreign plant industries during the past 60 years, and we are also ready to satisfy the needs of valves in the future business design of customer.

Mafiufacture & Supply

PK VNE manufactures and supplies customer-reliable products with a comprehensive system of valve manufacture including pattern-making plant, casting plant, machining plant, painting plant, laboratory room, R&D division, etc. where we run of our own.

Diagfiosis & Repair

PK VNE is performing the repair works on defective products and the diagnosis activities to judge safety, environmental suitability, and efficiency for several Industries using valves as well as several customers that habitually use and buy our products.

Ifispectiofi & Quality Guidafice

Our quality assurance system gives the top priority to the requirements of customer, and has been highly appreciated by customers as most of its own quality control standards are strictly designed and applied. Moreover, we give quality guidance suitable for the quality assurance system to both cooperators and other companies as requested.

Supervisiofi & Witfiessifig Trial Rufi

PK VNE can propose an optimization of valve selection or use, and secure high-grade engineers and supervisors who have an ability of immediate solution for valve problems that may be found through witnessing customer's trial run.

Supply of Piping Materials

PK VNE has an agency ability of supplying piping materials, importing valves, and automation facilities of various products except our own ones.

External Training

On the basis of experiences and know-how accumulated, PK Valve gives a regular valve technical training to valve designers, purchasers, inspectors, and operators, and specially provides a chance to see with their own eyes all processes and products of PK VNE.

2-2. Products & Capacity

CAST STEEL

Section	Description
Material	Cast Carbon Steel Cast Alloy Steel / Cast Low Alloy Steel Cast Stainless Steel(Duplex, Super Duplex) Al-Bronze / Hastalloy / Incolloy / Inconel Others
Type	Gate, Parallel slide, Globe, Check, Butterfly, Bellows Seal Valve Split type Ball Valve(2-Piece & 3-Piece), Top Entry Ball Valve End Entry Ball Valve, Weld Entry type DBB(Double-block-and-bleed valve) 3-Way Ball Valve(L-Port, T-Port)
Application	Power Plant(Nuclear, Thermal & Combined Heat) Construction, Housing, General Piping Cryogenic(LNG, LN_2 , LO_2 , Ethylene, Propylene, LH_2) Chemical / Petrochemical / Oil Refinery Shipping / Offshore Plant Gas Plant / HRSG / Desalination Plant
Size	1inch ~ 100 inch
Pressure	150LB ~ 2500LB
Specification	ASME/ ANSI , API, KEPIC, ASTM, etc.

FORGED STEEL

Section	Description
Material	Carbon Steel (A105, A105N, LF2) Low Alloy Steel (F11, F22, F91 and etc.) Stainless Steel (F304(L), F316(L) and etc.
Type	Gate, Parallel Slide Gate, Globe and Y-Globe Split type Ball Valve(2-Piece & 3-Piece) & Spol Type
Application	Power Plant(Nuclear, Thermal & Combined Heat) Construction, Housing, General Piping Cryogenic(LNG, LN_2 , LO_2 , Ethylene, Propylene) Chemical / Petrochemical / Oil Refinery Shipping / Offshore Plant Gas Plant / HRSG / Desalination Plant
Size	1/2 inch ~ 8 inch (For Die Forging) Up to 20 inch (For Free Forging)
Pressure	GGC : 800LB ~ 4500LB BALL : 150LB ~ 4500LB, Spol Valve(API6A)
Specification	ASME/ ANSI , API, KEPIC, ASTM, etc.

2-2. Products & Capacity

CRYOGENIC VALVE FOR LIQUEFIED H2

Section	Description
Material	304,316,316L STAINLESS STEEL
Type	GLOBE TYPE / EXTENDED BONNET
Application	Seat Material : PCTFE of Metal(ESD) Flow Characteristic : Linear of On/Off Position Indicator Type Thermal Barrier Vacuum Jacketed with M.L.I or Non Jacketed Suitable for Cold Box Outside Screw and Yoke Type Easy Maintenance Degreasing Full Penetration Weld(Available Radiographic Testing)
Size	1/2inch ~ 80 inch
Pressure	150LB ~ 2500LB
Specification	As per BS6364 Cold Box

GAS VALVE UNIT(GVU)

Section	Description
FUNCTION	Leak-age test before engine start. Suppling the gas by engine control system. Purging with nitrogen before maintenance service. Quick stop at the end of DF operation mode. Quick stop in case of an emergency mode.
TECHNICAL SUMMARY	GVU Type : Vertical, Horizontal, Enclosure, Open Pipe Connection : DN50 ~ DN100 Valve Type : Ball Valves, Axial Valves Design Pressure : 16 bar Media Temperature : -25 ~ 60℃ Ambient Temperature : 0 ~ 60℃ Ex Classification : ATEX, IECEx Compressed Air Pressure : 5 ~ 9bar Options : Flowmeter, Filter
FEATURES & BENEFITS - Valve BV(Ball Valve)	No Welding Design Easy Maintenance High Durability Quick Open/Close Low Operating Torque Low Pressure Loss
FEATURES & BENEFITS - Valve XV(Axial Valve)	Built-in Actuator Compact Design No Welding Design High Durability Quick Open/Close Low Operating Torque

2-3. Major Customer

NORTH AMERICA

NO.	NORTH AMERICA
1	FLUOR
2	THE LINDE GROUP
3	Conoco Phillips
4	Exon Mobil
5	Marathon Oil
6	Canadian Natural
7	CE FRANKLIN LTD.
8	Formosa Plastic
9	Husky
10	Valero
11	Suncor
12	Shell

2-3. Major Customer

MIDDLE EAST

NO.	MIDDLE EAST
1	Sipchem
2	KNPC
3	RasGas
4	Petrofac
5	Borouge
6	Dodsal
7	Sabic
8	Qatar Petroleum
9	ADNOC
10	Bapco
11	QATARGAS
12	NPCC
13	Saudi Aramco
14	Kuwait Oil Company

2-3. Major Customer

ASIA(Excluded Korea)

NO.	ASIA(Excluded Korea)
1	MAPRO
2	TOSHIBA
3	TOKYO GAS
4	Kawasaki
5	J GC
6	CHIYODA CORPORATION
7	MITUBISHI HEAVY INDUSTRIES
8	TOYO ENGINEERING
9	SINOPEC
10	CTCI
11	TCC
12	Ptt
13	PETRONAS
14	KBR
15	PETRAMINA

2-3. Major Customer

EUROPE & AFRICA

NO.	EUROPE & AFRICA
1	EIL
2	LARSEN & TOUBRO LIMITED
3	ONGC
4	MRC Global
5	ABB
6	Siemens AG
7	TECNICAS REUNIDAS
8	TOTAL
9	TechnipFMC

2-3. Major Customer

SOUTH KOREA

NO.	SOUTH KOREA
1	POSCO E&C
2	Hanwha
3	KOSEP
4	LOTTE E&C
5	KHNP
6	DOOSAN Enerbility
7	GS E&C
8	GS Caltex
9	DL E&C
10	SK ecoplant
11	SK energy
12	S-OIL
13	Hyundai Oilbank
14	DAEWOO E&C
15	SAMSUNG ENGINEERING

2-3. Major Customer

LNGC

SAMSUNG HEAVY INDUSTRIES

MARAN GAS MARITIME INC.

PAN OCEAN

Celsius

ARCTIC LNG 2

"K" LINE LNG SHIPPING (UK) LTD.

HYUNDAI HEAVY INDUSTRIES CO.,LTD.

H-LINE SHIPPING

J.P.Morgan

HYUNDAI SAMHO HEAVY INDUSTRIES CO.,LTD.

Knutsen OAS Shipping

SCF Safety Comes First

DSME

HSD engine

PK Valve & Engineering

2-4. Developed Items

NO.	ITEM	DATE	REMARKS
1	CRYOGENIC VALVE FOR LIQUEFIED H2	2022	
2	GVU(Gas Valve Unit)	2022	
3	Cryogenic Top-Entry Ball Valve	2022	
4	Swing Type NRV(Class 150#~900# / Size 10"~42")	2019	
5	900# 24" Cryogenic Ball Valve	2018	
6	2500# Blowdown Valve	2016	
7	High Pressure Forged steel GATE Valve(CL4500 Parallel slide type 20 inch)	2015	
8	Casting Steel GATE Valve(CL150 Parallel slide type 92 inch)	2014	
9	BLOWDOWN Valve (CBD CL1500 3 inch, IBD CL1500 4 inch)	2014	
10	AXIAL CHECK Valve	2014	
11	High Pressure Forged steel Y-GLOBE Valve(CL900 and CL1500, 2, 3 and 4 inch)	2013	
12	High Pressure Forged steel GATE Valve(CL900 and CL1500, 2, 3 and 4 inch)	2012	
13	Casting Steel GATE Valve(CL150 Wedge Type 88 inch)	2008	
14	Cryogenic Shut-off of Butterfly Valves of By-direction Metal Seat Construction for LN G Carrier	2007	
15	Design and Fabrication Technology Development of Co-free Swing Check Valves for High Pressure Service	2005	
16	Cryogenic Butterfly Valves	2004	
17	Triple Offset Metal Seat Butterfly Valves	2000	
18	Super Duplex Stainless Steel Valves	1999	
19	Double Piston Effect Type Ball Valves	1999	
20	Top Entry Ball Valves	1999	
21	Through Conduit Valves	1998	
22	Low Fugitive Emission Valves	1997	
23	Wafer Tilting Check Valves	1997	
24	Metal Seat Ball Valves	1997	
25	Tilting Check Valves	1997	
26	Bellows Valves	1997	

2-5. Patents

NO.	ITEM	DATE	REMARKS
1	Regeneration Method of waste casting and recycled casting manufactured therefrom	2023	
2	Swing check valve with anti-chattering function	2020	
3	High differential pressure regulating valve with pressure offset type flow path	2020	
4	High differential pressure control valve with pressure offset type cage	2020	
5	Butterfly valve with disc slip prevention structure	2018	
6	Globe valve with low flow control structure	2018	
7	Globe check valve for powder transfer	2014	
8	Overlay MIG welding device using Inconel 625 wire	2013	
9	Live-load seat-supported cryogenic butterfly valve	2007	









3. Capacity

3. Capacity

3-1. Certificate

Quality Certificate

UPDATE 2023.07.24

NO.		Certificate name		Validity
1		**API Q1 and specification 6D - Approved By API API** Scope : Gate, Ball, Check Valves License No : 6D-0037	**API**	2023.02.20 ~2026.02.20
2		**API Q1 and specification 600 - Approved By API API** Scope : Bolted Bonnet Steel Gate Valves License No : 600-0028	**API**	2023.02.20 ~2026.02.20
3		**ISO 9001:2015/KSA 9001 :2015 - Approved by BV** Scope : DESIGN/DEVELOPMENT, PRODUCTION AND SERVICING OF GATE, GLOBE, CHECK, BALL, PLUG & BUTTERFLY VALVE AND STEEL CASTING Certificate Number : KR002830	**BV**	2020.10.27 ~2023.10.28
4		**ISO 45001:2018 - Approved by BVQBV** Scope : DESIGN/DEVELOPMENT, PRODUCTION AND SERVICING OF GATE, GLOBE, CHECK, BALL, PLUG & BUTTERFLY VALVE AND STEEL CASTING Certificate Number : KR002857	**BV**	2020.11.16 ~2023.11.15
5		**CE-PED(2014/68/UE) : Module 'H' - Approved by BV** Scope : Cast steel Gate, Globe, Swing/Tiliting/Lift Check, BF v/v, Ball valve, Forging steel Ball valve, Cryogenic : Gate, Globe, Swing check, Butterfly & Ball valve Certificate Number :CE-0062-PED-H-PKV 002-20-KOR	**BV**	2020.08.30 ~ 2023.08.29
6		**KEPIC MN - Approved by Korea Electric Association** Scope : Construction of Class 1,2,3 line valve and parts & appurtenance Material organization manufacturing casting Material organization supplying ferrous, nonferrous, and welding materials Certificate Number : MN-085	**KEA**	2022.12.31 ~ 2025.12.30

3. Capacity

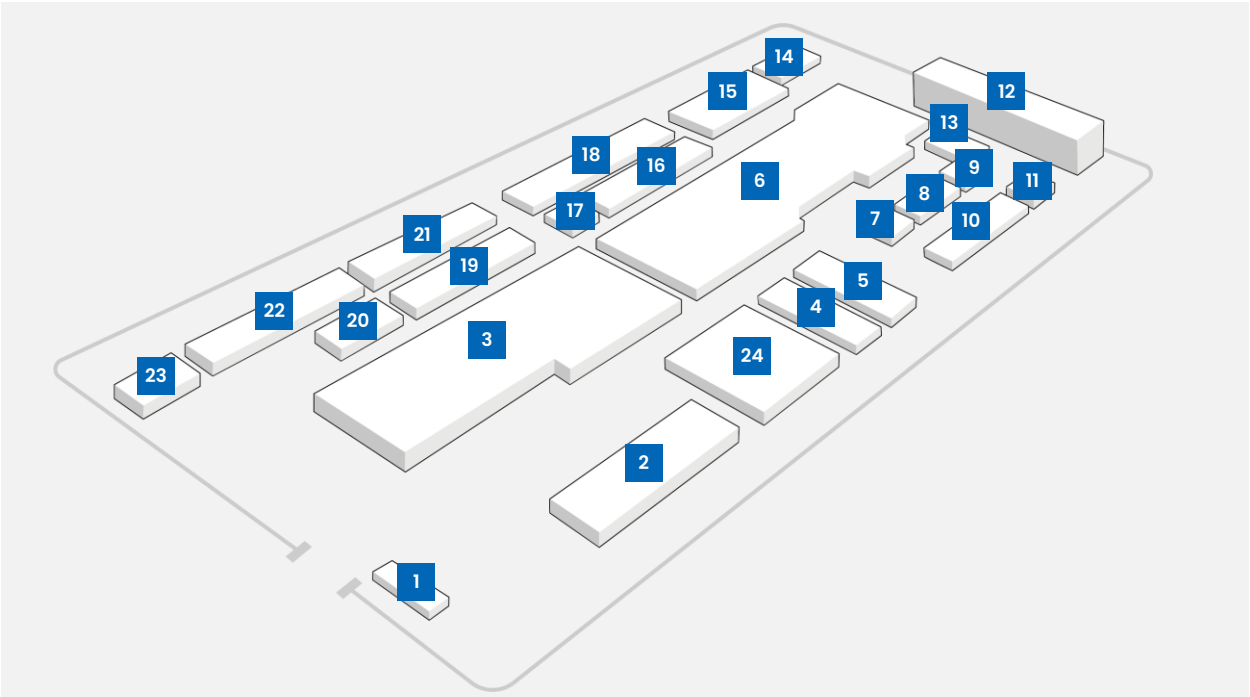
3-1. Certificate

Quality Certificate

UPDATE 2023.07.24

NO.		Certificate name		Validity
7		**ASME N** Scope : Construction of Class 1, 2 & 3 valves. Certificate Number : N-4797	**ASME**	2021.06.18 ~ 2024.06.18
8		**ASME NPT** Scope : Class 1, 2 & 3 fabrication without design responsibility and fabrication with design responsibility for Class 1,2 & 3 appurtenances and as a material organization manufacturing and supplying ferrous & nonferrous material. Certificate Number : N-3361	**ASME**	2021.06.18 ~ 2024.06.18
9		**SIL Level 2** Scope : GATE 150, 300, 600, 900, 1500 and 2500 : FS/71/220/14/066 GLOBE 150, 300, 600, 900, 1500 and 2500 : FS/71/220/14/068 BALL 150, 300, 600 and 900 : FS/71/220/14/071 BUTTERFLY 150 and 300 : FS/71/220/14/069	**SGS-TUV**	2014.12.05 ~
10		**TR-CU** GATE : CGT, PGT, BGT, GTV, SGT, PSG, TCG, KGV, MOV, AOV, GOV, HOV GLOBE : CGL, PGL, PYG, PAG, BGL, GLV, YGL, AGL, SGL, MOV, AOV, GOV, HOV CHECK : CCH, PCH, PTC, CHV, TCH, NRV, LCH BALL : FBA, MOV, AOV, GOV, HOV BUTTERFLY : CBF, TOB, DOB, MOV, AOV, GOV, HOV Certificate No. : RU C-KR.MI-062.B.01792		2020.05.30 ~ 2025.05.29
11		**AEO - Authorized Economic Operator(AEO) Certificate** Type of business : Exporter, Importer AEO LEVEL : A	**Commissioner, KCS**	2023.04.30 ~ 2028.04.29
12		**World Class Company** PK VALVE&ENGINNERING is selected as one of the companies supported by world class plus project for its outstanding commitment and growth potential as to become a globally leading enterprise.	**Minister of Trade Industry and Energy**	2023. 07. 20.

3-2. Facility



NO.	Facility name
1	Entrance, Lounge
2	Main Office
3	Machinery Shop, Test Shop, Auditorium 18 Painting Shop
4	Cryogenic Teat Shop
5	Machinery Shop
6	Foundry Shop, Molding Shop, Heat Treatment Furnace, Test Shop
7	Foundry Office
8	Material R&D center 23 Office
9	Laboratory
10	Pattern Shop
11	Facility Maintenance Office
12	Foundry Shop 2

NO.	Facility name
13	Lounge
14	Pattern Warehouse
15	Painting Shop
16	Painting Shop
17	Painting Shop
18	Painting Shop
19	Witness Inspection Shop
20	R&D Center
21	Packaging Shop
22	Production Warehouse
23	Office
24	Cryogenic Valve Shop NEW

3-3. Production Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
CASTING	Furnace	3 ton	2 EA	
		1 ton	2 EA	
		350 kg	1 EA	
		5 kg	1 EA	
	VRH Molding Line	-	1 Line	
	Heat Treatment Furnace	30 ton	1 EA	
		10 ton	2 EA	
		4 ton	2 EA	
	Molding Machine	-	7 EA	
	Mixer	-	4 EA	
	Shot Blast Machine	-	11 EA	
	Gear Laddle	05Ton ~6Ton	1 2EA	
	Welding Rod Dryer	500kg~1000kg	6 EA	
	band saw		5 EA	
	Boring Machine(CNC)	-	7 EA	
MACHINING	Milling Machine : 12	500-1500kgf.cm	4 EA	
	Lathe(Horizontal)	-	28 EA	
	Lathe(Vertical)	-	0 EA	
	Planar	-	1 EA	
	Slotter	-	1 EA	
	Shaper	-	1 EA	
	Drilling Machine : Bench type	-	8 EA	
	Drilling Machine : Radial type	-	12 EA	
	Welding Machine : Mig,	-	19 EA	
	Welding Machine : Tig,		28 EA	
	Welding Machine : Arc		26 EA	
	Welding Machine : Gauging	-	8 EA	
	Welding Machine : Spot	-	3 EA	
	Welding Machine : Plsma		3 EA	
	Lapping Machine	-	4 EA	
	Automatic Painting System	-	3 Line	
	Paint Booth		3 EA	
	Air Less		3 EA	
	Hydraulic TorqueWrench	-	6 EA	
	High Pressure Gas Compressor	초저온 관련	6 EA	

3. Capacity

3-3. Production Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
MACHINING	BFV fabrication bed	S,M,L	2 EA	
	BFV hydraulic actuator		5 EA	
	Spot Facing Machine	-	6 EA	
	Automatic Washing Device		2 EA	
	Welding Turn Table	300kg~1000kg	6 EA	
	Screw Compressor	50HP~215HP	9 EA	
	GVU Test Equipment		1 EA	
	V/V function test machine	24" 이하	1 EA	
LIFTING EQUIPMENT	CRANE & HOIST	1TON	73 EA	
		2TON	25 EA	
		2.8TON	21 EA	
		3TON	36 EA	
		5TON	33 EA	
		10TON	20 EA	
		30TON	6 EA	
DUST COLLECTOR		Bag filter	31 EA	
		AC Tower	10 EA	
		Local Exhaust Ventilation	6 EA	
		Portable Bag filter	22 EA	
		Cyclone Dust Collector	9 EA	
HAULAGE EQUIPMENT	Folk-lift	2.5ton (electric)	31 EA	
		3.5ton (engine)	1 EA	
		scissor lift	1 EA	

3-4. Test and Inspection Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
CHEMICAL ANALYSIS	Spectrometer (ARL 3460)	Lab. Equip.	1 EA	SS/Alloy/ Duplex etc.
	X-met 3000,5000,7000 series (Oxford)	Protable	3 EA	SS/Alloy etc
	PMI Master pro (Oxford)	Protable	1 EA	SS/Alloy etc
IMPACT TEST	SHARPY IMPACT TESTER	0-30kgf.m	1 EA	Calibrated by NIST
VOLT/ AMPER	DIGITAL CLAMP TESTER	1000V/1000A	1 EA	
	CLAMP TESTER	600V/2000A	1 EA	
	AMPER METER	600A, etc	51 EA	
	VOLT METER	150V, etc	51 EA	
LENGTH (LENGTH/ DEPTH/ THICKNESS)	DIAL GAUGE	0.01-10mm	10 EA	
	THICKNESS GAUGE	0.1-80mm	2 EA	
	GAUGE BLOCK	32BON	1 EA	
	HEIGHT GAUGE	0-300mm	3 EA	
	HEIGHT GAUGE	0-600mm	2 EA	
	HEIGHT GAUGE	0-1000mm	1 EA	
	HEIGHT GAUGE(DIGITAL)	0-300mm	1 EA	
	HEIGHT GAUGE(DIGITAL)	0-600mm	2 EA	
	INSIDE MICROMETER	0-500mm	2 EA	
	INSIDE MICROMETER	50-1500mm	1 EA	
	OUTSIDE MICROMETER	0-150mm	1 EA	
	OUTSIDE MICROMETER	150-300mm	1 EA	
	OUTSIDE MICROMETER	300-400mm	1 EA	
	OUTSIDE MICROMETER	400-500mm	1 EA	
	OUTSIDE MICROMETER	500-600mm	1 EA	
	OUTSIDE MICROMETER	1000-1200mm	1 EA	
	VERNIER CALIPERS	0-150mm	3 EA	
	VERNIER CALIPERS(DIGITAL)	0-150mm	2 EA	
	VERNIER CALIPERS	0-200mm	10 EA	
	VERNIER CALIPERS(DIGITAL)	0-200mm	8 EA	
	VERNIER CALIPERS (Depth)	0-200mm	1 EA	
	VERNIER CALIPERS (DIGITAL) Depth	0-200mm	1 EA	
	VERNIER CALIPERS	0-300mm	54 EA	
	VERNIER CALIPERS(DIGITAL)	0-300mm	10 EA	
	VERNIER CALIPERS(DIGITAL) Depth	0-300mm	1 EA	

3-4. Test and Inspection Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
CHEMICAL ANALYSIS	Spectrometer (ARL 3460)	Lab. Equip.	1 EA	SS/Alloy/ Duplex etc.
	X-met 3000,5000,7000 series (Oxford)	Protable	3 EA	SS/Alloy etc
	PMI Master pro (Oxford)	Protable	1 EA	SS/Alloy etc
IMPACT TEST	SHARPY IMPACT TESTER	0-30kgf.m	1 EA	Calibrated by NIST
VOLT/ AMPER	DIGITAL CLAMP TESTER	1000V/1000A	1 EA	
	CLAMP TESTER	600V/2000A	1 EA	
	AMPER METER	600A, etc	51 EA	
	VOLT METER	150V, etc	51 EA	
LENGTH (LENGTH/ DEPTH/ THICKNESS)	DIAL GAUGE	0.01-10mm	10 EA	
	THICKNESS GAUGE	0.1-80mm	2 EA	
	GAUGE BLOCK	32BON	1 EA	
	HEIGHT GAUGE	0-300mm	3 EA	
	HEIGHT GAUGE	0-600mm	2 EA	
	HEIGHT GAUGE	0-1000mm	1 EA	
	HEIGHT GAUGE(DIGITAL)	0-300mm	1 EA	
	HEIGHT GAUGE(DIGITAL)	0-600mm	2 EA	
	INSIDE MICROMETER	0-500mm	2 EA	
	INSIDE MICROMETER	50-1500mm	1 EA	
	OUTSIDE MICROMETER	0-150mm	1 EA	
	OUTSIDE MICROMETER	150-300mm	1 EA	
	OUTSIDE MICROMETER	300-400mm	1 EA	
	OUTSIDE MICROMETER	400-500mm	1 EA	
	OUTSIDE MICROMETER	500-600mm	1 EA	
	OUTSIDE MICROMETER	1000-1200mm	1 EA	
	VERNIER CALIPERS	0-150mm	3 EA	
	VERNIER CALIPERS(DIGITAL)	0-150mm	2 EA	
	VERNIER CALIPERS	0-200mm	10 EA	
	VERNIER CALIPERS(DIGITAL)	0-200mm	8 EA	
	VERNIER CALIPERS (Depth)	0-200mm	1 EA	
	VERNIER CALIPERS (DIGITAL) Depth	0-200mm	1 EA	
	VERNIER CALIPERS	0-300mm	54 EA	
	VERNIER CALIPERS(DIGITAL)	0-300mm	10 EA	
	VERNIER CALIPERS(DIGITAL) Depth	0-300mm	1 EA	

3-4. Test and Inspection Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
LENGTH (LENGTH/ DEPTH/ THICKNESS)	VERNIER CALIPERS (Depth)	0-300mm	1 EA	
	VERNIER CALIPERS	0-600mm	24 EA	
	VERNIER CALIPERS(DIGITAL)	0-600mm	1 EA	
	VERNIER CALIPERS (Depth)	0-600mm	1 EA	
	VERNIER CALIPERS	0-1000mm	8 EA	
	VERNIER CALIPERS	0-1500mm	4 EA	
	VERNIER CALIPERS(DIAL)	0 -600mm	1 EA	
HARDNESS	Brinell Hardness	0 ~ 450 HB	2 EA	
	Micro-Vickers / Vickers Hardness	0.01~1/1~50 kgf	2 EA	
	Portable Hardness	HB/HL	2 EA	
FLOW LATE	ROTA METER	0-100cc/min	1 EA	
	ROTA METER	0 ~ 250 cc/min	3 EA	
ANGLE	BEVEL PROTRECTOR	0-90'	1 EA	
	COMBINETION SQURE	0-180'	1 EA	
FORCE/ TORQUE	TENSION TESTER	0-50TON	1 EA	
	TORQUE WRENCH	0-9.8 N-m	1 EA	
	TORQUE WRENCH	0-19 N-m	1 EA	
	TORQUE WRENCH	5-25 N-m	1 EA	
	TORQUE WRENCH	0-49 N-m	1 EA	
	TORQUE WRENCH	0-98 N-m	1 EA	
	TORQUE WRENCH	30-140 N-m	5 EA	
	TORQUE WRENCH	0-196 N-m	1 EA	
	TORQUE WRENCH	0-210 N-m	2 EA	
	TORQUE WRENCH	0-353 N-m	1 EA	
	TORQUE WRENCH	40-280 N-m	2 EA	
	TORQUE WRENCH	60-420 N-m	2 EA	
	TORQUE WRENCH	10-500 N-m	2 EA	
	TORQUE WRENCH	100-750 N-m	1 EA	
	TORQUE WRENCH	100-850 N-m	1 EA	
	TORQUE WRENCH	100-1000 N-m	1 EA	
	TORQUE WRENCH	20-140 Kg-m	1 EA	
	TORQUE WRENCH	200-1000 Kg-m	1 EA	

3-4. Test and Inspection Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
TEMPERATURE	HIGRO-THERMOMETER	50℃	1 EA	
	DIGITAL THERMOMETER	-200 - 1600℃	2 EA	
	TEMPERATURE RECORD	0 - 1600℃	4 EA	
	OPTICAL TEMPERATURE	800 - 1800℃	3 EA	
	THERMO METER	600 - 1200℃	8 EA	
	TEMPERATURE CONTROL INDICATOR	0 - 200℃	1 EA	
	TEMPERATURE CONTROL INDICATOR	0 - 400℃	3 EA	
	TEMPERATURE CONTROL INDICATOR	0 - 600℃	2 EA	
	TEMPERATURE CONTROL INDICATOR	0 - 1700℃	1 EA	
	THERMO COUPLE (K TYPE)	0 - 600℃	5 EA	
	THERMO COUPLE (K TYPE)	0 - 1200℃	6 EA	
	THERMO COUPLE (K TYPE)	600 - 1200℃	10 EA	
	THERMO COUPLE (R TYPE)	600 - 1200℃	13 EA	
PRESSURE	DEAD WEIGHT TESTER	5 - 500kgf/㎠	1 set	
	PRESSURE GAUGE	0 -76CmHg	1 EA	
	PRESSURE GAUGE	0 - 10kgf/㎠	4 EA	
	PRESSURE GAUGE	0 - 15kgf/㎠	15 EA	
	PRESSURE GAUGE	0 - 25kgf/㎠	8 EA	
	PRESSURE GAUGE	0 - 50kgf/㎠	19 EA	
	PRESSURE GAUGE	0 - 100kgf/㎠	9 EA	
	PRESSURE GAUGE	0 - 150kgf/㎠	19 EA	
	PRESSURE GAUGE	0 - 250kgf/㎠	22 EA	
	PRESSURE GAUGE	0 - 500kgf/㎠	15 EA	
	PRESSURE GAUGE	0 - 1000kgf/㎠	11 EA	
LENGTH	Venire Calipers	0 ~ 1500 mm	130 EA	
	Micrometer	0 ~ 1500 mm	8 EA	
	Height Gauge	0 ~ 600 mm	10 EA	
	Wall Thickness Dial Gauge	0 ~ 150 mm	4 EA	
	Wall Thickness Gauge (Digital)	0 ~ 200 mm	2 EA	
NDT Inspection Equipment	RT Source	Ir-192	5 EA	
		Co-60	2 EA	
	Ultrasonic Examination	-	2 EA	
	Magnetic Particle Examination	Yoke	4 EA	
		Probe	1 EA	
	Liquid Penetrant Examination	Spray type	-	

3-4. Test and Inspection Equipment

UPDATE Mar 31, 2023

DIVISION	DESCRIPTION	RANGE	Q'TY(EA)	REMARKS
Hydro test	Hydro pressure tester	2000 Ton	2ea	Pressure limitation: Up to 1,180 Bar
	Hydro pressure tester	1500 Ton	1ea	
	Hydro pressure tester	1000 Ton	1ea	
	Hydro pressure tester	800 Ton	2ea	
	Hydro pressure tester	400 Ton	1ea	
	Hydro pressure tester	250 Ton	8ea	
	Hydro pressure tester	50 Ton	4ea	
High pressure Gas Test	High pressure Gas pressure tester	Max. 700Bar	2ea	
	High pressure Gas pressure tester	Max. 700Bar	2ea	
Cryogenic test	Cryogenic testbed	-	13ea	
	Helium detector	-	2ea	
	Inspection monitoring system	-	3ea	
	Digital Flow Meter	-	13ea	

3-5. Cryogenic Test Facilities

Ambient (Hydro) Testing Facility

	UNIT 1	REMARKS
Equipment	TEST BED : 8EA	
	Crane : 3ea (5 Ton : 1EA, 10 Ton : 2EA)	
	NPS 2 to NPS 54	
Operator	10 person	Foreman : 1 person
Capability per day	80 ~100EA	

Cryogenic Testing Facility

	UNIT 1			REMARKS
Equipment	TEST BED : 5EA	TEST BED : 3EA	TEST BED : 6EA	
	NPS 18 to NPS 54	NPS 2 to NPS 10	NPS 12 to NPS 16	
	He Dectector : 3EA Digital Flow meter, Monitoring Equipment : 10EA Cryogenic Test Data Recording System : 4EA			
Operator	3 person	3 person	4 person	Foreman : 1 person
Capability per day(Max.)	5 EA	6 EA	12 EA	Total: 23 EA / day

3-5. Cryogenic Test Facilities

3-5. Cryogenic Test Facilities

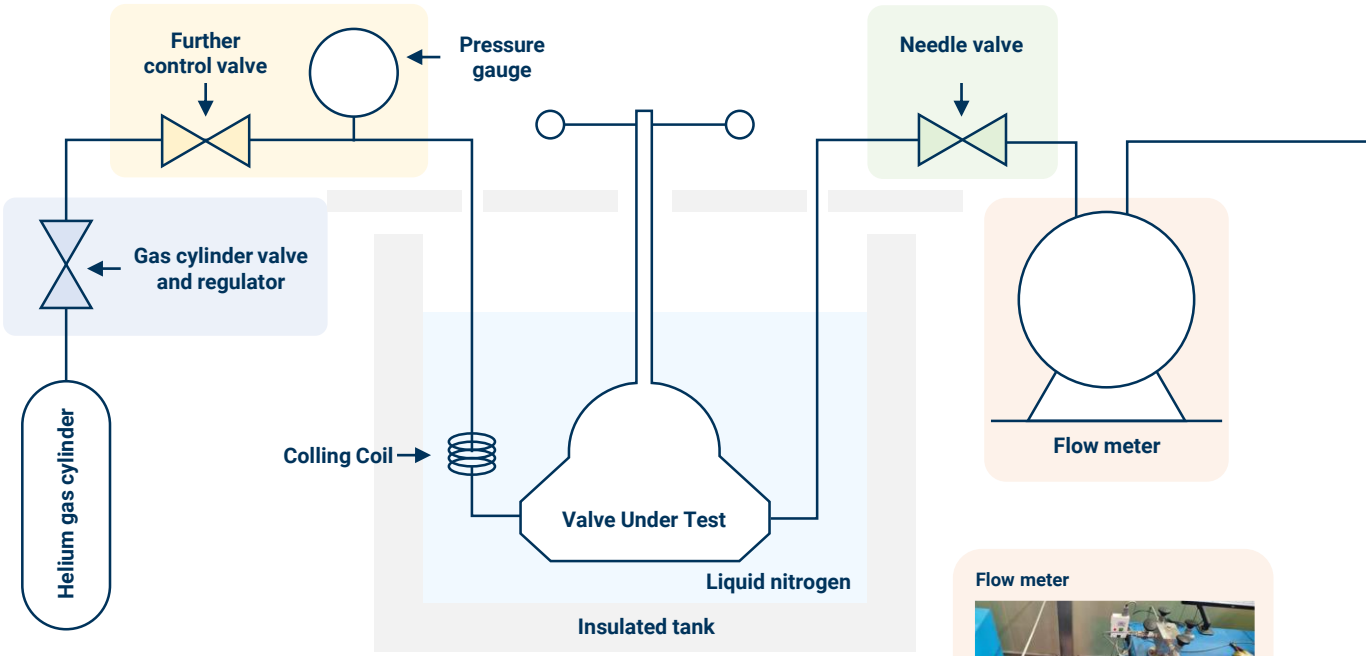
3-5. Cryogenic Test Facilities

Fig 1. Test apparatus diagram

Entire equipment picture

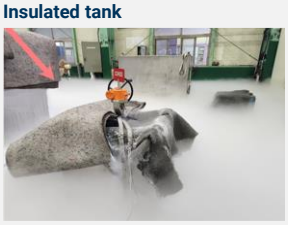
Further control valve
Pressure gauge

Needle valve



Gas cylinder valve and regulator

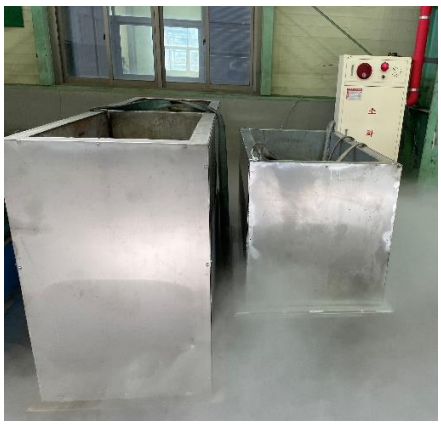
Insulated tank



Flow meter

3-5. Cryogenic Test Facilities

Insulation Tank (Test Box)



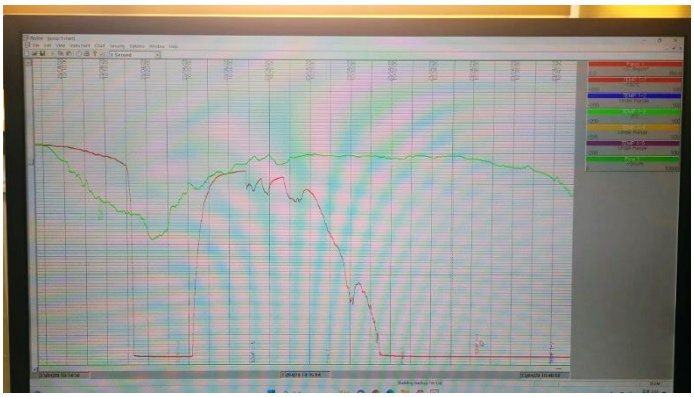
Cryogenic Insulation Tank (22 EA)

NO.	DEMENSION	Q'TY
1	450*300*450	1EA
2	730*500*620	1EA
3	730*730*860	1EA
4	830*830*1100	1EA
5	840*490*800	1EA
6	950*490*800	1EA
7	1040*640*1300	1EA
8	1100*600*730	1EA
9	1140*1000*1000	1EA
10	1140*640*1300	1EA
11	1180*700*1350	1EA
12	1250*700*1350	1EA

NO.	DEMENSION	Q'TY
13	1380*1440*1230	1EA
14	1400*1400*1420	1EA
15	1450*300*500	1EA
16	1800*1600*1530	1EA
17	2090*600*1050	2EA
18	2100*320*610	1EA
19	2200*1300*2250	1EA
20	2620*1980*1620	1EA
21	3090*2080*3000	1EA

3-5. Cryogenic Test Facilities

Monitoring Equipment System



NO.	MONITORING EQUIPMENT	Q'TY
1	Data Recording System	4 EA
2	Monitor	10 EA

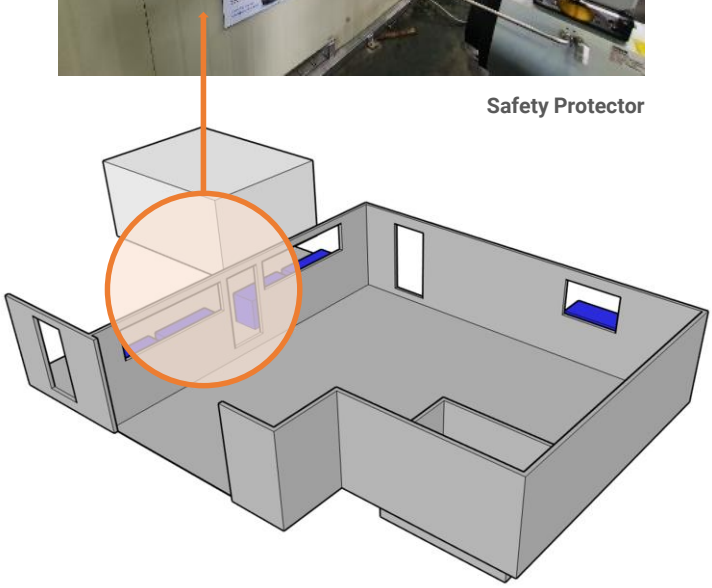
3-5. Cryogenic Test Facilities

Remote Inspection Facility

NO.	REMOTE INSPECTION	Q'TY
1	Monitor	2 EA
2	Camera	3 EA

Safety Protector & PPE (Personal Protective Equipments)

Safety Protector



PPE (Personal Protective Equipment)

3-5. Cryogenic Test Facilities

ETC.

Liquid Nitrogen Tank

Test Zig

NO.	FACILITY		Q'TY
1	Liquid Nitrogen Tank	19 Ton	1EA
2	Test Zig		200 SET

3-5. Cryogenic Test Facilities

Production Range of Cryogenic Service Valve

MAXIMUM SIZE OF SUPPLY RECORDS					
CLASS	BUTTERFLY VALVE	GATE VALVE	GLOBE VALVE	SWING CHECK VALVE	BALL VALVE
150	48”	56”	14”	24”	40”
300	16”	48”	14”	20”	28”
600		30”	30”	8”	10”
900		20”	8”	12”	24”
1500		20”	8”	12”	24”

4. Engineering

4-1. Engineering

HOW TO DESIGN

PKVALVE & ENGINEERING considers the following when designing.

1. Safety and Compliance:

We strictly comply with relevant laws and standards. This means making sure your project is legally acceptable and safe.

2. Customer's requirements:

Meeting the customer's requirements is the heart of the project. You must understand and reflect the needs and expectations of your customers.

3. Technical elements:

The technical aspects of the design are key. You must consider the technical factors necessary to achieve the project's objectives.

4. Environmental protection:

Measures to minimize the impact on the environment should be considered. Sustainable design must be adopted to conserve resources and minimize environmental pollution.

5. Maintainability:

You must be able to effectively maintain and upgrade the system or product for which it is designed. Long-term sustainability must be considered.

6. Quality control:

Quality control procedures and quality standards must be followed to ensure the highest quality output.

7. Project Schedule:

Design work must be planned to meet project schedules and complete on time.

8. Risk Management:

You need to identify the risks of your project and develop a management plan to be prepared to deal with unexpected problems.

9. Collaboration and Communication:

Seamless collaboration between design teams and effective communication with stakeholders must be maintained.

10. Local conditions:

Local conditions in which the project will take place must be taken into account. Design adjustments must be made taking into account factors such as geography, climate, and geology.

These factors are important considerations to ensure project success, and their importance may vary depending on the complexity and nature of the project. Therefore, it is important to prioritize and align importance to the specific needs and goals of the project.

4-1. Engineering

PK VALVE & ENGINEERING's own test facility for function qualification.

Product Verification Method

PK VALVE & ENGINEERING has own test facility for functional qualification.

- Pressure surge measurement
- Flow interruption & functional capability demonstration test
- End loading test
- Cold cycle test
- Flow coefficient measurement

QME-1 TEST for Motor Operated Valve in Nuclear Power Plant

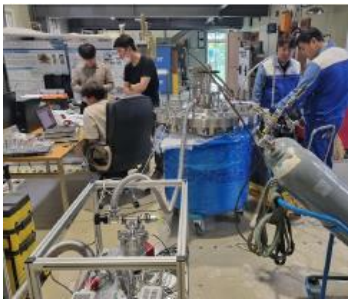
Qualification tests for Motor Operated Valves have been performed at Wyle Laboratories, US and Framatome, Germany

- Fundamental frequency test
- Seismic test
- Flow interruption & functional capability demonstration test
- Cold & hot cycle test
- End loading test

4-1. Engineering

Observation Port Demonstration

Gas Valve Unit Cycling Test



R&D CENTER staff are conducting a valve leakage test under - 253 ℃.

Demonstration

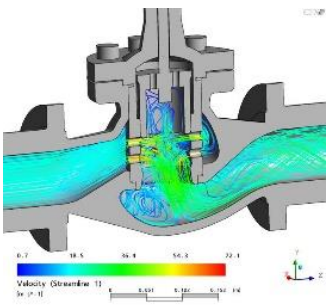
Demonstration is carried out according to the various requirements of the customer. By conducting demonstrations under conditions similar to the actual usage environment, highly reliable products can be provided to customers, and demonstration result reports and digital data are provided to customers.

PK VALVE & ENGINEERING is starting a performance verification demonstration business for products that are not regulated by codes and standards. By applying data sensing technology and data collection technology to design and manufacture new products, we are accumulating technologies that can accurately reflect customer requirements by implementing actual use environments.

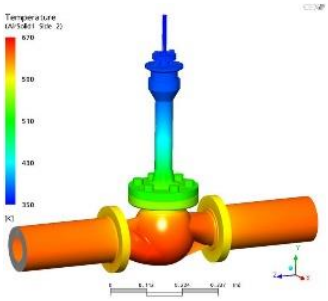
- Observation port demonstration test used in Duct Burner under 834 ℃ condition
- Gas Valve Unit cycling test, cycling 10,000 times
- Valve test for liquid hydrogen for emergency shut-off at -253 ℃

4-1. Engineering

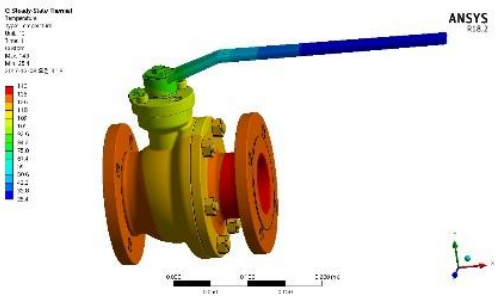
SECTION	APPLICATION
CAD System	**AUTO CAD 2022** **AUTODESK INVENTER SUITE 2022** PK VALVE & ENGINEERING are designed by CAD system (AUTO CAD 2022) and AUTODESK INVENTER is exclusively used 3D drawing Drawings for NSSS (Nuclear Steam Supply System) are preparing by AUTODESK INVENTER
Analysis Program ANSYS 2022 R2	**Design Analysis Capabilities with ANSYS program** - Structural Analysis - Structural Nonlinearity - Material Model - Thermal Analysis - Flow Analysis - Interaction analysis (fluid-structure analysis) - Pre processing / Post processing - CFX for CFD (Computational Fluid Dynamic) analysis
WLA	**Weak Link Analysis** for Motor Operated Valves
Functional Qualification Test	The **Functional Qualification Test** for active valves has been performed in accordance with the requirements of ASME QME-1 at the Wyle Laboratory in the U.S.A
Pressure	800LB ~ 4500LB



Fluid flow analysis



Cryogenic valve heat transfer analysis



Structural Stress Analysis

4-2. NDE Personnel Certification

Korea Testing Engineering Co., Ltd

UPDATE Mar 31, 2023

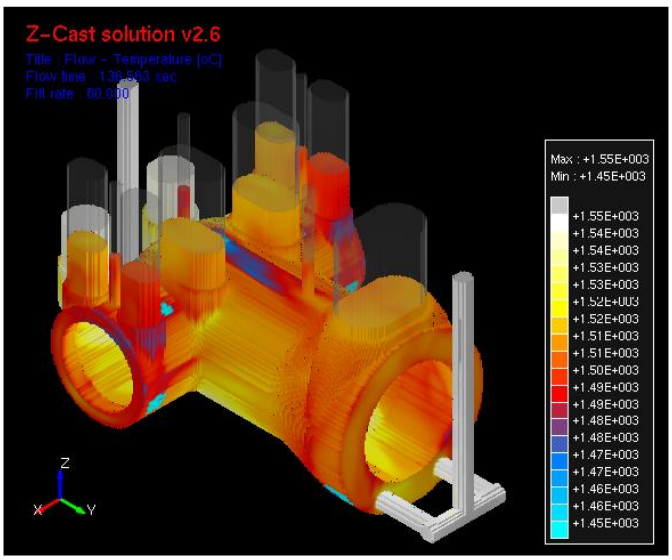
NO.	NAME	CERT' No.	CERTIFICATION METHOD				ISSUE DATE	EXPIRY DATE	REMARK
1	KIM YOON KIN	KTE-Q- LIII-0001	RT(III)	MT(III)	PT(III)	UT(III)	2021. 03.10	2026.03.09	KTE
		185472	RT(III)	MT(III)		UT(III)	2020.07.13	2025.07.12	ASNT
2	BAE DAEJONG	KTE-Q- LIII-0492	RT(III)	MT(III)	PT(III)	UT(III)	2022. 08.12	2028.08.11	KTE
		98910/2	RI				2019. 12.23	2024.12.26	TWI
3	KIM MIN SIK	KTE-Q-LII- 0493	RT(II)	MT(II)	PT(II)	UT(II)	2020. 09.03	2023.09.03	KTE
4	CHOI YONG JIN	KTE-Q-LII- 0535	RT(II)	MT(II)	PT(II)		2021. 01.21	2024.01.20	KTE
5	NAM HAE SONG	KTE-Q-LII- 0516	RT(II)	MT(II)	PT(II)		2021. 01.21	2024.01.20	KTE
6	SEO YOUN GIL	KTE-Q-LII- 0500	RT(II)	MT(II)	PT(II)		2021. 02.01	2024.02.02	KTE
7	BANG CHANG HUN	KTE-Q-LII- 0668	MT(II)	PT(II)			2023. 01.01	2028.01.05	KTE
8	KANG WOO SEOK	KTE-Q-LII- 0472	RT(II)	MT(II)	PT(II)	LT(II)	2020. 05.25	2023.05.23	KTE
9	KIM NAM HOONI	KTE-Q-LII- 0101	RT(II)	MT(II)	PT(II)	UT(II)	2022. 05.25	2027.05.24	KTE

4-3. Casting Simulation

Z-CAST: Casting Process Simulation System

UPDATE Mar 31, 2023

PROCESS	DESCRIPTION
Pre Processing (Data Input)	a) 3D Modeling: AUTO CAD INVENTER SUITE 2009 b) Casting Design Modeling: AUTO CAD INVENTER SUITE 2009 c) CAD Data Interface: STL, IGES File d) CELL Cutting: MESH Creation
Analysis	**a) Flow Analysis** - Unsteady analysis considering incompressible viscous fluid and inertia Force. - Using the continuity equation, equation of emotion and energy equation. - Using SOLA VOF Method **b) Solidification Analysis** - 3D unsteady thermal conductivity analysis and solidification analysis - Using finite-difference method (FDM) and temperature recovery method (Latent heat) - Utilization the result of flow analysis as basic factor for solidification anAlysis
Post Processing (Data Output)	a) Saving as Movie (AVI) b) Filling time distribution, heat flow temperature distribution, speed vector, pressure distribution, checking the solidification fraction during flow c) Solidification time distribution, temperature distribution, criterion function d) Check shrinkage



Solidification analysis

5. Reference

5. Reference

5-1. LNG

LNG Carrier

UPDATE Aug 31, 2023

NO.	AREA	OWNER/CLIENT	PROJECT NAME	TYPE OF VESSEL	VESSEL QTY	SHIP YARD	CLASS	ENGINE	TANK	ACTUATOR MAKERAREA
1	CHINA	CMES	DSIC 175K LNGC G175K-1	LNGC	4	DSIC	LR+CCS			EMERSON
2	CHINA	CNOOC / MOL	H1880A SERIES 174K LNGC	LNGC	6	HZS	ABS+CCS	X-DF	NO96	KSB
3	CHINA	COSCO SHIPPING CO., LTD. / K-LINE	H1892A SERIES 174K LNGC	LNGC	2	HZS	ABS+CCS	X-DF	NO96	KSB
4	CHINA	COSCO SHIPPING CO., LTD. / MOL	H1831A SERIES 174K LNGC	LNGC	6	HZS	ABS+CCS	X-DF	NO96	KSB
5	CHINA	CSSC SHIPPING CO., LTD. / MOL	H1827A SERIES 174K LNGC	LNGC	2	HZS	LR+CCS	X-DF	NO96	KSB
6	DENMARK	CELSIUS SHIPPING	2459 SERIES 180K LNGC	LNGC	8	SHI	LR	X-DF	MKIII	KSB
7	GREECE	ALPHAGAS	#8105 SERIES 174K LNGC	LNGC	3	HSHI	DNV	X-DF	MKIII	EMERSON
8	GREECE	MARANGAS	SN2425 SERIES 174K LNGC	LNGC	3	SHI	BV	X-DF	MKIII	KSB
9	GREECE	MARANGAS	2528 SERIES 174K LNGC	LNGC	11	DSME	ABS	ME-GI	NO96	KSB
10	GREECE	TMS CARDIFF GAS	2635 SERIES 174K LNGC	LNGC	2	SHI	ABS	ME-GA	MKIII	SCANA
11	JAPAN	MOL	QATAR GAS 1790 SERIES 174K LNGC	LNGC	4	HZS	ABS+CCS	X-DF	NO96	KSB
12	JAPAN	NYK	2580 SERIES 174K LNGC	LNGC	4	SHI	DNV	X-DF	MKIII	EMERSON
13	JAPAN	NYK / C-LNG	QATAR GAS 1797 SERIES 174K LNGC	LNGC	2	HZS	ABS+CCS	X-DF	NO96	KSB
14	KOREA	H-LINE SHIPPING CO., LTD.	#8025 SERIES H-LINE SHPPING 174K LNGC	LNGC	4	HSHI	ABS	X-DF	MKIII	EMERSON
15	KOREA	H-LINE SHIPPING CO., LTD.	EXXONMOBIL 2607 SERIES 174K LNGC	LNGC	4	SHI	LR+KR	ME-GA	MKIII	EMERSON
16	KOREA	HYUNDAI GLOVIS	8170 HYUNDAI GLOVIS 174K LNGC	LNGC	1	HSHI	DNV-KR	X-DF	MKIII	EMERSON
17	KOREA	HYUNDAI LNG SHIPPING	H2521 SERIES HYUNDAI LNG 174K LNGC	LNGC	2	DSME	KR	ME-GI	NO96	KSB
18	KOREA	HYUNDAI LNG SHIPPING	#2451 SERIES HYUNDAI 174K LNG CARRIER	LNGC	2	DSME	KR	ME-GI	NO96	EMERSON
19	KOREA	KC(H-LINE, SK, PAN OCEAN)	QATAR GAS 2546 SERIES 174K LNGC	LNGC	11	DSME	BV-KR	ME-GA	NO96	TBD
20	KOREA	KC(H-LINE, SK, PAN OCEAN)	QATAR GAS 2611 SERIES 174K LNGC	LNGC	4	SHI	ABS	ME-GA	MKIII	KSB
21	KOREA	KOREA SM LINE	SN2233 SERIES KOGAS 7.5K LNGC	LNGC	2	SHI	KR			EMERSON
22	KOREA	KOREA SM LINE	#3185 SERIES KSL 174K LNGC(SHELL)	LNGC	4	HHI	KR	X-DF	MKIII	EMERSON
23	KOREA	PAN OCEAN	#3221 SERIES PAN OCEAN 174K LNGC(SHELL)	LNGC	4	HHI	DNV-KR	X-DF	MKIII	EMERSON
24	KOREA	PAN OCEAN	SN2426 PANOCEAN 174K LNGC	LNGC	1	SHI	ABS	X-DF	MKIII	KSB
25	MALAYSIA	MISC	SN2364 SERIES MISC 174K LNGC	LNGC	2	SHI	ABS	X-DF	MKIII	KSB
26	NORWAY	KNUTSEN	#8091 SERIES KNUTSEN 174K LNGC(SHELL)	LNGC	9	HSHI	LR	X-DF	MKIII	EMERSON
27	RUSSIA	SOVCOMFLOT	#8006 SERIES SOVCOMFLOT 174K LNGC	LNGC	3	HSHI	BV	X-DF	MKIII	EMERSON
28	RUSSIA	SOVCOMFLOT	SN2366 SERIES ARCTIC LNG-2 ICEBREAKING LNGC	ICEBREAKING LNGC	15	SHI	BV	X-DF	MKIII	ROTORK/ PLEIGER
29	TURKEY	Pardus Energy Limited(BOTAS)	#2945 Pardus Energy Limited 170K FSRU	FSRU	1	HHI	BV	DFDE	MKIII	EMERSON
30	UK	JP MORGAN	#3187 SERIES JP MORGAN 174K LNGC(SHELL)	LNGC	1	HHI	DNV	X-DF	MKIII	EMERSON
31	UK	JP MORGAN	SN2592 SERIES 174K LNGC	LNGC	6	SHI	ABS	ME-GA	MKIII	SCANA
32	UK	JP MORGAN	2596 SERIES QATAR GAS 174K LNGC	LNGC	14	SHI	ABS	ME-GA	MKIII	SCANA

5-2. Refinery

Refinery

UPDATE Aug 31, 2023

NO.	AREA	OWNER/CLIENT	EPC CONTRACTOR	PROJECT NAME
1	CANADA	PETRO-CANADA	Kellogg, Brown & Root (Canada) Company	PETRO-CANADA/SULPHUR-in-GASOLINE
2	CANADA	BP	FLUOR CORPORATION	CENOVUS CHRISTINA LAKE PHASE 1E
3	CANADA	CENOVUS ENERGY	CENOVUS ENERGY	CENOVUS SOC
4	CANADA	CENOVUS ENERGY	CENOVUS ENERGY	RECONSTRUCTION OF MAA REFINERY (KNPC)
5	KUWAIT	KNPC	SK E&C	KOC New BS-132 & Enhancements BS-131
6	KUWAIT	KUWAIT OIL COMPANY (KOC)	SK E&C	SAUDI NIC
7	SAUDI ARABIA	SABIC	SAMSUNG ENGINEERING CO.,LTD.	JERP #3 Aromatics Units
8	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Luberef Yanbu Refinery Expantion
9	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	JUBAIL EXPORT REFINERY PKG 2B
10	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	YANBU EXPORT REFINERY EPC-3&4, (YERP-4)
11	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Ras Tanura Refinery Clean Fuels
12	SAUDI ARABIA	SAUDI ARAMCO	TECNICAS REUNIDAS,S.A	YANBU EXPORT REFINERY EPC-2 & 3
13	SAUDI ARABIA	SAUDI ARAMCO	SK E&C	Jubail Export Refinery Package 5B (Plant Utility)
14	SAUDI ARABIA	SAUDI ARAMCO	SK E&C	Yanbu Export Refinery Tank Farm (SP1) Project
15	SAUDI ARABIA	SAUDI ARAMCO	ENPPI	JAZAN REFINERY AND TERMINAL PROJECT
16	SAUDI ARABIA	SAUDI ARAMCO	JGC CORPORATION	SOHAR REFINERY IMPROVEMENT PROJECT
17	OMAN	Oman Refineries and Petro Chemicals	DAELIM INDUSTRIAL Co.,Ltd.	MOTIVA CRUDE EXPANSION PROJECT
18	U.S.A	MOTIVA (SHELL + SAUDI ARAMCO)	Burns and Roe Group, Inc	VALERO UNIFIED HYDROCRACKER PROJECT
19	U.S.A	VALERO	FLUOR CORPORATION	DIAMOND GREEN DIESEL PROJECT
20	U.S.A	VALERO	Foster Wheeler	Chevron Lianzi Development Project
21	U.S.A	CHEVRON	CHEVRON	NSRP Complex Project
22	VIETNAM	PETRO VIETNAM	JGCS Consortium	Long Son Package A1 - Olefins PJT
23	VIETNAM	PETRO VIETNAM	TPSK CONSORTIUM	Long Son Complex Project(LSP)
24	VIETNAM	PETRO VIETNAM	SAMSUNG ENGINEERING CO.,LTD.	TAKREER RRE Utilities & Offfsites(Pkg#3)
25	U.A.E	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	Green Diesel Project (GDP)
26	U.A.E	ADNOC Group	GS E&C	Inter Refineries Pipelines-II
27	U.A.E	ADNOC Group	DAEWOO E&C	Borouge 3 XLPE
28	U.A.E	ADNOC Group	HYUNDAI E&C Co., Ltd.	PETRO-CANADA/SULPHUR-in-GASOLINE

5-3. Power

Power

UPDATE Aug 31, 2023

NO.	AREA	OWNER/CLIENT	EPC CONTRACTOR	PROJECT NAME
1	BRAZIL	PETROBRAS	TOYO ENGINEERING CORPORTATION	CGP-Expansion Project(CGPEX)
2	SAUDI ARABIA	SWCC	Doosan Heavy Industries & Construction Co., Ltd.	Yanbu 2 POWER AND WATER PROJECT
3	SAUDI ARABIA	SWCC	Doosan Heavy Industries & Construction Co., Ltd.	RAS AZ ZAWR CCPP HRSG 2400MW, 10 units
4	SAUDI ARABIA	SEC(Saudi Electricity Company)	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	JEDDAH SOUTH THERMAL POWER PLANT STAGE-I
5	SAUDI ARABIA	SEC(Saudi Electricity Company)	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	SHUQAIQ STEAM POWER PLANT
6	U.A.E	Emirates Nuclear Energy Corporation	KEPCO	BNPP (Barakah Nuclear Power Plant)
7	U.A.E	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	BNPP (Barakah Nuclear Power Plant)
8	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	UCN56
9	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Yeonggwang nuclear 5 & 6
10	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Singori Nuclear Power #1,2
11	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Nuclear Power Plant of Sinwolsung #1,2
12	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	SHIN-KORI NUCLEAR POWER PLANT UNITS 3&4
13	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Shin-Ulchin Nuclear Power Plants Unit 1,2
14	SOUTH KOREA	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Shin-Kori 5&6 Nuclear Power Plants
15	SOUTH KOREA	WP	KUKJE Engineering	7,8 Taean Thermal Power Plant SCR installations
16	SOUTH KOREA	KOEN	Doosan Heavy Industries & Construction Co., Ltd.	KOSEP Youngheung 1&2
17	SOUTH KOREA	OCI	Doosan Heavy Industries & Construction Co., Ltd.	SAEMANGUM CPH ENERGY PROJECT
18	Libya	GE COMPANY	DAEWOO E&C	BENGHAZI CCPP
19	Libya	GE COMPANY	Doosan Heavy Industries & Construction Co., Ltd.	ZAWIA COMBINED CYCLE POWER PLANT
20	VIETNAM	EVN	Doosan Heavy Industries & Construction Co., Ltd.	Phu My 2,1 Extension Add On CCPP
21	VIETNAM	TOSHIBA CORPORATION	MAPROS CORPORATION	Van Phong 1 BOT Thermal Power Plant Project
22	VIETNAM	AES	Doosan Heavy Industries & Construction Co., Ltd.	Mong Duong 2 600 MW X 2 TPP - CMV
23	VIETNAM	EVN	DAELIM INDUSTRIAL Co.,Ltd.	VIETNAM Thai Binh 2 Thermal Power Plant

5-4. Chemical

Chemical

UPDATE Aug 31, 2023

NO.	AREA	OWNER/CLIENT	EPC CONTRACTOR	PROJECT NAME
1	ALGERIA	Sonatrach	JGC CORPORATION	HASSI R'MEL BOOSTING PROJECT
2	ALGERIA	Sonatrach	DAEWOO E&C	CAFC OIL PROJECT
3	CANADA	Syncrude Canada Ltd.	KENTS E&C	SYNCRUDE - AURORA PROJECT
4	CANADA	PETRO-CANADA	COLT ENGINEERING	PETRO-CANADA/COLT.ENGG-McKAY RIVER SAGD
5	CANADA	HUSKY ENERGY	HUSKY ENERGY	HUSKY OIL CANADA
6	INDIA	ONGC	SAMSUNG ENGINEERING CO.,LTD.	ONGC(OPal DFCU & AU Project)
7	IRAN	NIOC	GS E&C	4th AROMATIC PJT.
8	IRAN	NIOC	TOYO ENGINEERING CORPORTATION	IRAN NPC/2050 TPD AMMONIA & 3250 UREA
9	KUWAIT	KUWAIT OIL COMPANY (KOC)	SK E&C	GC-24 (Building new gathering centre GC-24)
10	KUWAIT	KUWAIT OIL COMPANY (KOC)	GS E&C	WARA PRESSURE MAINTENANCE
11	KUWAIT	SABIC	SAMSUNG ENGINEERING CO.,LTD.	IBN Zahr PPIII PROJECT
12	KUWAIT	SABIC	SAMSUNG ENGINEERING CO.,LTD.	Ibn Zahr OCT
13	KUWAIT	SABIC	SAMSUNG ENGINEERING CO.,LTD.	SAUDI KAYAN PP & PH PROJECT
14	KUWAIT	SABIC	SAMSUNG ENGINEERING CO.,LTD.	Kayan Amines Facilities
15	KUWAIT	SABIC	SAMSUNG ENGINEERING CO.,LTD.	JUPC United EO/EG III Project (JUPC PJT)
16	KUWAIT	SABIC	FLUOR CORPORATION	SAUDI KAYAN PETROCHEMICAL COMPLEX (U&O)
17	KUWAIT	SABIC	DAELIM INDUSTRIAL Co.,Ltd.	Polycarbonates Facilities for Saudi KayanCracker
18	KUWAIT	SABIC	FLUOR CORPORATION	Amine Facilities Project - Saudi Kayan
19	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Maaden Ammonia
20	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Ras Tanura DHT
21	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Shaybah Increase Gas Handling Facilities(PKG4)
22	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Shaybah NGL Power Generation PKG 3
23	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Clean Transpotation Fuels at Riyadh Refinery(RCTF)
24	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	SHAYBAH CPFE(CENTER PROCESS FACILITY EXPENSION) PR
25	SAUDI ARABIA	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Hawiyah Unayzah Gas Reservoir Storage Project
26	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Wasit SUR & Utilities PJT(WUC) Package #3
27	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	SAMAPCO CA/EDC PORT FACILTY
28	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Rabigh Phasell Petrochemical CP1 & 2

5-4. Chemical

Chemical

UPDATE Aug 31, 2023

NO.	AREA	OWNER/CLIENT	EPC CONTRACTOR	PROJECT NAME
29	SAUDI ARABIA	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Umm Wu'al EPC (Ma'aden Ammonia Plant)
30	SAUDI ARABIA	SAUDI ARAMCO	Petrofac Engineering & Construction	Fadhili Gas Plant - Sulfur Recovery Facilities
31	SAUDI ARABIA	SAUDI ARAMCO	Petrofac Engineering & Construction	RABIGH PHASE-II PETROCHEMICAL PROJECT
32	SAUDI ARABIA	SAUDI ARAMCO	SAIPEM	MARJAN INCREM WATER INJECTION FIXED FAC
33	SAUDI ARABIA	SAUDI ARAMCO	TECNICAS REUNIDAS,S.A	JIGCC Utilities - Common Area - Package 5
34	SAUDI ARABIA	SAUDI ARAMCO	SK E&C	Wasit Inlet & Gas Processing PJT(WGC) Package #1
35	SAUDI ARABIA	SAUDI ARAMCO	GS E&C	Rabigh II Refining and Petrochemical
36	SAUDI ARABIA	SAUDI ARAMCO	C.A.T	MASTER GAS EXPANSION PHASE 1
37	BAHRAIN	Bahrain Petroleum Company	Doosan Heavy Industries & Construction Co., Ltd.	MED Package for Bapco Modernization Program Projec
38	BAHRAIN	Bahrain Petroleum Company	SAMSUNG ENGINEERING CO.,LTD.	BAPCO MODERNIZATION PROJECT(BMP PJT)
39	THAILAND	PTT	SAMSUNG ENGINEERING CO.,LTD.	ESP
40	THAILAND	PTT	SAMSUNG ENGINEERING CO.,LTD.	WANGNOI COMPRESSOR STATION PROJECT
41	THAILAND	PTT	SK E&C	THPP#3
42	U.A.E	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	UAE Borouge OCU
43	U.A.E	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	Takreer Carbon Black & Delayed Coker
44	U.A.E	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	FERTIL Expansion Project (FERTIL-2)
45	U.A.E	ADNOC Group	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	IGD DAS PROJECT
46	U.A.E	ADNOC Group	HYUNDAI ENGINEERING	UONE / GROUP III Lube Base Oil Production Faciliti
47	U.A.E	ADNOC Group	DSME	H5485S ADNOC VLCC_ Cryogenic Butterfly Valve
48	SINGAPORE	EXXONMOBIL	Foster Wheeler	SPT Olefins Furnaces Project
49	SINGAPORE	EXXONMOBIL	MITSUBISHI HEAVY IND	SPT SME PROJECT
50	U.S.A	EXXONMOBIL	MITSUBISHI HEAVY IND	NAG PROJECT

6. Catalog

E-CATALOG

Energy Solutions

Valve & Engineering
Controls the flow

Head Office & Factory

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Fax_ +82-55-286-0281

Seoul Sales Office

Address_ 1318, Myeongdong MFirst Place, 15-1, Samil-daero 8-gil, Jung-gu, Seoul
Tel_ +82-55-260-5795 / 5796

Beginning

1980
Renamed to Pan-Korea Metal Ind.

1974
Moved to Changwon Industrial Complex

1946
Established Busan Pokum .Ind

Challenge

1994
Established R&BD Center

1988
Registered as selected localization company of Cryogenic Valve at KOGAS

1985
Developed Cryogenic Valve

Korea's First and Largest Industrial Valve Specialized Manufacturer, PK Valve & Engineering Co.,Ltd.

Growth

2006
NEP Certification for Cryogenic Metal Seated Butterfly Valve
Changed company name to PK Valve

2002
Developed Cryogenic Butterfly Valve
Cryogenic valve supply started to KOGAS

2000
1st Valve Academy launched

Leap

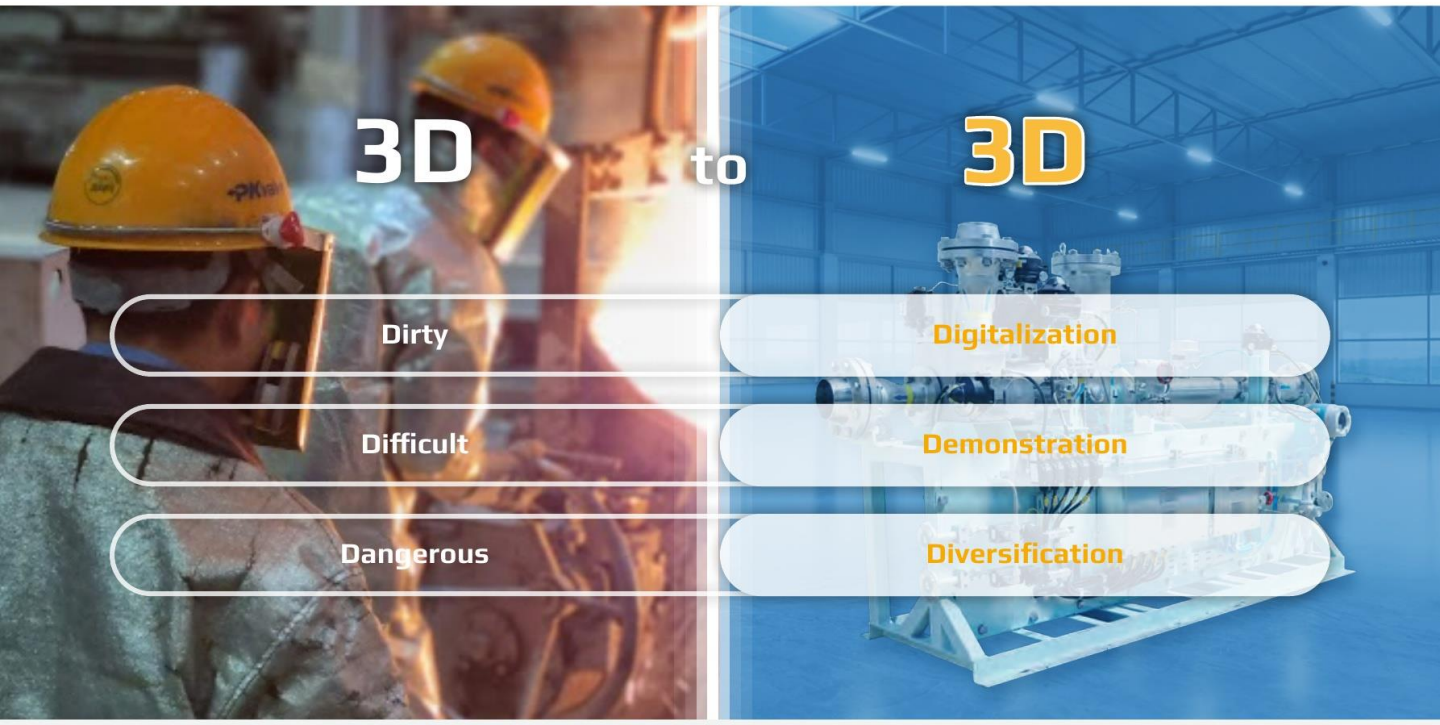
2022
Changed company name to PK Valve & Engineering

2021
Expansion of cryogenic valve factory

2017
Cryogenic Butterfly valves supply started to LNGC

2012
Awarded 100 Million Dollar Export Tower

About Us



Digitalization

PK VALVE&ENGINEERING has already achieved digitalization of data on orders, production process, and quality control for the past 20 years through the establishment of an ERP system, and now PK VALVE&ENGINEERING is preparing to digitize the development process and results. By accumulating data on the development process, we will dramatically reduce trial and error and provide solutions that satisfy customers within a short delivery

Demonstration

PK VALVE&ENGINEERING is starting a performance verification demonstration business for products that are not regulated by codes and standards. By applying data sensing technology and data collection technology to design and manufacture new products, we are accumulating technologies that can accurately reflect customer requirements by implementing actual use environments.

Diversification

PKVALVE & ENGINEERING is striving to diversify its products by developing various products that can be used in extreme conditions such as ultra-low temperature, ultra-high temperature, ultra-large size, and ultra-high pressure through digitalization and demonstration.

Certificates

SHEQ & Product

API Q1&6D

API Q1&600


CE PED


SIL Level 2


TR-CU


ISO 9001


ISO 14001


ISO 45001

Nuclear

KEPIC MN

ASME N

ASME NPT

Marine Classification


DNV-GL


LR


KR


BV

ABS

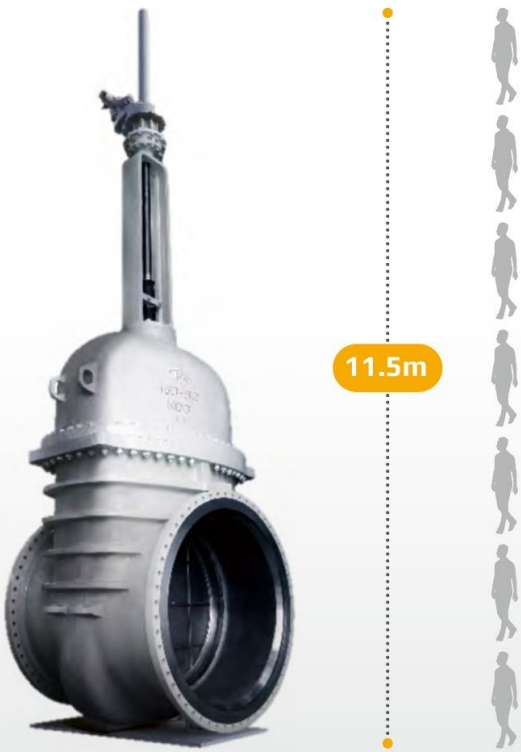

NK


CCS

Refinery

Long experience and proven references in large scale projects

PK VALE & ENGINEERING has a track record of participating in large-scale oil refinery projects for decades.
We have the capability to manufacture and test a large number of valves in a timely manner and the capability to manage projects, thereby supporting the successful project execution of our customers. In addition to our capacity and capability to produce the world's largest 92-inch cast steel gate valve, we have developed and manufactured all types of valves used in extreme conditions, such as high-temperature/ pressure and cryogenic applications



Controls the flow

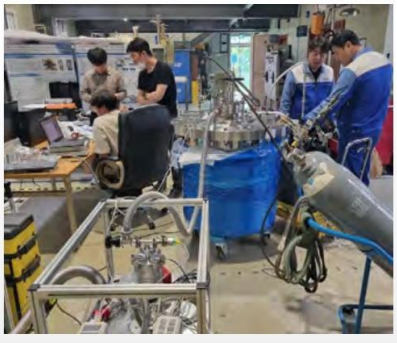
Production Capability

We maintain an integrated production system that allows us to control all processes from A to Z in our own facility, Engineering, Foundry, Machining, Assembly, Test/inspection, Paining and Package. It is designed and manufactured to meet and go beyond customer needs and expectation, and supplied after thorough verification test through demonstration under conditions similar to the operating environment.

We are able to offer an optimized solutions for our customers by reflecting accumulated know-how and experiences at site in resolving issues and challenges with customers.
In case repair and maintenance is required, VALVE MEDIC TEAM is available 24/7 upon request.

Integrated production system

Workers are pouring molten metal in our factory to make casting material.



R&D CENTER staff are conducting a valve leakage test under -253 degrees Celsius.

The VALVE MEDIC TEAM (valve maintenance organization) is repairing the MOTER OPERATED VALVE.

Power

Key supplier in Nuclear Steam Supply System and Balance of Plant In Nuclear Power Plant

PK Valve & Engineering has been playing a vital role as a reliable supplier for the Nuclear Steam Supply System (NSSS) and Balance of Plant (BOP) in nuclear power plants as well as cogeneration and combined cycle power plants.

In 1988, through the development of valves for nuclear power, PK started to supply to the Korea's nuclear power plant by participating in Yeonggwang Units 3 and 4, and followed by Uljin Nuclear Power Plant, Kori Nuclear Power Plant, Shin-Kori Nuclear Power Plant, Shin-Wolseong Nuclear Power Plant, Shin-Gori Units 5 and 6 Nuclear Power Plant.

The Barakah Nuclear Power Plant in UAE was the first nuclear power plant in overseas and is expected to export to global nuclear markets.

Valve development and quality control system

We operate a system to supply valves that is required for a high level of design and quality control, such as products in main and auxiliary equipment of nuclear power plants.

In particular, we are working on design improvement by utilizing our experience accumulated for a long period of time.

The computer simulation technology can contribute to improving quality of high temperature/pressure valves installed in pipes for cogeneration and combined cycle power plants.

Prototype (16 inch-1680#) manufacturing for QME-1 Test in Nuclear Power Plant

››› Controls the flow

Capability to design and manufacture valves capable of controlling high-temperature, high-pressure differentials

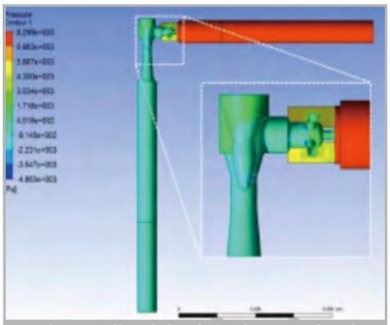
CBD Valves (Continuous Blowdown Valve) :

Continuous blowdown valves are used in power plants to continuously remove a small amount of boiler water to control the concentration of impurities within the boiler. These impurities, such as dissolved solids and minerals, tend to concentrate in the boiler water when steam is produced. If not removed, various problems such as scale build-up, corrosion and reduced boiler efficiency can occur.

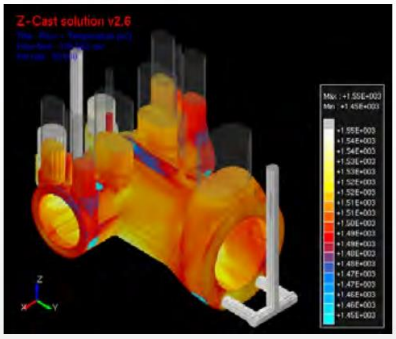
IBD Valves (Intermittent Blowdown Valve) :

Unlike continuous blowdown, intermittent blowdown discharges a larger volume of boiler water at fewer intervals. Intermittent blowdowns are usually performed during periods of low boiler demand or when certain conditions are met, such as predetermined time intervals or a certain water level in the boiler.

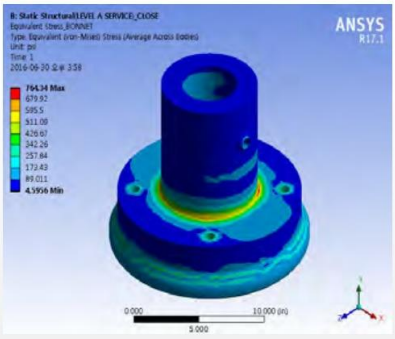
Since CBD/IBD Valves are a high-temperature, high-pressure, and corrosive environment, it requires extremely high durability and ease of maintenance compared to common valves.
PKVALVE & ENGINEERING has the capability to design and manufacture valves that can be used in these harsh environments.



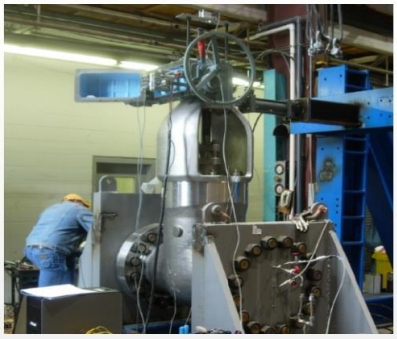
Angle-Needle Globe (2inch-1500#) Valve



Computer solidification analysis
to check the soundness
of the casting before mass production



Computer structural analysis to examine
whether structural stability can be secured
even under high temperature and
high pressure conditions



QME-1 TEST
for Motor Operated Valve
in Nuclear Power Plant

Chemical

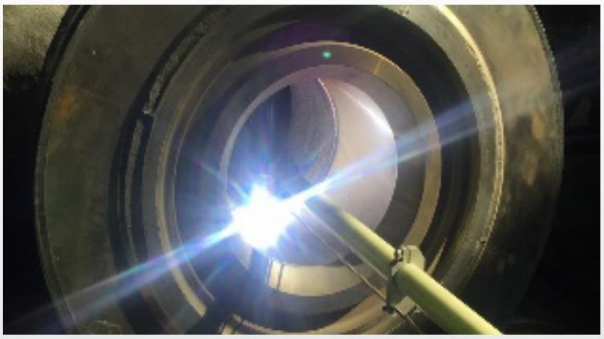
Supply of specialized products to chemical plants through experience in participating in chemical projects

PKVALE & ENGINEERING has a track record of participating in large-scale chemical plant construction projects for decades.
LFE Packing is also used for general chemical process valves to solve the leakage problem from valves, and we have design and quality control capabilities to ensure low leakage performance.
In particular, we have numerous supply records as well as design and manufacturing capabilities to supply Bellows valves in cases where leakage is extremely limited.

Photo of finished product cladding
inside of GATE VALVE (20inch-2500#)

Price Competitiveness with cladding technology

In case of valve required for severe corrosion resistance, there is no choice but to use solid corrosion-resistant materials such as Monel and Inconel whcih are very expensive.
In case of valves, unlike pipes, it is difficult to apply cladding because of complicated its shape and structure.
However, PK VALVE & ENGINEERING has developed cladding technology at our own that can be applied with the patented welding technology cost-efficient cladding process.
In case of 6" and larger, cladding is recommended, but for 4" or smaller, cladding is not an option due to price advantage and accessibility for cladding.



>>> Controls the flow

Photo of cladding inside
the bonnet of the 20inch-2500# GATE VALVE

Photo of cladding inside
the body of the 20inch-2500# GATE VALVE

Bellows valve – the best choice for leak prevention

If valve leakage is becoming a problem due to the increase in the use of various chemicals harmful to the human body, our bellows valve is the best choice to solve this challenge. "Take safety and efficiency to the next level with our bellows valves." Our bellows valves are designed to fit into modern plant operating environments, ensuring safe operation while minimizing leakage problems

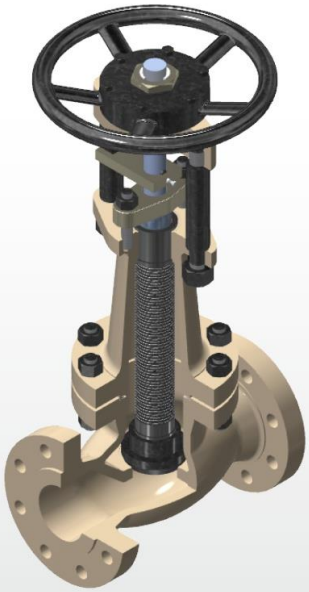
This provides the following benefits:

Leak-proof technology: Advanced bellows technology makes the valve virtually leak-free and greatly reduces the chance of hazardous substances leaking.

Environmentally friendly: Supports the use of new fuels such as ammonia and methanol to create an environmentally friendly production environment.

Durability and reliability: Bellows valves made with specially strengthened materials and precision manufacturing techniques ensure long li fe and excellent performance.

Adaptability and versatility: Available in a variety of specifications and sizes, applicable to a wide variety of chemical production plants. Get rid of leakage problems and meet bellows valves for safe and efficient production. We are always ready to be with you for your successful production.



Supply Reference - Refinery

LOGO	Owner/Client	EPC CONTRACTOR	PROJECT NAME	Area
	PETRO-CANADA	Kellogg, Brown & Root (Canada) Company	PETRO-CANADA/SULPHUR-in-GASOLINE	CANADA
	BP	FLUOR CORPORATION	BP OCC WHITING PROJECT	CANADA
cenovus	CENOVUS ENERGY	CENOVUS ENERGY	CENOVUS CHRISTINA LAKE PHASE 1E	CANADA
	CENOVUS ENERGY	CENOVUS ENERGY	CENOVUS SOC	CANADA
	KNPC	SK E&C	RECONSTRUCTION OF MAA REFINERY (KNPC)	KUWAIT
	KUWAIT OIL COMPANY (KOC)	SK E&C	KOC New BS-132 & Enhancements BS-131	KUWAIT
	SABIC	SAMSUNG ENGINEERING CO.,LTD.	SAUDI NIC	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	JERP #3 Aromatics Units	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Luberef Yanbu Refinery Expantion	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	JUBAIL EXPORT REFINERY PKG 2B	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	YANBU EXPORT REFINERY EPC-3&4, (YERP-4)	SAUDI ARABIA
	SAUDI ARAMCO	TECNICAS REUNIDAS,S.A	Ras Tanura Refinery Clean Fuels	SAUDI ARABIA
	SAUDI ARAMCO	SK E&C	YANBU EXPORT REFINERY EPC-2 & 3	SAUDI ARABIA
	SAUDI ARAMCO	SK E&C	Jubail Export Refinery Package 5B (Plant Utility)	SAUDI ARABIA
	SAUDI ARAMCO	ENPPI	Yanbu Export Refinery Tank Farm (SP1) Project	SAUDI ARABIA
	SAUDI ARAMCO	JGC CORPORATION	JAZAN REFINERY AND TERMINAL PROJECT	SAUDI ARABIA
	Oman Refineries and Petro Chemicals	DAELIM INDUSTRIAL Co.,Ltd.	SOHAR REFINERY IMPROVEMENT PROJECT	OMAN
MOTIVA	MOTIVA (SHELL + SAUDI ARAMCO)	Bums and Roe Group, Inc	MOTIVA CRUDE EXPANSION PROJECT	U.S.A
	VALERO	FLUOR CORPORATION	VALERO UNIFIED HYDROCRACKER PROJECT	U.S.A
	VALERO	Foster Wheeler	DIAMOND GREEN DIESEL PROJECT	U.S.A
	CHEVRON	CHEVRON	Chevron Lianzi Development Project	U.S.A
	PETRO VIETNAM	JGC5 Consortium	NSRP Complex Project	VIETNAM
	PETRO VIETNAM	TPSK CONSORTIUM	Long Son Package A1 - Olefins PJT	VIETNAM
	PETRO VIETNAM	SAMSUNG ENGINEERING CO.,LTD.	Long Son Complex Project(LSP)	VIETNAM
	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	TAKREER RRE Utilities & Offfsites(Pkg#3)	U.A.E
	ADNOC Group	GS E&C	Green Diesel Project (GDP)	U.A.E
	ADNOC Group	DAEWOO E&C	Inter Refineries Pipelines-II	U.A.E
	ADNOC Group	HYUNDAI E&C Co., Ltd.	Borouge 3 XLPE	U.A.E

Supply Reference - Power

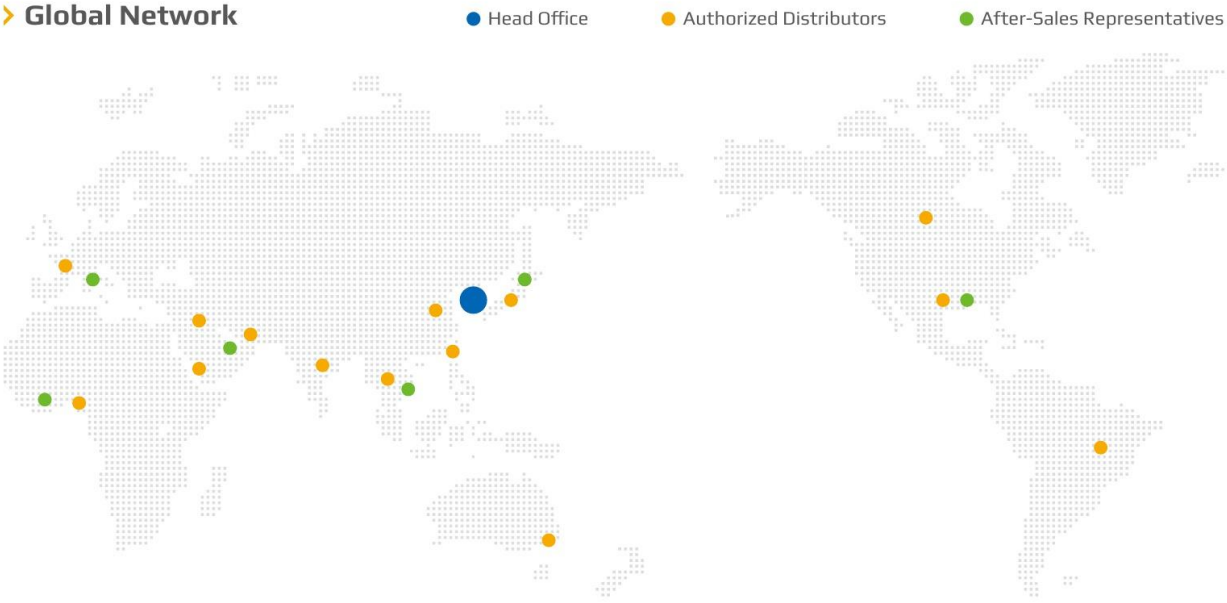
LOGO	Owner/Client	EPC CONTRACTOR	PROJECT NAME	Area
	Emirates Nuclear Energy Corporation	KEPCO	BNPP (Barakah Nuclear Power Plant)	U.A.E
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	BNPP (Barakah Nuclear Power Plant)	U.A.E
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	UCN56	SOUTH KOREA
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Yeonggwang nuclear 5 & 6	SOUTH KOREA
KHNP	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Singori Nuclear Power #1,2	SOUTH KOREA
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Nuclear Power Plant of Sinwolsung #1,2	SOUTH KOREA
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	SHIN-KORI NUCLEAR POWER PLANT UNITS 3&4	SOUTH KOREA
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Shin-Ulchin Nuclear Power Plants Unit 1,2	SOUTH KOREA
	KHNP	Doosan Heavy Industries & Construction Co., Ltd.	Shin-Kori 5&6 Nuclear Power Plants	SOUTH KOREA
	WP	KUKJE Engineering	7,8 Taean Thermal Power Plant SCR installations	SOUTH KOREA
KOEN	KOEN	Doosan Heavy Industries & Construction Co., Ltd.	KOSEP Youngheung 1&2	SOUTH KOREA
OCI	OCI	Doosan Heavy Industries & Construction Co., Ltd.	SAEMANGUM CPH ENERGY PROJECT	SOUTH KOREA
PETROBRAS	PETROBRAS	TOYO ENGINEERING CORPORTATION	CGP-Expansion Project(CGPEX)	BRAZIL
	SWCC	Doosan Heavy Industries & Construction Co., Ltd.	Yanbu 2 POWER AND WATER PROJECT	SAUDI ARABIA
	SWCC	Doosan Heavy Industries & Construction Co., Ltd.	RAS AZ ZAWR CCPP HRSG 2400MW, 10 units	SAUDI ARABIA
	SEC(Saudi Electricity Company)	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	JEDDAH SOUTH THERMAL POWER PLANT STAGE-I	SAUDI ARABIA
	SEC(Saudi Electricity Company)	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	SHUQAIQ STEAM POWER PLANT	SAUDI ARABIA
	GE COMPANY	DAEWOO E&C	BENGHAZI CCPP	Libya
	GE COMPANY	Doosan Heavy Industries & Construction Co., Ltd.	ZAWIA COMBINED CYCLE POWER PLANT	Libya
	EVN	Doosan Heavy Industries & Construction Co., Ltd.	Phu My 2,1 Extension Add On CCPP	VIETNAM
TOSHIBA	TOSHIBA CORPORATION	MAPROS CORPORATION	Van Phong 1 BOT Thermal Power Plant Project	VIETNAM
AES	AES	Doosan Heavy Industries & Construction Co., Ltd.	Mong Duong 2 600 MW X 2 TPP - CMV	VIETNAM
EVN	EVN	DAELIM INDUSTRIAL Co.,Ltd.	VIETNAM Thai Binh 2 Thermal Power Plant	VIETNAM

Supply Reference - Chemical

LOGO	Owner/Client	EPC CONTRACTOR	PROJECT NAME	Area
	Sonatrach	JGC CORPORATION	HASSI R'MEL BOOSTING PROJECT	ALGERIA
	Sonatrach	DAEWOO E&C	CAFC OIL PROJECT	ALGERIA
Syncrude	Syncrude Canada Ltd.	KENTS E&C	SYNCRUDE - AURORA PROJECT	CANADA
	PETRO-CANADA	COLT ENGINEERING	PETRO-CANADA/COLT.ENGG-McKAY RIVER SAGD	CANADA
Husky Energy	HUSKY ENERGY	HUSKY ENERGY	HUSKY OIL CANADA	CANADA
	ONGC	SAMSUNG ENGINEERING CO.,LTD.	ONGC(OPal DFCU & AU Project)	INDIA
	NIOC	GS E&C	4th AROMATIC PJT.	IRAN
	NIOC	TOYO ENGINEERING CORPORTATION	IRAN NPC/2050 TPD AMMONIA & 3250 UREA	IRAN
	KUWAIT OIL COMPANY (KOC)	SK E&C	GC-24 (Building new gathering centre GC-24)	KUWAIT
	KUWAIT OIL COMPANY (KOC)	GS E&C	WARA PRESSURE MAINTENANCE	KUWAIT
سابك sabic	SABIC	SAMSUNG ENGINEERING CO.,LTD.	IBN Zahr PPIII PROJECT	KUWAIT
	SABIC	SAMSUNG ENGINEERING CO.,LTD.	Ibn Zahr OCT	KUWAIT
	SABIC	SAMSUNG ENGINEERING CO.,LTD.	SAUDI KAYAN PP & PH PROJECT	KUWAIT
	SABIC	SAMSUNG ENGINEERING CO.,LTD.	Kayan Amines Facilities	KUWAIT
	SABIC	SAMSUNG ENGINEERING CO.,LTD.	JUPC United EO/EG III Project (JUPC PJT)	KUWAIT
	SABIC	FLUOR CORPORATION	SAUDI KAYAN PETROCHEMICAL COMPLEX (U&O)	KUWAIT
	SABIC	DAELIM INDUSTRIAL Co.,Ltd.	Polycarbonates Facilities for Saudi KayanCracker	KUWAIT
	SABIC	FLUOR CORPORATION	Amine Facilities Project - Saudi Kayan	KUWAIT
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Maaden Ammonia	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Ras Tanura DHT	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Shaybah Increase Gas Handling Facilities(PKG4)	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Shaybah NGL Power Generation PKG 3	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Clean Transpotation Fuels at Riyadh Refinery(RCTF)	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	SHAYBAH CPFE(CENTER PROCESS FACILITY EXPENSION) PR	SAUDI ARABIA
	SAUDI ARAMCO	SAMSUNG ENGINEERING CO.,LTD.	Hawiyah Unayzah Gas Reservoir Storage Project	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Wasit SUR & Utilities PJT(WUC) Package #3	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	SAMAPCO CA/EDC PORT FACILTY	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Rabigh Phasell Petrochemical CP1 & 2	SAUDI ARABIA
	SAUDI ARAMCO	DAELIM INDUSTRIAL Co.,Ltd.	Umm Wu'al EPC (Ma'aden Ammonia Plant)	SAUDI ARABIA
	SAUDI ARAMCO	Petrofac Engineering & Construction	Fadhili Gas Plant - Sulfur Recovery Facilities	SAUDI ARABIA
	SAUDI ARAMCO	Petrofac Engineering & Construction	RABIGH PHASE-II PETROCHEMICAL PROJECT	SAUDI ARABIA
	SAUDI ARAMCO	SAIPEM	MARJAN INCREM WATER INJECTION FIXED FAC	SAUDI ARABIA
	SAUDI ARAMCO	TECNICAS REUNIDAS,S.A	JIGCC Utilities - Common Area - Package 5	SAUDI ARABIA
	SAUDI ARAMCO	SK E&C	Wasit Inlet & Gas Processing PJT(WGC) Package #1	SAUDI ARABIA
	SAUDI ARAMCO	GS E&C	Rabigh II Refining and Petrochemical	SAUDI ARABIA
	SAUDI ARAMCO	C.A.T	MASTER GAS EXPANSION PHASE 1	SAUDI ARABIA
Bapco	Bahrain Petroleum Company	Doosan Heavy Industries & Construction Co., Ltd.	MED Package for Bapco Modernization Program Projec	BAHRAIN
	Bahrain Petroleum Company	SAMSUNG ENGINEERING CO.,LTD.	BAPCO MODERNIZATION PROJECT(BMP PJT)	BAHRAIN
	PTT	SAMSUNG ENGINEERING CO.,LTD.	ESP	THAILAND
	PTT	SAMSUNG ENGINEERING CO.,LTD.	WANGNOI COMPRESSOR STATION PROJECT	THAILAND
	PTT	SK E&C	THPP#3	THAILAND
	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	UAE Borouge OCU	U.A.E
	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	Takreer Carbon Black & Delayed Coker	U.A.E
	ADNOC Group	SAMSUNG ENGINEERING CO.,LTD.	FERTIL Expansion Project (FERTIL-2)	U.A.E
	ADNOC Group	HYUNDAI HEAVY INDUSTRIAL CO., LTD.	IGD DAS PROJECT	U.A.E
	ADNOC Group	HYUNDAI ENGINEERING	UONE / GROUP III Lube Base Oil Production Faciliti	U.A.E
	ADNOC Group	DSME	H54855 ADNOC VLCC_ Cryogenic Butterfly Valve	U.A.E
ExxonMobil	EXXONMOBIL	Foster Wheeler	SPT Olefins Furnaces Project	SINGAPORE
	EXXONMOBIL	MITSUBISHI HEAVY IND	SPT SME PROJECT	SINGAPORE
	EXXONMOBIL	MITSUBISHI HEAVY IND	NAG PROJECT	U.S.A

Customers Care

Global Network



SOUTH KOREA

- BUMHAN VALVE CO., LTD
- DAESUNG TMS
- PK VALVE PLUS
- DAESUNG PIPING
- HOAM CO., LTD

SOUTH EAST ASIA

- PT. VALVE AUTOMATION INDONESIA
- S.A. PETROTECH CO., LTD

AMERICA

- MENGER VALVE(USA)
- ALEXANDER VALVE & SUPPLY (CANADA)

EUROPE & AFRICA

- G.G.C VALVES(UK)
- TNB GLOBAL

Valve Medic

After consultation with the customers, our engineers visit the customers and provide customized training and consulting to solve the problems faced by the customers. We respond to customer problems together, such as valve troubleshooting, maintenance method training, valve specification review.

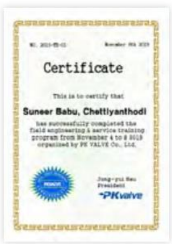
AEO

On April 30, 2023, AEO certification (KR AEO 3123007) was obtained from the Korea Customs Service. AEO certification is a system that certifies export safety management companies that meet the international standards of the World Customs Organization for trade safety and facilitation.

Training & Education

Engineer Training

Training Service for Engineers came from Middle East Fuji LLC.


Certificate

This is to certify that

Suneer Babu, Chettiyanthodi

has successfully completed the field engineering & service training program from November 4 to 8 2019 organized by PK VALVE Co., Ltd.

Jong-yul Bae
President
PKvalve


Certificate

This is to certify that

Millan, Joseph

has successfully completed the field engineering & service training program from November 4 to 8 2019 organized by PK VALVE Co., Ltd.

Jong-yul Bae
President
PKvalve

Training Service for Engineers came from Marine Systems & Solutions


Certificate

This is to certify that

Marine Systems & Solutions

Dmitry Otyukov

has successfully completed the PK's field service training program from December 6 to 10 2021 organized by PK VALVE Co., Ltd.

Yoon-chul Cho
CEO
PKvalve

Valve Academy

PK VALVE&ENGINEERING is the only valve manufacture in the world that has been running the “Valve Academy” program since 2000 to strengthen communication with customers. It was first held free courses for valve agency employees in terms of valve job training, and it was opened to general customers in 2005 at the request of major customers. In 2023, the “18th Valve Academy” was held to expand communication with customers.

Head Office & Factory

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Tel +82-55-260 5500

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Tel +82-55-260-5500 / 5795 / 5796

E-CATALOG

Green Energy Solutions

PK Valve & Engineering
Controls the flow

Head Office & Factory

Address_ 80 Gongdan-ro, Seungsan-gu, Changwon-si, Gyeongsangnam-do, Korea, 51567
Tel_ +82-55-268-3777
Fax_ +82-55-286-0281

Seoul Sales Office

Address_ 1318, Myeongdong MFirst Place, 15-1, Samil-daero 8-gil, Jung-gu, Seoul
Tel_ +82-55-260-5795 / 5796

Beginning

1980
Renamed to Pan-Korea Metal Ind.

1974
Moved to Changwon Industrial Complex

1946
Established Busan Pokum .Ind

Challenge

1994
Established R&BD Center

1988
Registered as selected localization company of Cryogenic Valve at KOGAS

1985
Developed Cryogenic Valve

Korea's First and Largest Industrial Valve Specialized Manufacturer, PK Valve & Engineering Co.,Ltd.

Growth

2006
NEP Certification for Cryogenic Metal Seated Butterfly Valve
Changed company name to PK Valve

2002
Developed Cryogenic Butterfly Valve
Cryogenic valve supply started to KOGAS

2000
1st Valve Academy launched

Leap

2022
Changed company name to PK Valve & Engineering

2021
Expansion of cryogenic valve factory

2017
Cryogenic Butterfly valves supply started to LNGC

2012
Awarded 100 Million Dollar Export Tower

About Us

Digitalization

PK VALVE&ENGINEERING has already achieved digitalization of data on orders, production process, and quality control for the past 20 years through the establishment of an ERP system, and now PK VALVE&ENGINEERING is preparing to digitize the development process and results. By accumulating data on the development process, we will dramatically reduce trial and error and provide solutions that satisfy customers within a short delivery

Demonstration

PK VALVE&ENGINEERING is starting a performance verification demonstration business for products that are not regulated by codes and standards. By applying data sensing technology and data collection technology to design and manufacture new products, we are accumulating technologies that can accurately reflect customer requirements by implementing actual use environments.

Diversification

PKVALVE & ENGINEERING is striving to diversify its products by developing various products that can be used in extreme conditions such as ultra-low temperature, ultra-high temperature, ultra-large size, and ultra-high pressure through digitalization and demonstration.

Certificates

Marine Classification


DNV-GL


LR


KR


BV

ABS

NK


CCS

Nuclear

KEPIC MN

ASME N

ASME NPT

SHEQ & Product

API Q1&6D

API Q1&600


CE PED


SIL Level 2


TR-CU

ISO 9001

ISO 14001

ISO 45001

Cryogenic Valves

PK VALVE&ENGINEERING started research & development of cryogenic service valves in cooperation with KIMM (Korea Institute of Machinery and Material) under Korea Government in 1983s. Due to high stability requirement for Cryogenic service valves, it requires many restrictions for material selection and extend bonnet length selection. By considering the selection of material and optimized extension bonnet length determination to keep the temperature close to ambient of gland packing, PK VALVE&ENGINEERING completed the development at 1985 and has been supplying to oversea and domestic customers for cryogenic industries including LNG liquefaction plant, receiving terminal and other gas plants for production, transportation and storage of liquefied gases such as oxygen, nitrogen, natural gas, hydrogen or helium. These optimized lengths for different sizes are then subjected to thermal analysis using finite element method for evaluate the temperature at the gland packing area. The thermal analysis is done using ANSYS software. Along with material selection and optimized extension length PK VALVE&ENGINEERING has improved assembly, production and management method to keep the capability and quality.

Characteristic of Cryogenic Valve

- Packing protected from cryogenic temperatures
- Anti Inner Pressure Build-Up by Bleed hole on the Disc of Gate Valve or Ball Valve
- Stable sealing by Bi-directional sealing design
- Quick and easy maintenance due to side entry design
- Prevent leakage and ensure long life through double & triple eccentric design

Cryogenic Top Entry Ball Valve

Cryogenic Butterfly Valve

››› Controls the flow

Manufacturing Item

Type	Class	150	300	600	900	1500	2500
Gate		2~56	2~48	2~36	2~24	2~16	2~8
Globe		2~30	2~30	2~30	2~14	2~10	2~8
Check	Swing	2~36	2~36	2~36	2~24	2~16	2~8
	Dual	2~36	2~36	2~12	2~6	2~6	-
	Axial	2~36	2~36	2~36	2~32	-	-
Ball	Floating	½~6	½~6	½~4	½~2	½~2	-
	Trunnion	8~24	8~24	6~24	3~24	3~24	-
	DBB(2 Ball)	½~6	½~6	½~4	½~2	½~2	-
Butterfly		4~48	4~24	*UD	-	-	-

*UD : Under Development

LH_2 Valves

Demonstration of liquefied hydrogen valve test at -253°C for the first time in the world

PK Valve & Engineering has successfully completed a verification and demonstration of liquefied hydrogen valves for the first time in the world witnessed by hydrogen-related customers.

Over the last one and half years of research and development, we have put together all of our technical know-how, experience and enthusiasm not only to minimize the Boil Off Gas (BOG) and leakage at - 253 ℃ but also to find the best demonstration test method.

In this demonstration, Emergency Shut Down Globe Valve got zero leakage and well operability throughout shell, seat leak test and operation test which were carried out by our own liquefied hydrogen valve test equipment and test procedures.

LH_2 Check Valve

LH_2 Emergency Shutoff Valve

LH_2 Globe Valve

››› Controls the flow

Characteristic of LH_2 Valve

- Designed with our unique design that enables high-vacuum insulation and maintenance outside the cold box
- Provide Globe Valve, Check Valve (Lift Type), Emergency Shut-Off Valve
- Provide various operation options (manual, gear, MOV, POV)
- Block external leakage by applying bellows seal and gland packing
- Application of thermal barrier structure that BOG(Boil-Off Gas) that may occur inside the valve

Specification

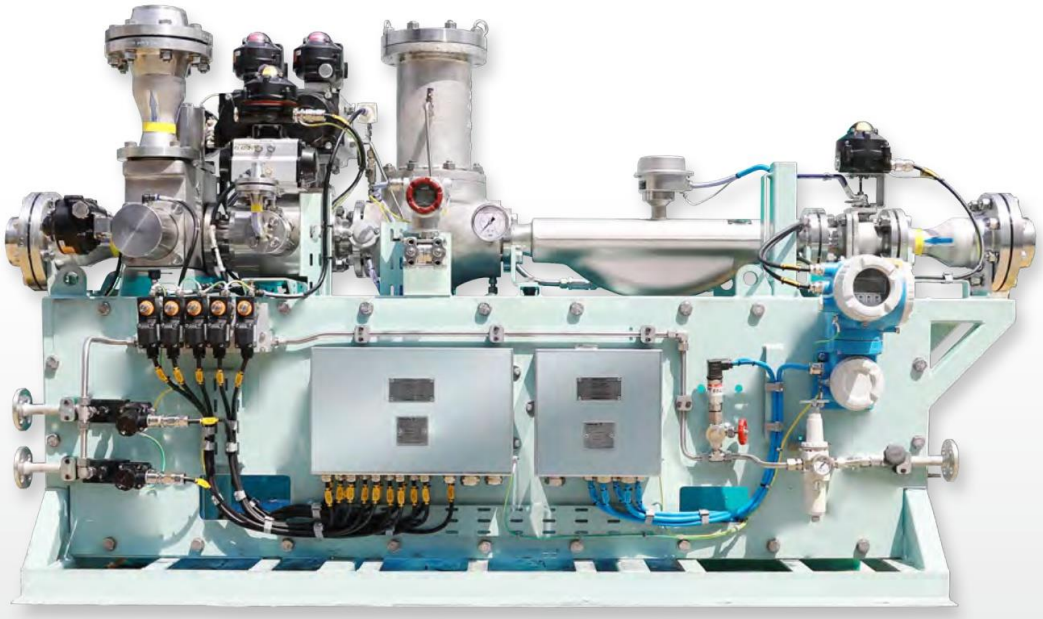
Type	Specification
Operating Temp.	-253°C (-269°C) to +80°C
Service Fluids	LH_2, LHe, LNG, LO_2
Valve Type	Globe, Check Valve
Material	304L, 316L Stainless Steel
Valve Size	½" ~ 10"
Valve Rating (ASME)	Class 150 to 300
End Connections	Butt welding According to ASME B16.25
Operation	Manual, Gear, Motor, pneumatic
Cryogenic Extension	As per MSS SP-134, BS 6364, ISO 28921-1
Stem Sealing	Bellows & Gland Packing
Seat Material	Metal (Body) / PCTFE (Disc)
	Metal (Body) / Metal (Disc)
Flow Characteristic	Linear or On/Off
Special	Position Indicator
	Thermal Barrier
	Vacuum jacketed with M.L.I or Non jacketed
	Suitable for Cold Box
	Outside screw and yoke Type Easy maintenance
	Degreasing & Cleaning
	Full Penetration Weld applied on extension joint (Available Radiographic Testing)

Gas Valve Unit (GVU)

A device that controls gas in engines, generators, and boilers in ships that use natural gas as fuel. The Gas Valve Unit (GVU) represents the interface between the engine and the fuel gas supply system. It ensures safe isolation of the engine during shutdown and maintenance.

Function of gas valve unit

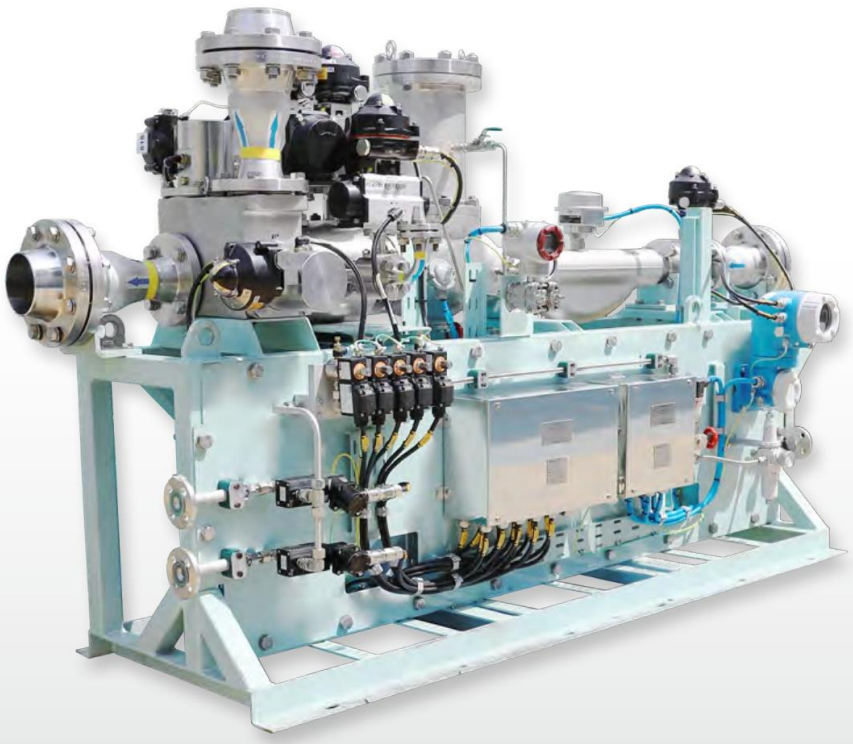
- Leakage test before engine start
- Suppling the gas by engine control system
- Purging with nitrogen before maintenance service
- Quick stop at the end of DF operation mode
- Quick stop in case of an emergency mode



››› Controls the flow

Specification

Item	Specification
GVU Type	Vertical / Horizontal / Enclosure / Open
Pipe Connection	DN 50 ~ DN 100
Valve Type	Ball Valves, Axial Valves
Design Pressure	16 bar
Service Media	Gas
Media Temperature	-25 ~ 60℃
Ambient Temperature	0 ~ 60℃
Ex Classification	ATEX, IECEx
Compressed Air Pressure	5 ~ 9bar
Options	Flowmeter, Filter



Supply Reference - LNG Carrier

No.	Area	Owner/Client	PROJECT NAME	TYPE OF VESSEL	VESSEL QTY	SHIP YARD	CLASS	ENGINE	TANK	ACTUATOR MAKERAREA
1	CHINA	CMES	DSIC 175K LNGC G175K-1	LNGC	4	DSIC	LR+CCS			EMERSON
2	CHINA	CNOOC / MOL	H1880A SERIES 174K LNGC	LNGC	6	HZS	ABS+CCS	X-DF	NO96	KSB
3	CHINA	COSCO SHIPPING CO., LTD. / K-LINE	H1892A SERIES 174K LNGC	LNGC	2	HZS	ABS+CCS	X-DF	NO96	KSB
4	CHINA	COSCO SHIPPING CO., LTD. / MOL	H1831A SERIES 174K LNGC	LNGC	6	HZS	ABS+CCS	X-DF	NO96	KSB
5	CHINA	CSSC SHIPPING CO., LTD. / MOL	H1827A SERIES 174K LNGC	LNGC	2	HZS	LR+CCS	X-DF	NO96	KSB
6	DENMARK	CELSIUS SHIPPING	2459 SERIES 180K LNGC	LNGC	8	SHI	LR	X-DF	MKIII	KSB
7	GREECE	ALPHAGAS	#8105 SERIES 174K LNGC	LNGC	3	HSHI	DNV	X-DF	MKIII	EMERSON
8	GREECE	MARANGAS	SN2425 SERIES 174K LNGC	LNGC	3	SHI	BV	X-DF	MKIII	KSB
9	GREECE	MARANGAS	2528 SERIES 174K LNGC	LNGC	11	DSME	ABS	ME-GI	NO96	KSB
10	GREECE	TMS CARDIFF GAS	2635 SERIES 174K LNGC	LNGC	2	SHI	ABS	ME-GA	MKIII	SCANA
11	JAPAN	MOL	QATAR GAS 1790 SERIES 174K LNGC	LNGC	4	HZS	ABS+CCS	X-DF	NO96	KSB
12	JAPAN	NYK	2580 SERIES 174K LNGC	LNGC	4	SHI	DNV	X-DF	MKIII	EMERSON
13	JAPAN	NYK / C-LNG	QATAR GAS 1797 SERIES 174K LNGC	LNGC	2	HZS	ABS+CCS	X-DF	NO96	KSB
14	KOREA	H-LINE SHIPPING CO., LTD.	#8025 SERIES H-LINE SHPPING 174K LNGC	LNGC	4	HSHI	ABS	X-DF	MKIII	EMERSON
15	KOREA	H-LINE SHIPPING CO., LTD.	EXXONMOBIL 2607 SERIES 174K LNGC	LNGC	4	SHI	LR+KR	ME-GA	MKIII	EMERSON
16	KOREA	HYUNDAI GLOVIS	8170 HYUNDAI GLOVIS 174K LNGC	LNGC	1	HSHI	DNV-KR	X-DF	MKIII	EMERSON
17	KOREA	HYUNDAI LNG SHIPPING	H2521 SERIES HYUNDAI LNG 174K LNGC	LNGC	2	DSME	KR	ME-GI	NO96	KSB
18	KOREA	HYUNDAI LNG SHIPPING	#2451 SERIES HYUNDAI 174K LNG CARRIER	LNGC	2	DSME	KR	ME-GI	NO96	EMERSON
19	KOREA	KC(H-LINE, SK, PAN OCEAN)	QATAR GAS 2546 SERIES 174K LNGC	LNGC	11	DSME	BV-KR	ME-GA	NO96	TBD
20	KOREA	KC(H-LINE, SK, PAN OCEAN)	QATAR GAS 2611 SERIES 174K LNGC	LNGC	4	SHI	ABS	ME-GA	MKIII	KSB
21	KOREA	KOREA SM LINE	SN2233 SERIES KOGAS 7.5K LNGC	LNGC	2	SHI	KR			EMERSON
22	KOREA	KOREA SM LINE	#3185 SERIES KSL 174K LNGC(SHELL)	LNGC	4	HHI	KR	X-DF	MKIII	EMERSON
23	KOREA	PAN OCEAN	#3221 SERIES PAN OCEAN 174K LNGC(SHELL)	LNGC	4	HHI	DNV-KR	X-DF	MKIII	EMERSON
24	KOREA	PAN OCEAN	SN2426 PANOCEAN 174K LNGC	LNGC	1	SHI	ABS	X-DF	MKIII	KSB
25	MALAYSIA	MISC	SN2364 SERIES MISC 174K LNGC	LNGC	2	SHI	ABS	X-DF	MKIII	KSB
26	NORWAY	KNUTSEN	#8091 SERIES KNUTSEN 174K LNGC(SHELL)	LNGC	9	HSHI	LR	X-DF	MKIII	EMERSON
27	RUSSIA	SOVCOMFLOT	#8006 SERIES SOVCOMFLOT 174K LNGC	LNGC	3	HSHI	BV	X-DF	MKIII	EMERSON
28	RUSSIA	SOVCOMFLOT	SN2366 SERIES ARCTIC LNG-2 ICEBREAKING LNGC	ICEBREAKING LNGC	15	SHI	BV	X-DF	MKIII	ROTORK/PLEIGER
29	TURKEY	Pardus Energy Limited(BOTAS)	#2945 Pardus Energy Limited 170K FSRU	FSRU	1	HHI	BV	DFDE	MKIII	EMERSON
30	UK	JP MORGAN	#3187 SERIES JP MORGAN 174K LNGC(SHELL)	LNGC	1	HHI	DNV	X-DF	MKIII	EMERSON
31	UK	JP MORGAN	SN2592 SERIES 174K LNGC	LNGC	6	SHI	ABS	ME-GA	MKIII	SCANA
32	UK	JP MORGAN	2596 SERIES QATAR GAS 174K LNGC	LNGC	14	SHI	ABS	ME-GA	MKIII	SCANA

Supply Reference - LNG Terminal

Manzanillo LNG Terminal / Mexico
- EPC / END USER : SAMSUNG ENG / CFE
- Delivery : 2010
- Cryogenic Gate, Globe, Check, Butterfly V/V

PANAMA LNG Terminal / PANAMA
- EPC / END USER : POSCO E&C / AES
- Delivery : 2017
- Cryogenic Gate, Globe, Check, Butterfly V/V

Incheon LNG Terminal 3
- 2001 ~ 2013
- Gate, Globe, Check, Butterfly, Ball V/V
- Class 150 ~ 900, 1360 EA

SamChuck LNG Terminal
- 2013 ~ ongoing
- Gate, Globe, Check, Butterfly
- Class 150 ~ 900, 846 EA

Ogishima LNG Terminal / Japan
- EPC / END USER : IHI Corp / Tokyo Gas
- Cryogenic Gate, Globe, Check

PyengTaek LNG Terminal
- 2004 ~ 2012
- Gate, Globe, Check, Butterfly, Ball V/V
- Class 150 ~ 1500, 1652 EA

Tongyeong LNG Terminal
- 2001 ~ 2012
- Gate, Globe, Check, Butterfly, Ball V/V
- Class 150 ~ 900, 1599 EA

SOMA LNG Terminal II / Japan
- EPC / END USER : IHI Corp / JAPEX
- Delivery : 2017
- Cryogenic Gate, Globe, Check V/V

Boryeong LNG Terminal
- 2015 ~ 2018
- Gate, Globe, Check, Butterfly, Ball V/V
- Class 150 ~ 300, 66 EA

Gwangyang LNG Terminal3
- 2005 ~ 2010
- Globe, Check, Butterfly
- Class 150 ~ 900, 31 EA

Gwangyang LNGT Terminal4
- 2021~2022
- Gate, Globe, Check, Butterfly, Ball V/V
- Class 150~900, 251EA

Gwangyang LNGT Terminal6
- 2022~2023
- Gate, Globe, Check, Butterfly V/V
- Class 150~900, 62EA

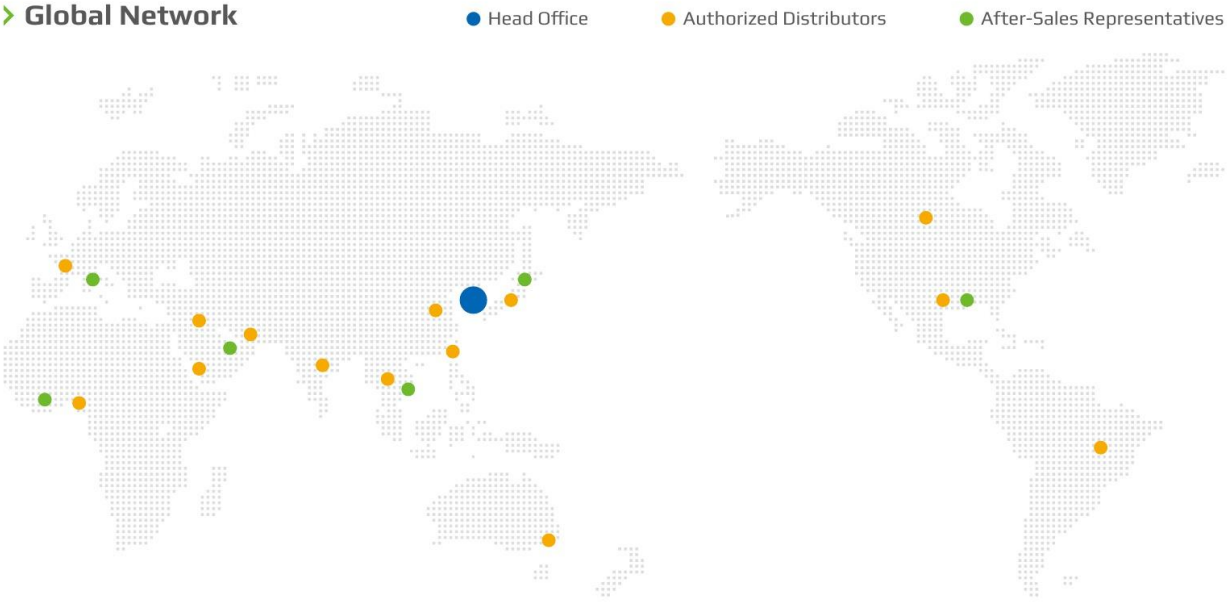
Negishi LNG Terminal / Japan
- EPC / END USER : Chiyoda Corp / Tokyo Gas
- Cryogenic Gate, Globe, Check

Hitachi LNG Terminal / Japan
- EPC / END USER : Chiyoda Corp / Tokyo Gas
- Cryogenic Gate, Globe, Check

Jeju LNG Terminal
- 2018
- Globe, Check, Butterfly V/V
- Class 150 ~ 600, 213 EA

Customers Care

Global Network



SOUTH KOREA

- BUMHAN VALVE CO., LTD
- DAESUNG TMS
- PK VALVE PLUS
- DAESUNG PIPING
- HOAM CO., LTD

SOUTH EAST ASIA

- PT. VALVE AUTOMATION INDONESIA
- S.A. PETROTECH CO., LTD

AMERICA

- MENGER VALVE(USA)
- ALEXANDER VALVE & SUPPLY (CANADA)

EUROPE & AFRICA

- G.G.C VALVES(UK)
- TNB GLOBAL

Valve Medic

After consultation with the customers, our engineers visit the customers and provide customized training and consulting to solve the problems faced by the customers. We respond to customer problems together, such as valve troubleshooting, maintenance method training, valve specification review.

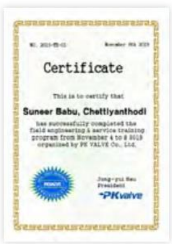
AEO

On April 30, 2023, AEO certification (KR AEO 3123007) was obtained from the Korea Customs Service. AEO certification is a system that certifies export safety management companies that meet the international standards of the World Customs Organization for trade safety and facilitation.

Training & Education

Engineer Training

Training Service for Engineers came from Middle East Fuji LLC.


Certificate

This is to certify that

Suneer Babu, Chettiyanthodi

has successfully completed the field engineering & service training program from November 4 to 8 2019 organized by PK VALVE Co., Ltd.

Jong-yul Bae
President
PKvalve


Certificate

This is to certify that

Millan, Joseph

has successfully completed the field engineering & service training program from November 4 to 8 2019 organized by PK VALVE Co., Ltd.

Jong-yul Bae
President
PKvalve

Training Service for Engineers came from Marine Systems & Solutions


Certificate

This is to certify that

Marine Systems & Solutions

Dmitry Otyukov

has successfully completed the PK's field service training program from December 6 to 10 2021 organized by PK VALVE Co., Ltd.

Yoon-chul Cho
CEO
PKvalve

Valve Academy

PK VALVE&ENGINEERING is the only valve manufacture in the world that has been running the “Valve Academy” program since 2000 to strengthen communication with customers. It was first held free courses for valve agency employees in terms of valve job training, and it was opened to general customers in 2005 at the request of major customers. In 2023, the “18th Valve Academy” was held to expand communication with customers.

Head Office & Factory

Address 51567, 80, Gongdan-ro, Seongsan-gu, Changwon-si, Gyengsangnam-do, Republic of Korea

Tel +82-55-260 5500

Seoul Sales Office

Address 04552, 1318, Myeongdong MFirst Place, 15-1, Samil-daero 8-gil, Jung-gu, Seoul, Republic of Korea

Tel +82-55-260-5500 / 5795 / 5796

7. Management System Manual

MSM-100 REV.49

CONTROLLED COPY

MANAGEMENT SYSTEM MANUAL

□ CONTROLLED COPY: _____

80, GONGDAN-RO, SEONGSAN-GU, CHANGWON-SI, KOREA
ZIP CODE: 51567, TEL: 055-268-3781, FAX: 055-286-2112
HOMEPAGE: http://www.pkvne.com

I. Company Introduction

Since its establishment in 1946, PK Valve & Engineering Co., Ltd. is a Korean leading valve manufacturing company producing and supplying various kinds of steel valves including carbon steel, stainless steel, low-alloy steel, and high special alloy steel valves for petrochemical industry, chemical industry, oil & gas industry, power plant, or nuclear power plant.

PK V&E has been producing quality valves of large range that meet the requirements of both domestic and foreign customers on the basis of advanced technologies, wide experiences, and skilled personnel, and makes every efforts to supply best-quality valve products with the highest competitive price and delivery by constructing a consistent work system for design, pattern manufacturing, melting, casting process, fabrication process, and testing and inspection.

2) History

- 1946: Established Busan Pokum Ind. Company in Busan, Korea
- 1968: Changed to Busan Pokum Ind. Co., Ltd.
- 1971: Obtained KS (Korean Industrial Standard) manufacturing license certification for Bronze & Cast Iron Valves
- 1975: Removed all facilities and factory to Chang-won Industrial Complex
  Obtained KS manufacturing license certification for Cast Steel & Marine Valves
- 1978: Approved API 6D Pipe Line Valves (Gate, Check, Ball, Plug) Manufacturer by API
  Approved Carbon Steel & Stainless Steel Castings Manufacturer by KR
- 1980: Renamed to Pan-Korea Metal Ind. Co., Ltd.
  Approved Steel Casting Manufacturer by Lloyd's
- 1981: Obtained Manufacturing License for Nuclear Power Plant Valves
  Approved Steel Casting Manufacturer by Nippon Kaiji Kyokai
- 1983: Approved Steel Casting Manufacturer by DNV
- 1985: Developed Cryogenic Valves
- 1986: Obtained Patent of Manufacturer for Emergency Shutoff Ball Valve
  Approved Steel Castings Manufacturer by BV
- 1987: Developed Pressure Steel Type Valves for high pressure and high temperature
- 1993: Obtained ISO 9001 certificate for quality system by BVQI
- 1996: Developed Bellows Seal Gate & Globe, Metal Seat Ball, Wafer Tilting Check valves
- 1997: Obtained KEPIC certificate for mechanical nuclear engineering (MN)
- 1999: Developed Low Emission Packing for valve and Super Duplex Stainless Steel
- 2000: Developed Triple Offset Butterfly valve
- 2001: Obtained CE certificate for PED/97/23/EC by SGS UK
- 2005: Obtained API Monogram certificate for API Std. 600 Bolted Bonnet Gate Valve
- 2005: Obtained ISO 14001 & OHSAS 18001 certificate by BVQI
- 2006: Renamed to PK Valve Co., Ltd.
- 2007 :Changed Notify Body(NB) for CE certificate (SGS UK → BV Internationally Certified)
- 2009: Obtained N, NPT Certificate of Authorization by ASME
- 2011 : Material R&D Center
  Shipment of 88 inch Gate valve which is the biggest in the world
- 2014 : Obtained SIL Certificate
  Obtained TR-CU Certificate
- 2015 : Shipment of 92 inch Gate valve which is the biggest in the world
- 2016 : Obtained ABS Certificate
- 2022 : PK Valve & Engineering Co., Ltd. Company Name Change

3) Certifications

NO.	Certification Body	Scope of Certification	Remarks
1	BV Internationally Certified	Design/Development, Production and Servicing of Gate, Globe, Check, Ball, Plug & Butterfly Valve and Steel Casting	ISO 9001: 2015 ISO 14001: 2015 OHSAS 18001:2007
2	American Petroleum Institute	API 6D & API 600 Monogram	
3	Korea Register of Shipping	Carbon and Stainless Steel Castings	
4	Lloyd's Register of Shipping	Steel Casting : Carbon and Carbon-manganese, Austenitic stainless	
5	Nippon Kaiji Kyokai	Carbon Steel Castings	
6	DNV-GL	Steel Castings : Carbon and Carbon-manganese, Austenitic stainless	
7	Bureau Veritas	Steel Castings in Carbon steel, Alloy steel, Austenitic stainless steel, Duplex steel and Al-Bronze steel	
8	Korea Electric Association	- Construction of Class 1, 2, 3 line Valve - Fabrication of Class 1, 2, 3 parts & appurtenance - Material organization manufacturing casting and supplying ferrous, non-ferrous and welding material related to above items	KEPIC-MN
9	BV Internationally Certified	Casting Gate, Globe, Swing check, Tilting check, Lift check, Ball, Butterfly Valve & Forged Ball Valve	PED 2014/68/EU
10	ASME (American Society of Mechanical Engineers)	Construction of Class 1, 2 & 3 valves.	ASME N
		Class 1, 2 & 3 fabrication without design responsibility and fabrication with design responsibility for Class 1, 2 & 3 appurtenances and as a Material Organization manufacturing and supplying ferrous & nonferrous material.	ASME NPT
11	SGS-TUV	Gate, Globe, Butterfly, Ball Valve	SIL Level II
12	Russian Certification Institute	Gate, Globe, Check, Butterfly, Ball Valve	TR-CU
13	American Bureau of Shipping	Steel Casting : Carbon, Low Alloy and Stainless steel	

II. SHEQ Management Policy

On the basis of "Base on Reliability" as a fundamental management philosophy, all employees at PK Valve & Engineering Co., Ltd. ("PK V&E") respect human life and worker's health care before all production activities, provide satisfactory products and services that meet the requirements of customers by means of management activities in harmony with environment and continuing technological development and quality innovations, and further make every efforts to fulfill our social responsibilities and obligations with the realization of human happiness as our top priority, including the policies specified below.

- Effective operation of Quality & SHE (Safety, Health, and Environment) management system and complying with regulatory.
- Customer satisfaction and enhance competitiveness.
- Continual improvement to minimize environment effects.
- Participation of workers and preventing potential accidents through proactive hazard control.

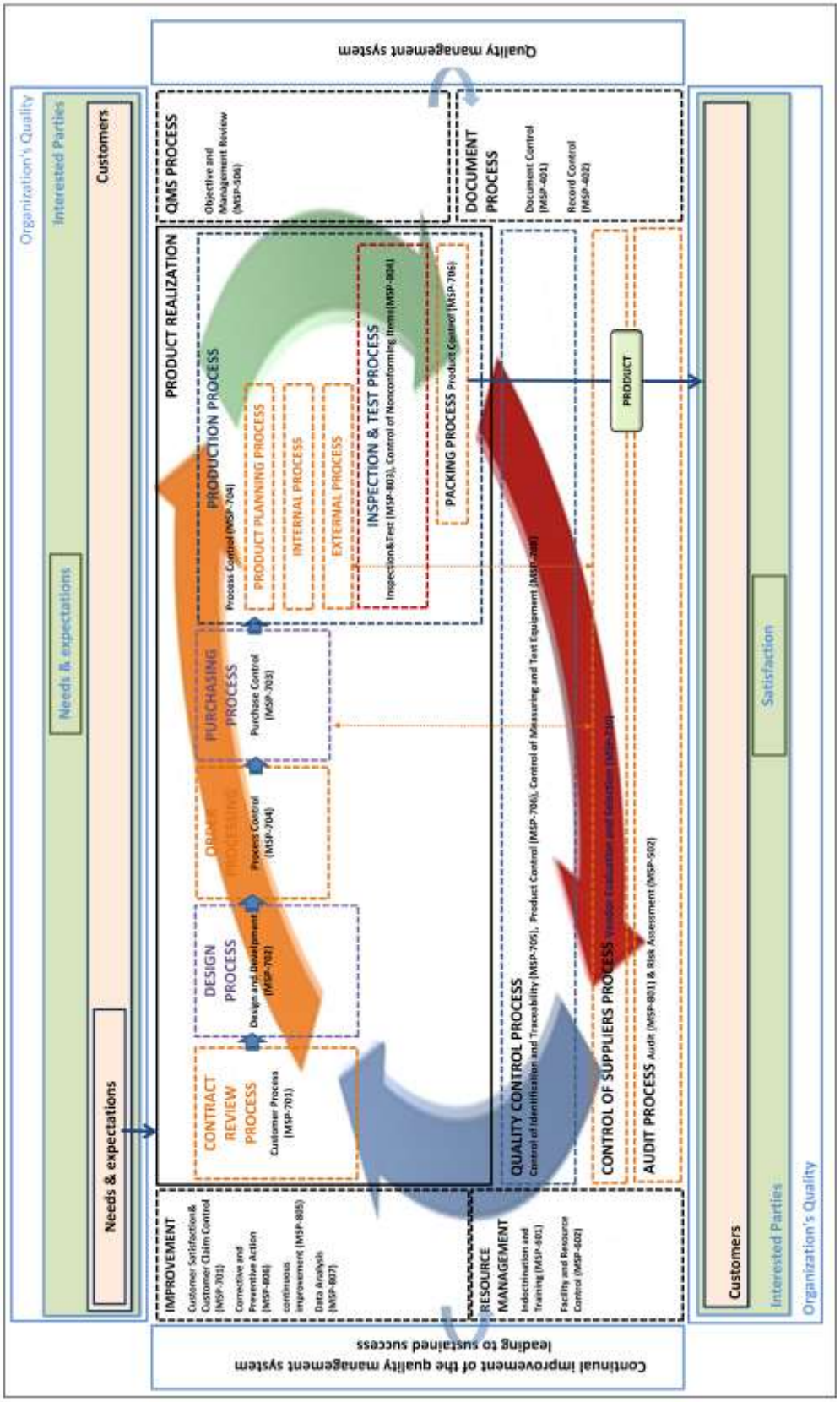
PK Valve & Engineering Co., Ltd. recognizes that all employees can create prosperous future in harmony with environment, customer satisfaction, and industrial accidents through knowledge management for quality & safety, health and environment. It is imperative that we all take proactive actions to achieve the highest level of knowledge management.

PK Valve & Engineering Co., Ltd.

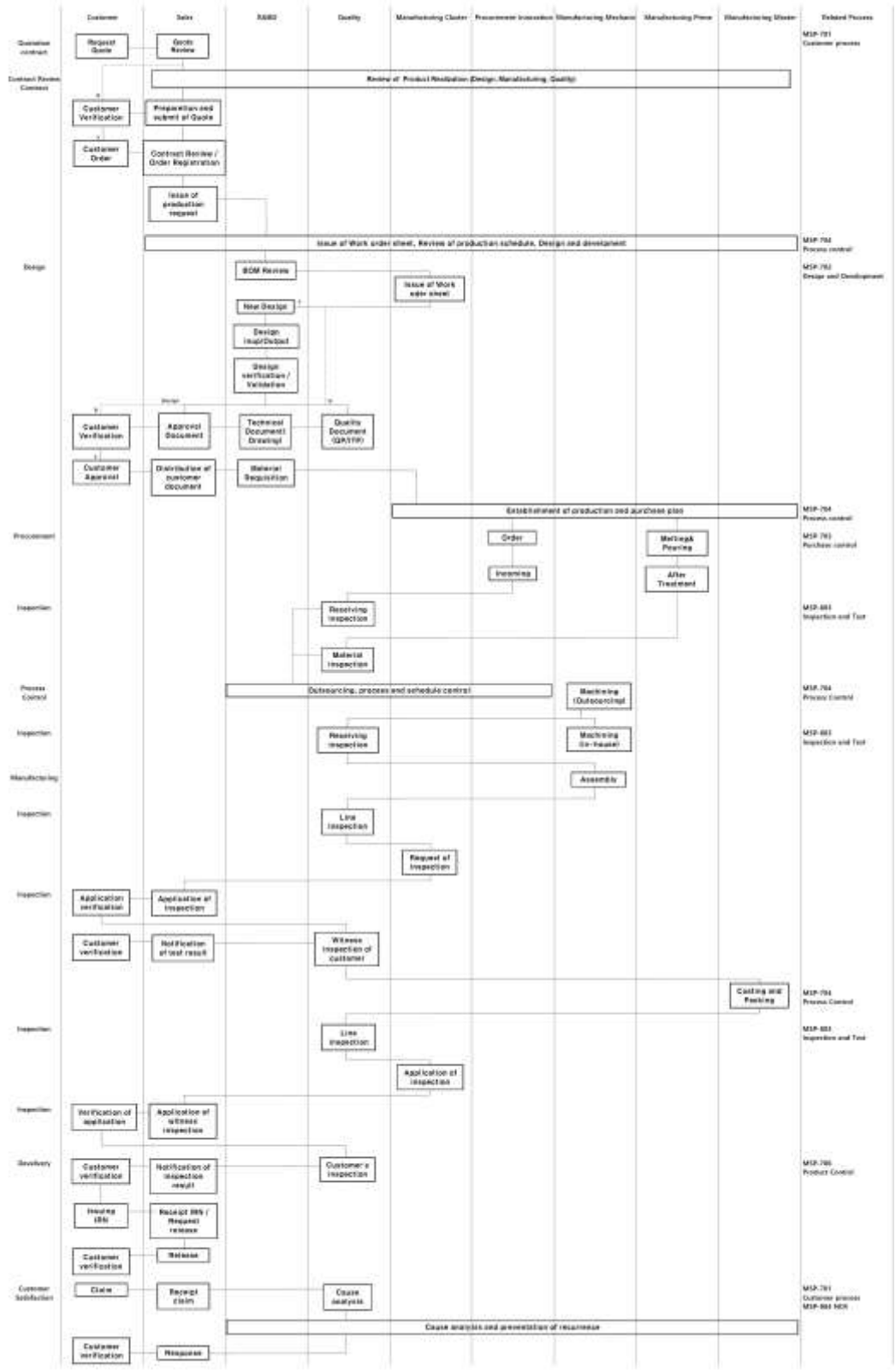
Young Chan, Chun
CEO

2022.07.20
Date

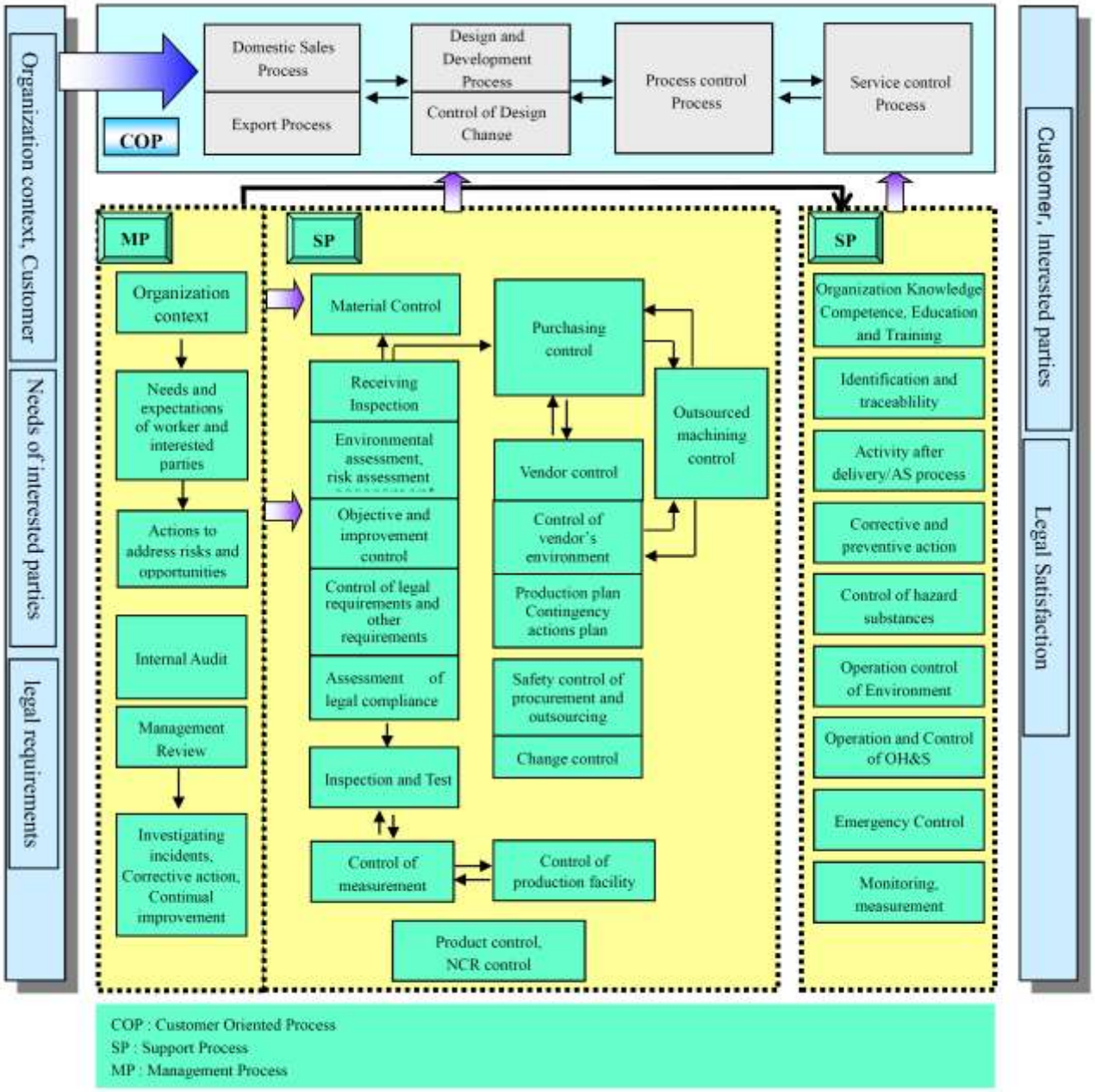
III. Management System Chart (Quality)



III. Management System Chart : Product Realization Process



III. Management System Chart (Environment, Safety&Health)



IV. Revision Status

Revision date	Revision No.	Revision contents	Remark
2018.07.23	42	This manual was overall revised according to ISO 9001 : 2015, ISO 14001 : 2015	
2019.05.08	43	Change of organization : Outsourcing Team is added	
2019.11.27	44	Missed code requirements (API Q1) are added. And related procedures are identified.	
2020.02.03	45	Change of organization : Production Technology Team is added	
2020.06.15	46	This manual was overall revised according to ISO 45001 : 2018	
2022.03.31	47	Change of Organization and Management System Chart	
2022.06.17	48	Change of Company Name and Reorganization	
2022.07.20	***49***	***Added PE(S)R 2016***	

Contents

Prepared by	Reviewed by	Approved by
Y. M. Kim	J. H. Hong	Y. C. Chun
QA Team Engineer (July 20, 2022)	QA Manager (July 20, 2022)	CEO (July 20, 2022)

1. Scope

This Management Manual specifies and documents a effective implementing method of the SHEQ management system to establish, document, implement, maintain and continually improve a SHEQ management system of PK Valve & Engineering Co., Ltd. (hereinafter referred to as "PKV&E"), and applies to the products, activities, and services specified below.

1) Design, development, production and servicing of valves (GATE, GLOBE, CHECK, BALL, PLUG & BUTTERFLY)
2) Design, development, production and servicing of steel casting
3) SHE activities relating to the design, development, production and servicing of above products
4) Address : 80, Gongdan-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea

Our management system includes all requirements of ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, PED 2014/68/EU, ***PE(S)R 2016,*** API Q1 9th Edition, API Spec 6D and API Std.600.

2. References

This management manual includes the following references.

1) ISO 9000:2015 Quality Management System– Basic provisions and definitions
2) ISO 9001:2015 Quality Management System– Requirements
3) ISO 9004:2000 Quality Management System– Requirements
4) ISO 14001:2015 Environmental Management System– Requirements
5) ISO 14004:2004 Environmental Management System– General Guidelines on Principle, Systems and Support Techniques
6) ISO 45001:2018 health and safety management systems– Requirements
7) API Q1 9th Edition: Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry
8) API 6D 24rd Edition: Specification for Pipeline Valves
9) API 600 14th Edition: Bolted Bonnet Steel Gate Valves
10) PED 2014/68/EU Pressure Equipment Directive
11) ***PE(S)R 2016 The Pressure Equipment (Safety) Regulations 2016***

3. Definitions

For the purpose of this Management Manual, except the followings, the terms and definitions presented above apply.

1) SHEQ management system
   A management system to direct and management a company in connection with safety, health, environment, and quality activities (hereinafter referred to as "management system")

4. Context of the organization

4.1 Understanding the organization and its context

1) The PK V&E shall determine external and internal issues that are relevant to its purpose and its strategic direction and that affect its ability to achieve the intended result(s) of its quality
2) The PK V&E shall monitor and review information about these external and internal issues.
3) For SHE, such issues shall include SHE conditions being affected by or capable of affecting the PK V&E.
4) Positive or negative factors or consideration conditions may be included in the issue. Issues are composed of external issues and internal issues, external issues have issues arising from legal, technical, competitive, market, cultural, social and economic environments. Internal issues have issues related to PK V&E's values, culture, knowledge and performance. The PK V&E shall determine internal and external issues in consideration of PK V&E's characteristics and capabilities.

4.2 Understanding the needs and expectations of interested parties and workers

PK V&E's ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, the PK V&E shall determine:

1) the workers and other interested parties that are relevant to the SHEQ management system.
2) the relevant requirements, needs and expectations requirements of workers and other interested parties.
3) PK V&E's compliance obligations arising from needs and expectations related to the SHE.
4) Applicable team shall review information on stakeholders and their related needs in connection with the PK V&E's situation and manage by reflecting in the improvement plan after the risk is determined for the identified needs and expectations.
5) The principal team and each team manager decide risks by considering the understanding the organization and its context and needs and expectations of interested parties.

4.3 Determining the scope of the management system

1) The PK V&E shall determine the boundaries and applicability of the management system to establish its scope. When determining this scope, the PK V&E shall consider and scope is described paragraph 1.0
   (1) the external and internal issues for understanding the situation
   (2) the requirements of relevant interested parties and terms of compliance in the environment
   (3) In the case of environment, safety and health, unit, function and physical boundary
   (4) Activities, products and services
   (5) The authorities and abilities to administer and influence
2) The all requirements of management system shall be applied if they are applicable within the determined scope of its management system.
3) The scope of management system shall be available and be maintained as documented information. The scope shall state the types of products and services covered, and provide justification for any requirement of this Management Manual that the organization determines is not applicable to the scope of this

Management Manual.

4) Conformity to this Management Manual may only be claimed if the requirements determined as not being applicable do not affect the PK V&E's ability or responsibility to ensure the conformity of products and services and the enhancement of customer satisfaction.

4.4 Management System and processes

1) The PK V&E shall establish, implement, maintain and continually improve a management system, including the processes needed and their interactions, in accordance with the requirements of applicable Standard.
2) The PK V&E shall determine the processes needed for the management system and their application throughout the PK V&E, and shall:
   (1) determine the inputs required and the outputs expected from these processes;
   (2) determine the sequence and interaction of these processes;
   (3) determine and apply the criteria and methods (including monitoring, measurements and related performance indicators) needed to ensure the effective operation and control of these processes;
   (4) determine the resources needed for these processes and ensure their availability and consider the contractor and outsourcing activities.
   (5) assign the responsibilities and authorities for these processes;
   (6) address the risks and opportunities as determined in accordance with the requirements of risk control
   (7) evaluate these processes and implement any changes needed to ensure that these processes achieve their intended results;
   (8) improve the processes and the management system.
3) To the extent necessary, the PK V&E shall:
   (1) maintain documented information to support the operation of its processes;
   (2) retain documented information to have confidence that the processes are being carried out as planned.
4) Control of management manual
   (1) The management manual shall be prepared by QA Team Engineer, reviewed by the QA Manager and approved by the CEO.
   (2) QA Team Engineer shall distribute the controlled copy of approved management manual to applicable Team and other necessary organizations.
   (3) QA Team Engineer shall keep the distribution status of controlled copies for management manual.
5) The management manual shall be implemented, maintained and improved in accordance with applicable procedures that describe details of process.

5. Leadership

5.1 Leadership and commitment

5.1.1 General

The CEO shall demonstrate leadership and commitment with respect to the management system by:

1) taking accountability for the effectiveness of the SHEQ management system;
2) ensuring that the management policy and objectives are established for the management system and are

compatible with the context and strategic direction of the PK V&E.
3) ensuring the integration of the management system requirements into the PK V&E's business processes;
4) promoting the use of the process approach and risk-based thinking;
5) ensuring that the resources needed for the management system are available;
6) communicating the importance of effective management system and of conforming to the management system requirements;
7) ensuring that the management system achieves its intended results;
8) engaging, directing and supporting persons to contribute to the effectiveness of the management system;
9) promoting improvement;
10) supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility.
11) developing, leading and promoting a culture in PK V&E that supports the intended outcomes of the OH&S management system.
12) protecting workers from reprisals when reporting incidents, hazards, risks and opportunities
13) ensuring the PK V&E establishes and implements a process(es) for consultation and participation of workers
14) supporting the establishment and functioning of health and safety committees

5.1.2 Customer focus
The CEO shall demonstrate leadership and commitment with respect to customer focus by ensuring that:
1) customer and applicable statutory and regulatory requirements are determined, understood and consistently met;
2) the risks and opportunities that can affect conformity of products and services and the ability to enhance customer satisfaction are determined and addressed;
3) the focus on enhancing customer satisfaction is maintained

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Objective and Management Review, Customer Process

5.2 Policy

5.2.1 Developing the SHEQ policy
The CEO shall establish, implement and maintain a quality, environment, health and safety policy that:
1) is appropriate to the purpose and context of the PK V&E and supports its strategic direction;
2) provides a framework for setting SHEQ objectives;
3) includes a commitment to satisfy applicable requirements;
4) includes a commitment to continual improvement of the SHEQ management system
5) includes a commitment to prevent pollution related to the context of the PK V&E and to protect the environment which including other specific commitment
6) includes a commitment to provide safe and healthy working conditions for the prevention of work-related

injury and ill health

7) includes a commitment to eliminate hazards and reduce OH&S risks

8) includes a commitment to meet consultation and participation of workers and PK V&E's compliance obligations

9) includes a commitment to continual improvement of the SHEQ management system;

10) includes a commitment to consultation and participation of workers, and where they exist, workers' representatives.

5.2.2 Communicating the quality, environment, safety and health policy

The quality, environment, safety and health policy shall

1) be available and be maintained as documented information;

2) be communicated, understood and applied within the PK V&E;

3) be available to relevant interested parties, if necessary.

5.2.3 Control of management policy

Quality policy shall be controlled by the QA Manager and environment, safety and health policy shall be controlled by Management Supporting Team Manager.

5.3 Organizational roles, responsibilities and authorities

The CEO shall ensure that the responsibilities and authorities for management system are assigned, communicated and understood throughout the organization. He shall assign the responsibility and authority for:

1) ensuring that the management system conforms to the requirements of applicable Standard;

2) ensuring that the processes are delivering their intended outputs;

3) reporting on the performance of the management system and on opportunities for improvement to CEO

4) ensuring the promotion of customer focus throughout the PK V&E ;

5) ensuring that the integrity of the management system is maintained when changes to the management system are planned and implemented.

5.4 Consultation and participation of workers

1) The PK V&E shall establish, implement and maintain a process(es) for consultation and participation of workers (workers' representatives) all applicable levels and functions in the development, planning, implementation, performance evaluation and actions for improvement of the SHE management system.

2) The PK V&E shall :

(1) provide mechanisms, time, training and resources necessary for consultation and participation;

(2) provide timely access to clear, understandable and relevant information about the OH&S management system;

(3) determine and remove obstacles or barriers to participation and minimize those that cannot be removed. Obstacles and barriers can include failure to respond to worker inputs or suggestions, language or literacy

barriers, reprisals or threats of reprisals and policies or practices that discourage or penalize worker participation.

3) emphasize thae consultation of non-managerial workers on the following:
(1) determining the needs and expectations of interested parties
(2) establishing the OH&S policy
(3) assigning organizational roles, responsibilities and authorities as applicable
(4) determining how to fulfil legal requirements and other requirements
(5) establishing OH&S objectives and planning to achieve them
(6) determining applicable controls for outsourcing, procurement and contractors
(7) determining what needs to be monitored, measured and evaluated
(8) planning, establishing, implementing and maintaining an audit programme(s)
(9) continual improvement activities are implemented in consultation with workers

4) emphasize the participation of non-managerial workers in the following:
(1) determining the mechanisms for their consultation and participation
(2) identifying hazards and assessing risks and opportunities
(3) determining actions to eliminate hazards and reduce OH&S risks
(4) determining competence requirements, training needs, training and evaluating training
(5) determining what needs to be communicated and how this will be done
(6) determining control measures and their effective implementation and use
(7) investigating incidents and nonconformities and determining corrective actions
(8) ensuring participation through other potential risk discovery, TBM activities, and safety and health committee activities

6. Planning

6.1 Actions to address risks and opportunities

6.1.1 When planning for the management system, the PK V&E shall consider the issues referred to in paragraph 4.1 and 4.2 and determine the risks and opportunities that need to be addressed to:
1) give assurance that the SHEQ management system can achieve its intended result(s);
2) enhance desirable effects;
3) prevent, or reduce, undesired effects including external potentials that affect the organization;
4) achieve continual improvement.
5) Environment, safety and health aspects
6) Consider all compliance obligations

6.1.2 PK V&E shall plan
1) actions to address these risks and opportunities;

2) how to :
(1) integrate and implement the actions into management system processes
(2) evaluate the effectiveness of these actions.
3) Actions taken to address risks and opportunities shall be proportionate to the potential impact on the conformity of products and services.
4) Within the scope of the SHEQ management system, the management supporting team shall determine potential emergency situations, including those that can have an environmental impact when risk assessment and maintained in an emergency response process.
5) When determining the risks and opportunities to the OH&S management system and its intended outcomes that need to be addressed, the management supporting team shall take into account;
(1) hazards
(2) OH&S risks and other risks
(3) OH&S opportunities and other opportunities
(4) legal requirements and other requirements
6) The processes and actions necessary to determine and address opportunities (section 6.1.5, 3) and decision risks and opportunities shall be maintained as documented information
7) Opportunities can lead to the adoption of new practices, launching new products, opening new markets, addressing new clients, building partnerships, using new technology and other desirable and viable possibilities to address the PK V&E's or customer's needs.

6.1.3 Determination of environmental aspect, risk factor, risk assessment and control method (environment, safety and health)

6.1.3.1 Hazard identification, assessment of risks and opportunities

The management supporting team shall establish, implement and maintain a process(es) for continual and active hazard identification. The process(es) shall take into account but not be limited to:

1) how work is organized social factors (including workload, work hours, victimization, harassment and bullying), leadership and the culture in the organization;
2) routine and non-routine activities and situations, including hazards arising from:
(1) infrastructure, equipment, materials, substances and the physical conditions of the workplace;
(2) product and service design, research, development, testing, production, assembly, construction, service delivery, maintenance and disposal;
(3) human factors;
(4) how the work is performed;
3) past relevant incidents, internal or external to the PK V&E, including emergencies, and their causes;
4) potential emergency situations;
5) people, including consideration of:
(1) those with access to the workplace and their activities, including workers, contractors, visitors and other persons;
(2) those in the vicinity of the workplace who can be affected by the activities of the PK V&E;

(3) workers at a location not under the direct control of the PK V&E;

6) other issues, including consideration of:

(1) the design of work areas, processes, installations, machinery/equipment, operating procedures and work organization, including their adaptation to the needs and capabilities of the workers involved;

(2) situations occurring in the vicinity of the workplace caused by work-related activities under the control of the PK V&E;

(3) situations not controlled by the PK V&E and occurring in the vicinity of the workplace that can cause injury and ill health to persons in the workplace;

7) actual or proposed changes in organization, operations, processes, activities and OH&S management system

8) changes in knowledge of, and information about, hazards.

6.1.3.2 Assessment of OH&S risks and other risks to the OH&S management system

1) Within the defined scope of the environmental management system, the PK V&E shall determine the environmental aspects of its activities, products and services that it can control and those that it can influence, and their associated environmental impacts, considering a life cycle perspective.

(1) assess OH&S risks from the identified hazards, while taking into account the effectiveness of existing controls;

(2) determine and assess the other risks related to the establishment, implementation, operation and maintenance of the OH&S management system.

2) The organization's methodology(ies) and criteria for the assessment of OH&S risks shall be defined with respect to their scope, nature and timing to ensure they are proactive rather than reactive and are used in a systematic way. Documented information shall be maintained and retained on the methodology(ies) and criteria.

3) Assessment of OH&S opportunities and other opportunities to the OH&S management system

The PK V&E shall establish, implement and maintain a process(es) to assess:

(1) OH&S opportunities to enhance OH&S performance, while taking into account planned changes to the organization, its policies, processes or its activities and:

(2) opportunities to adapt work, work organization and work environment to workers;

(3) opportunities to eliminate hazards and reduce OH&S risks;

(4) other opportunities for improving the OH&S management system.

(5) assessment of opportunities is managed by reflecting in the process of organization's context identification, risks and determination of opportunities because OH&S risks and OH&S opportunities can result in other risks and other opportunities to the organization.

4) The methodology of risk assessment and determining controls

(1) the company methodology for hazard identification and risk assessment shall:

a) be defined with respect to its scope, nature and timing to ensure it is proactive rather than reactive;

b) provide hazard identification, priority setting, documentation and applied pan of proper management.

(2) for the management of change, the company shall identify OH&S hazard and risks associated with changes in the organization, OH&S management system, or its activities, prior to the introduction of such changes.

(3) When determining controls, they shall ensure that the results of these assessments are considered. When determining controls, or considering changes to existing controls, consideration shall be given to reducing the risks according to the following hierarchy.

a) elimination
b) substitution
c) engineering controls
d) signage/warning and/or administrative controls
e) personal protective equipment.

(4) The company shall ensure that the significant risks are taken into account in establishing, implementing, and maintaining its management system, and keep it up to date.

5) Regular risk assessment shall be carried out at least once a year.

6) Hazard identification, risk assessment and risk control shall follow “Risk Assessment Procedure”

6.1.3.3 Environmental aspects

1) Within the defined scope of the environmental management system, the PK V&E shall determine the environmental aspects of its activities, products and services that it can control and those that it can influence, and their associated environmental impacts, considering a life cycle perspective.
2) When determining environmental aspects, the PK V&E shall take into account:
   (1) change, including planned or new developments, and new or modified activities, products and services;
   (2) abnormal conditions and reasonably foreseeable emergency situations.
3) The PK V&E shall determine those aspects that have or can have a significant environmental impact, i.e. significant environmental aspects, by using established criteria.
4) The management supporting team shall communicate its significant environmental aspects among the various levels and functions of the organization, as appropriate.
5) The management supporting team shall maintain documented information of its:
   (1) environmental aspects and associated environmental impacts;
   (2) criteria used to determine PK V&E’s significant environmental aspects;
   (3) significant environmental aspects;
6) Significant environmental aspects can result in risks and opportunities associated with either adverse environmental impacts (threats) or beneficial environmental impacts (opportunities).
7) Regular environmental impacts assessment shall be carried out at least once a year.
8) Environmental impacts assessment shall follow “Environmental Impacts Assessment Procedure”.

6.1.4 Compliance obligations

1) The management supporting team shall:
   (1) determine and have access to the compliance obligations related to its environmental aspects;
   (2) determine how these compliance obligations apply to the PK V&E;
   (3) take these compliance obligations into account when establishing, implementing, maintaining and continually improving PK V&E’s environmental management system.
2) The management supporting team shall maintain documented information of PK V&E’s compliance

obligations.
3) Compliance obligations can result in risks and opportunities to the PK V&E.

6.1.5 Planning action
1) Each Team Manager shall plan for opportunities of quality and environment risk determined above 6.1.1.
(1) significant environmental aspects, compliance obligations, and take actions to address risks and opportunities
(2) Actions to address risks and opportunities shall be integated the management system process (action plan) and it shall be implemented. As an action method of risk and opportunity, it shall be included in annual business plan of each team.
(3) The effectiveness evaluation for actions of determined risks and opportunities shall be implemented a monthly or quarterly.
(4) Actions to address risks and opportunities should correspond to the potential impact on the suitability of the product and service and it should take into account the technical options, financial, operational and business requirements of the PK V&E.
2) Options to address risks include risk avoidance, risk mitigation to capture opportunities, elimination of risk factors, change of possibility or result, risk sharing, or risk-based decision.
3) Opportunities can lead to adoption of new practices, new product launches, new market development, creation of new customers, building partnerships, leveraging new technologies, and other desirable and viable options for dealing with PK V&E or customer needs.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Planning Control, Risk Assessment, Contingency planning

6.2 Objectives and planning to achieve them

6.2.1 Objectives
The PK V&E shall establish quality objectives at relevant functions, levels and processes needed for the management system.
1) The objectives shall:
(1) be consistent with the management policy;
(2) be measurable;
(3) take into account applicable requirements (including legal requirements), the results of the assessment of risks and opportunities, the result of consultation with workers
(4) be relevant to conformity of products and services and to enhancement of customer satisfaction;
(5) be monitored and assessed;
(6) be communicated;
(7) Company's technological alternatives, requirements of financial, operational and business and needs of interested parties
(8) be updated as appropriate.
2) The organization shall maintain documented information on the objectives.

6.2.2 Planning how to achieve objectives
When planning how to achieve its objectives, the PK V&E shall determine:
1) what will be done;
2) what resources will be require;
3) who will be responsible;
4) when it will be completed;
5) how the results will be evaluated.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Planning Control, Objective and Management Review

6.3 Planning of changes

When the PK V&E determines the need for changes to the management system, the changes shall be carried out in a planned and systematic manner and PK V&E shall consider:
1) the purpose of the changes and their potential consequences;
2) the integrity of the quality management system;
3) the availability of resources;
4) the allocation or reallocation of responsibilities and authorities.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Planning Control, MOC Control

7. Support

7.1 Resources

7.1.1 General
The PK V&E shall determine the resources needed for the establishment, implementation, maintenance and continual improvement of the management system. The PK V&E shall consider:
a) the capabilities of, and constraints on, existing internal resources;
b) what needs to be obtained from external providers.

7.1.2 Personnel
The PK V&E shall determine and provide the persons necessary for the effective implementation of management system and for the operation and control of its processes. Responsibilities and authorities are as follows
1) CEO

The CEO has overall responsibilities for all items constructed by PK V&E, for establishment of management policy, and for the support of establishment and implementation of the management system. He makes the organization and grants responsibilities and authorities of each team and division for effectiveness of management system. He also approves the Management Manual.

2) Management representative
The CEO shall appoint the Manufacturing Innovation Division General Director. as a management representative who, irrespective of other responsibilities, shall have the authority and responsibility to

(1) ensure that the process necessary to management system is established, implemented, and maintained;
(2) report the result of quality management system and the needs of improvement to the CEO;
(3) ensuring initiation of action(s) to minimize the likelihood of the occurrence of nonconformities;
(4) ensuring the promotion of awareness of customer requirements throughout the organization.

3) Development Division General Director
(1) He has responsibility for the overall work of developing new Valve products.
(2) He is accountable to the CEO and reporting to him is the R&BD Center Manager.

4) Business Division General Director
(1) He has overall responsibility for production, facility maintenance, material control, product control , delivery of item, overall marketing work, reviewing customer documents, bidding, contracting and communicating with customers.
(2) He has responsibility for the administration of production, product control and delivery for the compliance with Customer requirements and the Management Manual.
(3) He is accountable to the CEO and reporting to him is Sails Team and production Team Manager.

5) Management Planning Division General Director
(1) He has overall responsibility for human resource, work and purchasing control.
(2) He is accountable to the CEO and reporting to him is each Team Manager.

6) R&BD Center Manager (R&BD Manager)
He has overall responsibility for the new design of the valves including the following and for review of Customer documents in respect of design elements.
(1) valve design and development;
(2) New product development and discovery of new business items
(3) Development of state-supported projects (materials and valves)

7) Manufacture Engineering Team
(1) valve design
(2) establishment of standards (products, power plant valves, new design products);
(3) valve-related external standard control;
(4) drawings control for products(valves), power plant valves;
(5) parts code control;
(6) material request activity;

(7) preparation of welding procedure specification;
(8) patent rights and other industrial ownership related activities;
(9) valve manufacture engineering activities.

8) Management Supporting Team Manager
(1) accounting business;
(2) establishment of business plan;
(3) business information related activity;
(4) computer related activity;
(5) presiding of management meeting.
(6) work coordination between organizations;
(7) personnel and labor management;
(8) regulation control;
(9) external indoctrination and training
(10) presiding of fire fighting, safety, environment and health activities;
(11) presiding of risk assessment;
(12) establishment of safety, health and environment objectives;
(13) grasping, reviewing and registering of safety, health and environment legal and other requirements.

9) QA Manager
(1) establishment and maintenance of management system;
(2) establishment of quality objectives;
(3) certification of external management system;
(4) qualification and certification of personnel (Auditor, QC Personnel)
(5) management manual and system procedure control;
(6) evaluation of suppliers;
(7) internal and external audit activities;
(8) control of measuring and test equipment

10) QM Manager
(1) inspection and testing activities related to valve quality;
(2) non-conformance items control;
(3) inspection such as receiving inspection and source inspection

11) Manufacturing Cluster Team Manager
(1) establishment of production schedule and tantalizations of performance records;
(2) issue of work order sheet;
(3) production processes adjustment and delivery time control;
(4) painting, packaging, and shipping;

12) Manufacturing Prime Team Manager
He is accountable to the Business Division General Director and has responsibility for manufacturing of casting, repair welding for casting material, qualification of the Heat Treatment Operator and laboratory control.

13) Manufacturing Mechanic Team Manager

He is accountable to the Business Division General Director and has responsibility for machining, welding, assembly, and welding material control.

14) Manufacturing Master Team Manager
He is accountable to the Business Division General Director and has responsibility for material control, painting process, packing process and shipping of the product.

15) Procurement Innovation Team Manager
He is accountable to the Management Planning Division General Director and has responsibility for the overall material control including control of material, approval of Purchase Order and interface between PK V&E and Vendor.

16) Common works
(1) risk assessment and environmental impact assessment connected with the Dept. (Team);
(2) establishment and implementation of SHEQ detail targets and progress plan;
(3) compliance of legal and other requirements.
(4) implementation of education and training connected with the Dept. (Team)

7.1.3 Infrastructure
The organization shall determine, provide and maintain the infrastructure necessary for the operation of its processes to achieve conformity of products and services. The infrastructure shall include.
1) buildings and associated utilities;
2) equipment, including hardware and software;
3) transportation resources
4) information and communication technology

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Facility and Resource Control

7.1.4 Environment for the operation of processes
The organization shall determine, provide and maintain the environment necessary for the operation of its processes and to achieve conformity of products and services. A suitable environment can be a combination of human and physical factors as follows. These factors can differ substantially depending on the products and services provided.
1) social (e.g. non-discriminatory, calm, non-confrontational);
2) psychological (e.g. stress-reducing, burnout prevention, emotionally protective);
3) physical (e.g. temperature, heat, humidity, light, airflow, hygiene, noise).

7.1.5 Monitoring and measuring resources
7.1.5.1 General
1) The PK V&E shall determine and provide the resources needed to ensure valid and reliable results when

monitoring or measuring is used to verify the conformity of products and services to requirements.
2) The organization shall ensure that the resources provided:
(1) are suitable for the specific type of monitoring and measurement activities being undertaken;
(2) are maintained to ensure their continuing fitness for their purpose.
3) The organization shall retain appropriate documented information as evidence of fitness for purpose of the monitoring and measurement resources.

7.1.5.2 Measurement traceability
1) When measurement traceability is a requirement, or is considered by the QM team to be an essential part of providing confidence in the validity of measurement results, measuring equipment shall be:
(1) verified or calibrated, or both, at specified intervals, or prior to *use*, against measurement standards traceable to international or national measurement standards. when no such standards exist, the basis used for calibration or verification shall be retained as documented information;
(2) identified in order to determine their status;
(3) safeguarded from adjustments, damage or deterioration that would invalidate the calibration status and subsequent measurement results.
2) The QM Team shall assess and record the validity of the previous measuring results when the equipment is found not to conform to requirements, and take appropriate action on the equipment and product affected.
3) The QM Team shall maintain the records of the result of the calibration and verification. Records shall be included as followings
(1) equipment identifications including the measurement standard for calibration;
(2) revisions following engineering changes;
(3) any out-of-specification readings as received for calibration/verification;
(4) an assessment of the impact of out-of-specification condition
(5) notification to the customer if suspect product or material has been shipped.
4) The QM Team shall identify and control suitable environmental conditions for the calibrations, inspections, measurements and tests being carried out.
5) Where computer software is used for monitoring and measuring specified requirements, the capability of computer software shall be verified to satisfy the intended application. Such verification shall be carried out prior to the first use, and re-certified as necessary.
6) When the equipment is provided from a source external to the organization, including third-part, proprietary, employee- and customer-owned equipment, the organization shall verify that the equipment is suitable and provide evidence of conformity to the requirements of this requirement.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Measurement Equipment control

7.1.6 Organizational knowledge
1) The PK V&E shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services. This knowledge shall be maintained and be made available to the extent necessary.
2) When addressing changing needs and trends, the PK V&E shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates.

3) PK V&E's knowledge is knowledge specific to the PK V&E; it is gained by experience. It is information that is used and shared to achieve the PK V&E's objectives.
4) Organizational knowledge can be based on:
   (1) internal sources (e.g. intellectual property; knowledge gained from experience; lessons learned from failures and successful projects; capturing and sharing undocumented knowledge and experience; the results of improvements in processes, products and services);
   (2) external sources (e.g. standards; academia; conferences; gathering knowledge from customers or external providers).

7.2 Competence

PK V&E shall ;
1) determine the necessary competence for personnel performing work affecting conformity to product requirements and SHEQ management system, environment aspects and risk in accordance with the "Indoctrination/Training Procedure"
2) provide training or take other actions achieved the necessary competence, and evaluate the effectiveness of the actions taken by each team manager;
3) Each Team manager shall give qualification to the following personnel who control, perform, or verify the activities designated in management system, by specifying indispensable requisites on the basis of education, training, skill and experience, and individual qualification records of such personnel shall be documented:
   (1) quality control personnel including NDE personnel;
   (2) internal auditors;
   (3) welders/welding operators;
   (4) designers;
   (5) painting workers;
   (6) heat treatment operators;
4) Training includes the quality management system training and on-the-job training of personnel (including personnel of the contractors and sub-suppliers). The PK V&E should provide on-the-job training for personnel in any new or modified job affecting SHEQ aspects;
5) Maintain appropriate records of education, training, skills and experiences.
6) In case of API monogram 600, 6D products, personnel work affecting product quality shall notify customer for the result of nonconformance of quality requirements. In case of other products, she/he shall notify customer if required by contract.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Indoctrination and Training, Design and Development, Process control, Audit, Inspection and test

7.3 Awareness

The organization shall ensure that relevant persons doing work under the organizations control are aware of:

1) the SHEQ policy and relevant objective;
2) their contribution to the effectiveness of the SHEQ management system, including the benefits of improved SHEQ performance;
3) their contribution to the effectiveness of the SHEQ management system, including the benefits of improved performance;
4) the implications of not conforming with the management system requirements including the result that not implement compliance obligations.
5) incidents and the outcomes of investigations that are relevant to them
6) hazards, OH&S risks and actions determined that are relevant to them
7) the ability to remove themselves from work situations that they consider present an imminent and serious danger to their life or health, as well as the arrangements for protecting them from undue consequences for doing so.

7.4 Communication, participation and consultation

7.4.1 Internal communication

1) The CEO shall have internal communication about management policy, management objective, management review results, OH&S information, environmental aspects, quality trends, market trends of product, all kinds of information, production and business performance, customer satisfaction, improvement proposal results, etc.
2) For communications with employees for SHEQ information, the CEO shall ensure to
   (1) involved in the development and review of policies and procedures to manage SHEQ aspects;
   (2) consulted where there are any changes affect the SHEQ aspects of working place;
   (3) represented on SHEQ matters.
3) The applicable team shall establish, implement and maintain the process(es) needed for the internal and external communications relevant to the SHEQ management system, including determining
   (1) on what it will communicate;
   (2) when to communicate;
   (3) with whom to communicate:
   (4) how to communicate
4) Internal communication methods include
   (1) morning meeting and management meeting;
   (2) posting on notice board or internal internet line;
   (3) outputs from organization activities, or activity connections between organizations.

7.4.2 External communication

1) The Company shall determine the external communication for significant SHEQ aspects as needed, document the determinations, obtain the approval of the CEO in accordance with “SHE Communication Procedure”, and then carry out the determinations.
2) The access to our SHEQ policies is given to external interested parties, and if necessary, the performance and activities of SHEQ may be released through official document, company homepage, and mass media.

3) SHEQ-related requirements of all interested parties shall be controlled and disposed by the pertinent Dept. (Team), and the decision-making be recorded and maintained.
4) Where it is necessary to monitor the perception of interested parties, the monitoring results shall be analyzed by means of questionnaire, and used for the improvement of our management system.
5) In the event of emergency, the Company shall contact relevant external organizations and receive their supports.

7.4.3 Participation and consultation

The Management Support Team Manager shall ensure workers participation for work process regarding following items related safety & health, this shall not be limited. In case of participation, employee representative(s) or employees can participate directly.

1) Hazard identification, risk assessments and determining control method.
2) Incident investigation
3) Policy, development and setting of objectives
4) Consultation for changes affecting their safety and health
5) Representation of safety and health matters
6) Affecting safety and health (If required), consultation with subcontractors

7.5 Documented information

7.5.1 General

1) The PK V&E's management system shall include:
   (1) documented information required by reference standards;
   (2) documented information determined by the PK V&E as being necessary for the effectiveness of the management system.
      a) management policy and SHEQ objectives
      b) management manual
      c) procedure and instruction to implement management system
      d) legal and other applicable requirements
2) The extent of documented information for a management system can differ from one organization to another due to:
   (1) the size of organization and its type of activities, processes, products and services;
   (2) the complexity of processes and their interactions;
   (3) the competence of persons.

7.5.2 Creating and updating

When creating and updating documented information, the organization shall ensure appropriate:
1) identification and description (e.g. a title, date, author or reference number);
2) format (e.g. language, software version, graphics) and media (e.g. paper, electronic);
c) review and approval for suitability and adequacy.

7.5.3 Control of documented information

1) Documented information required by the management system and by reference standards shall be

controlled to ensure:
(1) it is available and suitable for use, where and when it is needed;
(2) it is adequately protected (e.g. from loss of confidentiality, improper use, or Joss of integrity).

2) For the control of documented information, the PK V&E shall address the following activities, as applicable:
(1) distribution, access, retrieval and use;
(2) storage and preservation, including preservation of legibility;
(3) control of changes (e.g. version control);
(4) retention and disposition.

3) Documented information of external origin determined by the PK V&E to be necessary for the planning and operation of the management system shall be identified as appropriate, and be controlled.

4) Documented information retained as evidence of conformity shall be protected from unintended alterations.

5) Access can imply a decision regarding the permission to view the documented information only, or the permission and authority to view and change the documented information.

7.5.4 Record Control

1) The organization shall maintain a documented procedure to identify the controls and responsibilities needed for the identification, collection, storage, protection, retrieval, retention time, and disposition of records.

2) Records, including those originating from outsourced activities shall be established and controlled to provide evidence of conformity to requirements and the organization's management system.

3) Records shall remain legible, identifiable, and retrievable

4) Records shall be retained for a minimum of five years or as required by customer, legal, and other applicable requirements, whichever is longer.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Document control, Record control

8. Operation

8.1 Operational planning and control

The PK V&E shall plan, implement and control the processes needed to meet the requirements for the provision of products and services, and to implement the actions determined in Clause 6. By;

1) determining the requirements for the products and services;

2) establishing criteria for:
(1) process
(2) the acceptance of products and services;

(3) determining the resources needed to achieve conformity to the product and service requirements;
(4) implementing control of the processes in accordance with the criteria;
(5) determining and keeping documented information to the extent necessary:
a) to have confidence that the processes have been carried out as planned;
b) to demonstrate the conformity of products and services to their requirements.

3) The output of this planning shall be suitable for the PK V&E's operations.
4) The PK V&E shall control planned changes and review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.
5) The applicable Team shall ensure that outsourced processes are controlled.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Planning control, Process control, Purchase control

8.2 Requirements for products and services

8.2.1 Customer communication
Communication with customers shall include:
1) providing information relating to products and services;
2) handling enquiries, contracts or orders, including changes;
3) obtaining customer feedback relating to products and services, including customer complaints;
4) handling and controlling customer property;
5) establishing specific requirements for contingency actions, when relevant.

8.2.2 Determination of requirements related to products and services
1) The PK V&E shall ensure that all legal and regulatory requirements that apply to its products and services and the requirements considered necessary by the PK V&E are processed.
2) The PK V&E shall ensure that the claims for products and services can be met.

8.2.3 Determination of requirements related to products and services
1) The PK V&E shall ensure that it has the ability to meet the requirements for products and services to be offered to customers.
2) The PK V&E shall conduct a review before committing to supply products and services to a customer to include:
(1) requirements specified by the customer, including the requirements for delivery and post-delivery activities;
(2) requirements not stated by the customer, but necessary for the specified or intended use, when known;
(3) requirements specified by the organization;
(4) statutory and regulatory requirements applicable to the products and services;
(5) contract or order requirements differing from those previously expressed.
3) The PK V&E shall ensure that contract or order requirements differing from those previously defined are Resolved.

4) The customer's requirements shall be confirmed by the Business Division before acceptance, when the customer does not provide a documented statement of their requirements.
5) The applicable team shall retain documented information, as applicable:
(1) on the results of the review;
(2) on any new requirements for the products and services.

8.2.4 Changes to requirements for products and services
When contract is changed, the Business Division shall notify the relevant team for changed requirements so that relevant persons are made aware of the changed requirements,

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Customer Process

8.3 Design and development of products and services

8.3.1 General
The Manufacture Engineering Team shall establish, implement and maintain a design and development process that is appropriate to ensure the subsequent provision of products and services.

8.3.2 Design and development planning
In determining the stages and controls for design and development, the Manufacture Engineering Team Center shall consider:
1) the nature, duration and complexity of the design and development activities;
2) the required process stages, including applicable design and development reviews;
3) the required design and development verification and validation activities;
4) the responsibilities and authorities involved in the design and development process;
5) the internal and external resource needs for the design and development of products and services;
6) the need to control interfaces between persons involved in the design and development process;
7) the need for involvement of customers and users in the design and development process;
8) the requirements for subsequent provision of products and services;
9) the level of control expected for the design and development process by customers and other relevant interested parties;
10) the documented information needed to demonstrate that design and development requirements have been met.
11) When design and development is outsourced, the Manufacture Engineering Team shall ensure that supplier provides objective evidence that requirements is met.

8.3.3 Design and development inputs
The Manufacture Engineering Team shall determine the requirements essential for the specific types of products and services to be designed and developed. The organization shall consider:
1) functional and performance requirements;
2) information derived from previous similar design and development activities;

3) statutory and regulatory requirements
4) standards or codes of practice that the PK V&E has committed to implement;
5) potential consequences of failure due to the nature of the products and services;
6) Inputs shall be adequate for design and development purposes, complete and unambiguous. Conflicting design and development inputs shall be resolved. The Manufacture Engineering Team shall retain documented information on design and development inputs.

8.3.4 Design and development controls

Design and development process shall be controlled to ensure that:
1) the results to be achieved are defined;
2) reviews are conducted to evaluate the ability of the results of design and development to meet requirements;
3) verification activities are conducted to ensure that the design and development outputs meet the input requirements;
4) validation activities are conducted to ensure that the resulting products and services meet the requirements for the specified application or intended use;
5) any necessary actions are taken on problems determined during the reviews, or verification and validation activities;
6) documented information of these activities is retained.
7) Design and development reviews, verification and validation have distinct purposes. They can be conducted separately or in any combination, as is suitable for the products and services of the organization.

8.3.5 Design and development outputs

1) Design and development output shall be provided in a form suitable for verification against the design and development input, and approved by personnel authorized to approve the applicable document prior to release.
2) Design and development output shall
   (1) meet the input requirements;
   (2) are adequate for the subsequent processes for the provision of products and services;
   (3) include or reference monitoring and measuring requirements, as appropriate, and acceptance criteria;
   (4) specify the characteristics of the products and services that are essential for their intended purpose and their safe and proper provision.
   (5) include identification of, or reference to, products and/or components deemed critical to the design;
   (6) include results of applicable calculations
3) Design and development outputs shall be documented;
4) Information for products and service provision can include details for the preservation of product.

8.3.6 Design and development changes

1) The Manufacture Engineering Team shall identify, review and control changes made during, or subsequent to, the design and development of products and services, to the extent necessary to ensure that there is no adverse impact on conformity to requirements.
2) The Manufacture Engineering Team shall retain documented information on:
   (1) design and development changes;

(2) the results of reviews;
(3) the authorization of the changes;
(4) the actions taken to prevent adverse impacts.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Design and Development control

8.4 Control of externally provided processes, products and services

8.4.1 General
1) The PK V&E shall ensure that externally provided processes, products and services conform to requirements.
2) The PK V&E shall determine the controls to be applied to externally provided processes, products and services when:
   (1) products and services from external providers are intended for incorporation into the PK V&E's own products and services;
   (2) products and services are provided directly to the customer(s) by external providers on behalf of the PK V&E;
   (3) a process, or part of a process, is provided by an external provider as a result of a decision by the PK V&E.
3) The PK V&E shall determine and apply criteria for the evaluation, selection, monitoring of performance, and re-evaluation of external providers, based on their ability to provide processes or products and services in accordance with requirements. The PK V&E shall retain documented information of these activities and any necessary actions arising from the evaluations.

8.4.2 Type and extent of control
1) The PK V&E shall ensure that externally provided processes, products and services do not adversely affect the organization's ability to consistently deliver conforming products and services to its customers.
2) The PK V&E shall:
   (1) ensure that externally provided processes remain within the control of its quality management system;
   (2) define both the controls that it intends to apply to an external provider and those it intends to apply to the resulting output;
   (3) take into consideration:
      a) the potential impact of the externally provided processes, products and services on the organization's ability to consistently meet customer and applicable statutory and regulatory requirements;
      b) the effectiveness of the controls applied by the external provider;
   (4) determine the verification, or other activities, necessary to ensure that the externally provided processes, products and services meet requirements.

8.4.3 Information for external providers
1) The PK V&E shall ensure the adequacy of requirements prior to their communication to the external

provider.

2) The PK V&E shall communicate to external providers its requirements for:
   (1) the processes, products and services to be provided;
   (2) the approval of :
      a) products and services;
      b) methods, processes and equipment;
      c) the release of products and services;
   (3) competence, including any required qualification of persons;
   (4) the external provider's interactions with the PK V&E;
   (5) control and monitoring of the external provider's performance to be applied by the PK V&E;
   (6) verification or validation activities that the PK V&E or customer intends to perform at the external provider's premises.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Purchase Control, Vendor Evaluation and Selection

8.5 Production and service provision

8.5.1 Control of production and service provision

1) The PK V&E shall implement production and service provision under controlled conditions.
2) Controlled conditions shall include, as applicable:
   (1) the availability of documented information that defines:
      a) the characteristics of the products to be produced, the services to be provided, or the activities to be performed;
      b) the results to be achieved;
   (2) the availability and use of suitable monitoring and measuring resources;
   (3) the implementation of monitoring and measurement activities at appropriate stages to verify that criteria for control of processes or outputs, and acceptance criteria for products and services, have been met;
   (4) the use of suitable infrastructure and environment for the operation of processes;
   (5) the appointment of competent persons, including any required qualification;
   (6) the validation, and periodic revalidation, of the ability to achieve planned results of the processes for production and service provision, where the resulting output cannot be verified by subsequent monitoring or measurement;
   (7) the implementation of actions to prevent human error;
   (8) the implementation of release, delivery and post-delivery activities.

8.5.2 Process Validation

1) Validation shall be conducted for the following process
   (1) Welding
   (2) Heat Treatment
   (3) NDE

2) Process validation shall be conducted in accordance with applicable procedure.

8.5.3 Identification and traceability

1) The Production Division shall use suitable means to identify outputs when it is necessary to ensure the conformity of products and services. Details of identification and traceability shall be controlled in accordance with “Identification and Traceability Control Procedure”
2) The QM Team shall identify the status of outputs with respect to monitoring and measurement requirements throughout production and service provision.
3) The applicable worker shall attend to be not damage the identification and traceability mark of products if identification or traceability marks on product are obliterated or contaminated, the QC personnel shall replace after the review of the related records.
4) The applicable team shall control the unique identification of the outputs when traceability is a requirement, and shall retain the documented information necessary to enable traceability.

8.5.4 Property belonging to customers or external providers

1) The PK V&E shall exercise care with property belonging to customers or external providers while it is under the organizations control or being used by the organization. The Business Division shall notify the details of customer property to the relevant Team. The applicable Team shall identify, verify, protect and safeguard customers' or external providers' property provided for use or incorporation into the products and services.
   The customer property provided for product realization shall be controlled in accordance with the “Product Control Procedure”.
2) When the property of a customer or external provider is lost, damaged or otherwise found to be unsuitable for use, the organization shall report this to the customer or external provider and retain documented information on what has occurred. A customer's or external provider's property can include material components, tools and equipment, customer premises, intellectual property and personal data.

8.5.5 Preservation

1) The organization shall preserve the outputs during production and service provision, to the extent necessary to ensure conformity to requirements. Preservation can include identification, handling, contamination control, packaging, storage, transmission or transportation, and protection. The details shall be controlled in accordance with the “Product Control Procedure”.
2) When transferring product, palette or firm ropes may be used. Machined surfaces shall be taken the appropriate action to prevent from damage.
3) Product in pending use or delivery shall be stored at the designated storage area to prevent damage or deterioration of product. The Manufacturing Master Team shall check the protection condition of product being received and dispatched to and from storage areas, take proper measures, and assess the condition of product in stock at appropriate intervals to detect deterioration and check records
   shall be maintained.
4) Product shall be firmly packaged to prevent damage during transportation by containing a desiccant and wrapping with vinyl to protect from moisture and dust. Packing boxes shall be identified with product name, quantity, and appropriate marking such as “Handle with Care”.
5) Preservation and delivery of products shall be carried out as follows;
   (1) Weld spatters produced during manufacturing process, NDE marking, or harmful contaminants for use

shall be completely eliminated.
(2) The test fluids in the valve shall be drained, and where applicable, lubricated before shipment.
(3) External surfaces of valve that may occur corrosion or rusting shall be painted as required by customers or the PK V&E requirements, and the metal surfaces not being painted shall be applied with anticorrosive.
(4) Flanges and welded bevels shall be fastened firmly by using woods or plastics to prevent damage of the surface or inside.
(5) Where contractually specified, the protection of product quality shall be extended to include delivery to destination.

8.5.6 Post-delivery activities

1) The PK V&E shall meet requirements for post-delivery activities associated with the products and services.
2) In determining the extent of post-delivery activities that are required, the PK V&E shall consider as followings and post-delivery activities can include actions under warranty provisions, contractual obligations such as maintenance services, and supplementary services such as recycling or final disposal.
(1) statutory and regulatory requirements;
(2) the potential undesired consequences associated with its products and services;
(3) the nature, use and intended lifetime of its products and services;
(4) customer requirements;
(5) customer feedback.
3) The Strategy Business Division shall receive nonconformity of product after delivery, evaluate the nonconformity, discuss with customers and relevant Team, and take a proper measure.
4) The Strategy Business Division shall document the description of nonconformity and corrective action and report to the CEO.
5) The applicable Team shall take a proper measure against the effects of nonconforming products and their potential effects.

8.5.7 Management of Change (MOC)

8.5.7.1 General

1) The PK V&E shall maintain a process for MOC.
2) The PK V&E shall ensure that the integrity of the management system is maintained when changes to the management system is planned and implemented.
3) For MOC, the PK V&E shall identify the potential risks associated with the change and any required approvals prior to the introduction of such changes.
4) The applicable team manager shall review and control changes for production or service provision, to the extent necessary to ensure continuing conformity with requirements.
5) The applicable team manager shall retain documented information describing the results of the review of changes, the persons authorizing the change, and any necessary actions arising from the review.
6) The PK V&E shall maintain records of MOC activities.

8.5.7.2 MOC Implementation

The PK V&E shall use the MOC process for any of the following that may negatively impact the quality of the product;

1) changes in organizational structure;
2) changes in key or essential personnel;
3) changes in critical suppliers; and/or
4) changes to the management system procedure, including changes resulting from corrective and preventive action

8.5.7.3 MOC Notification
The PK V&E shall notify relevant personnel, including the customer (when required by contract), of the change and residual or new risk due to changes that have either been initiated by the organization or requested by the customer.
The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Process control, Control of Identification and Traceability, Product Control
Management of Change (MOC)

8.6 Release of products and services

1) The QM Manager shall implement planned arrangements, at appropriate stages, to verify that the product and service requirements have been met.
2) The release of products and services to the customer shall not proceed until the planned arrangements have been satisfactorily completed, unless otherwise approved by a relevant authority and, as applicable, by the customer.
3) The QM Manager and Manufacturing Master Team Manager shall retain documented information on the release of products and services. The documented information shall include:
   (1) evidence of conformity with the acceptance criteria;
   (2) traceability to the person(s) authorizing the release.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Product Control, Inspection and test

8.7 Control of nonconforming products (outputs)

1) The QM Manager shall ensure that products (outputs) that do not conform to their requirements are identified and controlled to prevent their unintended use or delivery. And identification and control of nonconforming product shall be carried out in accordance with the “Nonconforming Product Control Procedure”
2) The PK V&E shall take appropriate action based on the nature of the nonconformity and its effect on the conformity of products and services. This shall also apply to nonconforming products and services detected after delivery of products, during or after the provision of services.
3) Nonconforming products (outputs) may be disposed one or more of the following ways:
   (1) correction (repair or rework, use-as-is, reject or scrapped)

(2) segregation, containment, return or suspension of provision of products and services;
(3) informing the customer;
(4) obtaining authorization for acceptance under concession.

4) Conformity to the requirements shall be verified when nonconforming products(outputs) are corrected.
5) The PK V&E shall retain documented information that:
(1) describes the nonconformity;
(2) describes the actions taken;
(3) describes the concessions obtained;
(4) identifies the authority deciding the action in respect of the nonconformity.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Control of Nonconforming Item

8.8 Operational planning and control for SHE Management

8.8.1 Operational planning and control

1) The management supporting team shall establish, implement, control and maintain the processes needed to meet SHE management system requirements, and to implement the actions identified in 6.1 and 6.2 by:
(1) establishing SHE operating criteria for the process;
(2) implementing control of the process, in accordance with the operating criteria.
(3) process of eliminating hazards and reducing risks can be implemented in accordance with the management steps (hierarchy-removal, replacement, technical, training, administrative, management, wearing protective gear). This can be implemented as part or a combination of management steps
2) The management supporting team shall control planned changes and review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.
3) The management supporting team shall ensure that outsourced processes are controlled or influenced. The type and extent of control or influence to be applied to the process shall be defined within the SHE management system.
4) Consistent with a life cycle perspective, the PK V&E shall:
(1) establish controls, as appropriate, to ensure that its environmental requirements are addressed in the design and development process for the product or service, considering each life cycle stage;
(2) determine its environmental requirements for the procurement of products and services, as appropriate;
(3) communicate its relevant environmental requirement to external providers, including contractors;
(4) consider the need to provide information about potential significant environmental impacts associated with the transportation or delivery, use, end-of-life treatment and final disposal of its products and services.
(5) control contractors and other visitors in the workplace, adapting work to workers
(6) make a documented procedure to control incident that do not comply with occupational safety and health policies and objectives due to lack of documented procedures.
5) The management supporting team shall maintain documented information to the extent necessary to have confidence that the SHE processes have been carried out as planned.

6) Operation and planning shall be controlled in accordance with management manual, environmental impact assessment procedure, risk assessment procedure, environmental operation management, safety and health management process and related procedures.

8.8.2 Management of change

1) The PK V&E shall establish a process(es) for the implementation and control of planned temporary and permanent changes that impact OH&S performance, including:
   (1) new products, services and processes, or changes to existing products, services and processes, including:
      (a) workplace locations and surroundings
      (b) work organization
      (c) working conditions
      (d) equipment, work force
   (2) changes to legal requirements and other requirements
   (3) changes in knowledge or information about hazards and OH&S risks
   (4) developments in knowledge and technology
2) The management supporting team shall review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.

8.8.3 Procurement

The PK V&E shall establish, implement and maintain a process(es) to control the procurement of products and services in order to ensure their conformity to its OH&S management system.

1) Contractors
   (1) The PK V&E shall coordinate its procurement process(es) with its contractors, to identify hazards and to assess and control the OH&S risks, arising from the:
      (a) actors' activities and operations that impact the PK V&E;
      (b) PK V&E's activities and operations that impact the contractors' workers;
      (c) contractors' activities and operations that impact other interested parties in the workplace.
   (2) The PK V&E shall ensure that the requirements of its OH&S management system are met by contractors and their workers. The PK V&E's procurement process(es) shall define and apply occupational health and safety criteria for the selection of contractors. The occupational health and safety criteria for the selection of contractors can be included in the contractual documents.
2) Outsourcing
   (1) The PK V&E shall ensure that outsourced functions and processes are controlled.
      The PK V&E shall ensure that its outsourcing arrangements are consistent with legal requirements and other requirements and with achieving the intended outcomes of the OH&S management system.
   (2) The type and degree of control to be applied to outsourcing processes shall be defined within the OH&S management system.

8.9 Emergency preparedness and response

1) The applicable team shall establish, implement and maintain the process needed to prepare for and respond to potential emergency situations identified in 6.1.1.
2) The applicable team shall:
   (1) prepare to respond by planning actions to prevent or mitigate adverse environmental, safety and healthy impacts from emergency situations;
   (2) respond to actual emergency situations;
   (3) take action to prevent or mitigate the consequences of emergency situations, appropriate to the magnitude of the emergency and the potential environmental impact;
   (4) periodically test the planned response actions, where practicable;
   (5) periodically review and revise the process and planned response actions, in particular after the occurrence of emergency situations or tests;
   (6) communicating relevant information and training related to emergency preparedness and response, as appropriate, to relevant interested parties, including persons working under its control.
   (7) communicating and providing relevant information to all workers on their duties and responsibilities;
   (8) taking into account the needs and capabilities of all relevant interested parties and ensuring their involvement, as appropriate, in the development of the planned response.
3) The applicable team shall maintain documented information to the extent necessary to have confidence that the process is carried out as planned.
4) Emergency preparedness and response shall be controlled in accordance with “Emergency Control Procedure”

9.0 Performance evaluation

9.1 Monitoring, measurement, analysis and evaluation

9.1.1 General
1) The pertinent team manager shall monitor, measure, analyze and evaluate for performance of SHEQ.
2) When Monitoring, measurement, analysis and evaluation, the PK V&E shall determine:
   (1) what needs to be monitored and measured (legal requirements, risks and opportunities, objective, effectiveness of operational control);
   (2) the methods for monitoring, measurement, analysis and evaluation needed to ensure valid results ; (If necessary)
   (3) when the monitoring and measuring shall be performed;
   (4) when the results from monitoring and measurement shall be analyzed and evaluated.
3) The PK V&E shall evaluate the performance and the effectiveness of the quality management system. The PK V&E shall retain appropriate documented information as evidence of the results.

9.1.2 Customer satisfaction
1) The Sale Division shall monitor customers' perceptions of the degree to which their needs and expectations have been fulfilled and determine the methods for obtaining, monitoring and reviewing this

information.

2) The following methods can be included as a method for monitoring customer perceptions.
   (1) customer surveys
   (2) customer feedback on delivered products or services
   (3) meetings with customers
   (4) claims
   (5) others (dealer reports, compliments, market-share analysis)

9.1.3 Evaluation of compliance

1) The management supporting team shall establish, implement and maintain the process needed to evaluate fulfilment of SHE compliance obligations.
2) The management supporting team shall conduct as following:
   (1) Compliance evaluation shall be conducted once a year by the management supporting team and could be carried out during internal audit.
   (2) Nonconformities which were detected by compliance evaluation shall be corrected by the applicable team.
   (3) The PK V&E shall maintain knowledge and understanding of its compliance status.
3) The management supporting team shall retain documented information as evidence of the compliance evaluation result and details shall be conducted in accordance with Monitoring and measurement procedure.

9.1.4 Analysis and evaluation

1) The PK V&E shall analyze and evaluate appropriate data and information arising from monitoring and measurement.
2) The results of analysis shall be used to evaluate:
   (1) conformity of products and services;
   (2) the degree of customer satisfaction;
   (3) the performance and effectiveness of the quality management system;
   (4) if planning has been implemented effectively;
   (5) the effectiveness of actions taken to address risks and opportunities;
   (6) the performance of external providers;
   (7) the need for improvements to the quality management system.
3) Methods to analyze data can include statistical techniques.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Monitoring and Measurement control, Inspection and test, Data Analysis

9.2 Internal audit

9.2.1 General

1) The PK V&E shall conduct internal audits at least every 12 months to provide information on whether the management system:

(1) conforms to:
a) the PK V&E's own requirements for management system;
b) the requirements of International Standard;
(2) is effectively implemented and maintained.

2) The PK V&E shall identify the audit criteria, scope, frequency, and methods to ensure that all processes of the management system.

3) Audit plan
(1) The QA Team shall establish the internal audit schedule on the basis of the status and importance of process and field to be audited and changes affecting the PK V&E as well as the results of previous audits. The Audit Plan shall identify the audit scope, requirements, audit personnel, activities to be audited, organization to be audited, applicable documents and schedule.
(2) Audits shall be performed under the responsibility of the lead auditor qualified to ensure the objectivity and fairness.
(3) Audit plan notify to the lead auditor and the organization to be audited.
(4) The lead auditor shall prepare audit checklist on the basis of the detail audit plan.

4) Qualification of auditors
(1) The audit personnel to be assigned shall be those who are independent of any direct responsibility for performing the activities which they will audit, and shall have sufficient authority and organizational freedom to make the audit process meaningful and effective. The audit personnel make full use of t technical language as far as it doesn't affect audit activities.
(2) The Lead Auditor shall confirm auditor qualification record that auditors have experience or training commensurate with the scope, complexity, special nature of activities to be audited

5) Auditing
(1) Auditors shall perform auditing against actual activities at the area to be audited on the basis of audit checklist prepared. Outsourced activities that impact the quality of the product and that are performed at the company facility shall be included as part of the internal audit.
(2) Auditors shall not be interfered in the audits being performed. The organization audited shall cooperate in auditing to make the audit process smoothly.
(3) The lead auditor shall notify the nonconformity and required action period audit findings to the audited organization to take corrective actions.
(4) The Lead Auditor shall prepare the audit report within ten (10) days after audit completion, and transmit it to the QA Manager. Audit Report shall include the followings.
a) Description of the audit scope
b) Identification of the Auditors.
c) Identification of personnel contacted on audit activities.
d) Summary of audit results
e) Description of each reported adverse audit finding in sufficient detail to enable corrective action to be taken by the audited organization.
f) Sign and date by the Lead Auditor.
(5) The audit report shall be approved by the QA Manager. But audit report for the QM Team and QA Team shall be approved by the CEO.

6) Follow-up actions
(1) The personnel responsible for audited activities shall take timely any necessary correction and corrective action to eliminate the deficiencies and causes found by the audit.

(2) Such follow-up actions shall be carried out in accordance with the corrective action procedure, including verification of action taken and reporting of verification results
(3) The QA Team shall take measures to verify the implementation and effectiveness of corrective actions performed during the next audit.

7) retain documented information as evidence of the implementation of the audit process and the audit results.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Audit

9.3 Management review

9.3.1 General

1) The CEO shall review at least every 12 months the PK V&E's management system to ensure its continuing suitability, adequacy, effectiveness and alignment.
2) Management reviews shall include assessing opportunities for improvement and the need for changes including the management policies and SHEQ objectives monitoring.
3) Each Team shall prepare the pertinent performance data and review output data for the following review inputs as management review data. Management review records shall be maintained in the form of report, minutes, etc.

9.3.2 Management review inputs

Management review inputs shall include

1) the status of actions from previous management reviews;
2) the following changes;
   (1) external and internal issues that are relevant to the management system
   (2) the needs and expectations of interested parties, including compliance obligations;
   (3) its significant environmental aspects, hazard and risk factors
   (4) the effectiveness of actions taken to address risks and opportunities
3) the extent to which SHEQ objectives have been met;
4) information and effectiveness on the PK V&E's SHEQ performance, including trends in:
   (1) customer satisfaction and feedback of relevant interested parties
   (2) process performance and achievement of product suitability;
   (3) investigation of incidents, nonconformities, corrective actions for SHEQ;
   (4) monitoring and measurement results for SHEQ;
   (5) audit results;
   (6) the performance of external providers;
   (7) results of evaluation of compliance with legal requirements of SHE
   (8) consultation and participation of workers, results of risk and opportunities assessment, accident investigation;

5) the adequacy of resources;
6) communication with relevant interested parties (including customer satisfaction and feedback);
7) opportunities for improvement;
8) changes that could affect the quality management system, including changes to legal and other applicable requirements (such as industry standards);
9) the analysis of product conformity, including nonconformities identified after delivery or use

9.3.3 Management review outputs

1) The outputs of the management review shall include decisions related to:
   (1) opportunities for improvement;
   (2) any need for changes to the management system;
   (3) resource needs;
   (4) continuing suitability, adequacy and effectiveness of the OH&S management system;
   (5) actions if management objective are not achieved.
   (6) opportunities to improve integration of the OH&S management system with other business processes, as necessary;
   (7) any implications for the strategic direction of the PK V&E, integration of the processes,
2) The QA Team shall be retained the results of management documented information.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Objective and Management Review

10.0 Improvement

10.1 General

1) The PK V&E shall determine and select opportunities for improvement and implement any necessary actions to achieve the intended results of the management system and to meet customer requirements and enhance customer satisfaction.
2) These shall include:
   (1) improving products and services to meet requirements as well as to address future needs and expectations;
   (2) correcting, preventing or reducing undesired effects;
   (3) improving the performance and effectiveness of the management system.
3) Examples of improvement can include correction, corrective action, continual improvement, breakthrough change, innovation and re-organization.

10.2 Nonconformity and corrective action, incident investigation

10.2.1 Nonconformity and corrective action

1) When a nonconformity occurs, including any arising from complaints, the PK V&E shall react to the nonconformity and, as applicable:
   (1) take action to control and correct it;
   (2) deal with the consequences;
2) evaluate the need for action to eliminate the cause(s) of the nonconformity, in order that it does not recur or occur elsewhere, by:
   (1) reviewing and analyzing the nonconformity;
   (2) determining the causes of the nonconformity;
   (3) determining if similar nonconformities exist, or could potentially occur
3) The QM Team shall implement any action needed
4) The QM Team shall review the effectiveness of any corrective action taken
5) The QM Team shall update risks and opportunities determined during planning, if necessary
6) The QM Team make changes to the quality management system, if necessary.
7) The QM Team shall retain documented information as evidence of:
   (1) the nature of the nonconformities and any subsequent actions taken;
   (2) the results of any corrective action.

10.2.2 Incident investigation

1) PK V&E shall prepare establish, implement and maintain a procedure, which is recording, investigating and analyzing of incident, for following.
   (1) contributes or causes of incident occurrence, and deciding other elements and potential defects of safety and health;
   (2) needs of corrective action;
   (3) needs of preventive action;
   (4) opportunity for continual improvement;
   (5) communicating of investigation results.
2) Incident investigation shall be performed by appropriate method timely.
3) Any identified need for corrective action or opportunities for preventive action shall be dealt with in accordance with nonconformance and corrective action procedure. The results of incident investigation shall be documented and maintained.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures.

Related Procedure : Corrective and Preventive Action and Investigation, Control of Nonconforming Item

10.3 Continual improvement

1) The PK V&E shall continually improve the suitability, adequacy and effectiveness of the management system.
2) The PK V&E shall consider the results of analysis and evaluation, and the outputs from management review, to determine if there are needs or opportunities that shall be addressed as part of continual improvement.

The Details are described in the related procedures and are carried out and maintained in accordance with the related procedures

Related Procedure : Continuous Improvement

Annex 1> API Monogram Program: Responsibilities

1. In order to hold the rights to use API monogram, PK V&E shall observe
   1) the quality system requirements of API standard Q1;
   2) API monogram requirements of API standard Q1, Annex A;
   3) the requirements included in API 6D and/or API 600 product standards;
   4) the requirements included in API License Agreement.

2. API specified requirement described in the API Specification Q1 including Annex A is mandatory for PK V&E to provide API monogrammed product.

3. PK V&E shall control the application of monogram as follows:
   1) Marking as license number and date of manufacture be marked on monogrammed product shall implement in accordance with “Product Identification and Traceability Control Procedure” , which is documented a marking procedures of API Spec 6D & API Std. 600;
   2) The date of manufacture shall be two digits representing the month and two digits representing year
   3) API monogram may be applied at any time appropriate during the production process but shall be removed if the product is subsequently found to be nonconforming with API specified requirement. API monogram is not attached to the products determined to be nonconforming to API specified requirements.
   4) Only PK V&E shall apply API Monogram.
   5) The monogram shall be applied at PK V&E facility.
   6) The QC personnel of PK V&E has authority applying and removing the API Monogram.

4. Any proposed change to the PK V&E’s quality program, to a degree requiring changes to the quality manual, shall submit to API for acceptance prior to incorporation into the PK V&E’s quality program.

Annex 2> PED 2014/68/EU ***or PE(S)R 2016***

1. This Annex applies the design, manufacturing, final inspection, and testing of valves as pressure equipment accessories that satisfy requirements of PED 2014/68/EU ***or PE(S)R 2016*** module H.

2. The Company must affix the CE ***or UKCA*** marking to each item of valve and draw up a written declaration of conformity. The CE ***or UKCA*** marking must be accompanied by the identification number of the notified body.

3. The Company shall implement the quality system approved to ensure that valves meet the requirements of PED 2014/68/EU ***or PE(S)R 2016*** Module H. Primary requirements of our quality system is to perform design, manufacturing, final inspection and testing that satisfy the requirements of PED 2014/68/EU ***or PE(S)R 2016*** and provide the products and services satisfying all the requirements of PED or ***or PE(S)R 2016***.

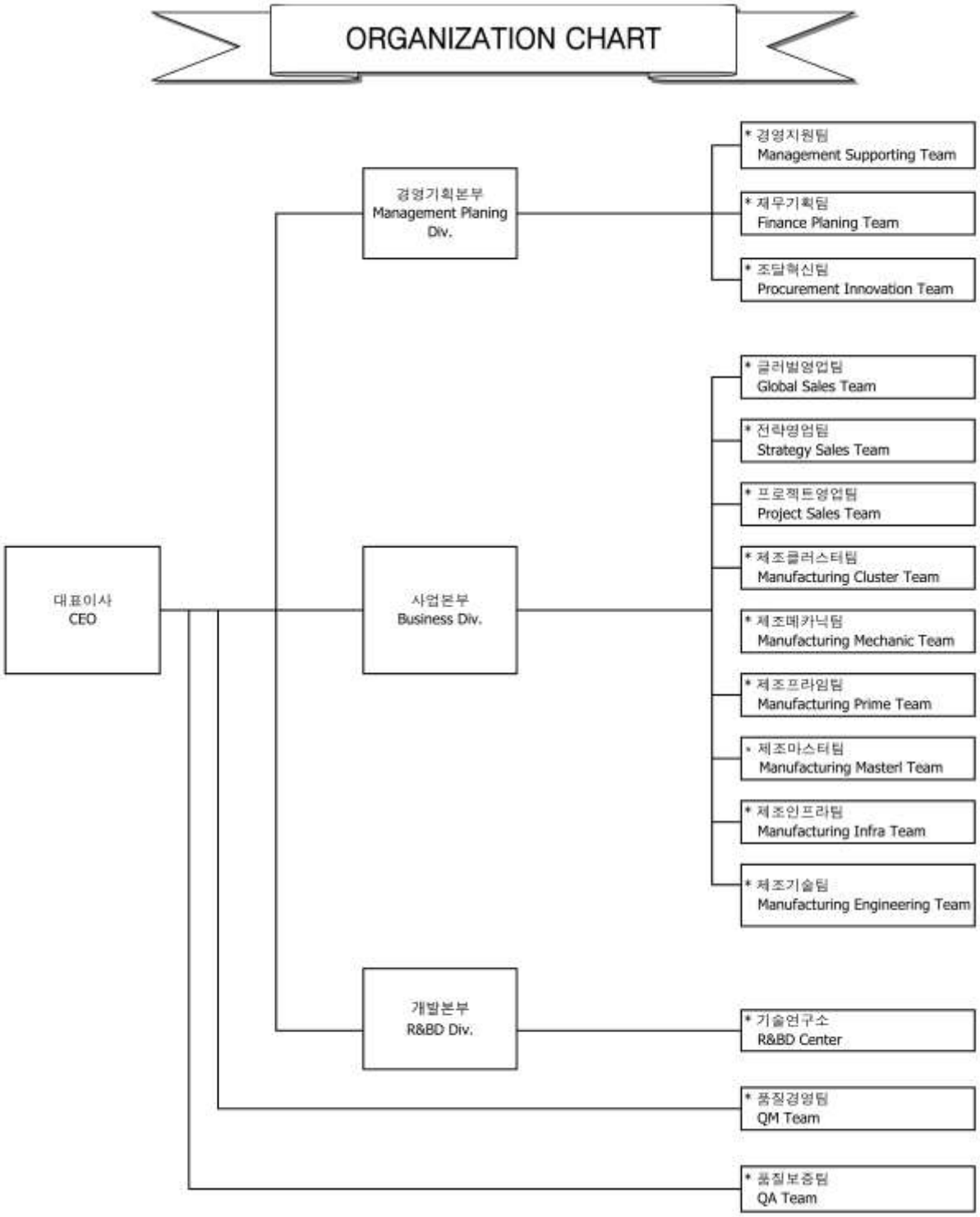
4. Valves must be designed, manufactured, and checked in such a way as to ensure its safety when it is used under reasonably foreseeable conditions. It must apply the principles set out below in the followings;
   (1) eliminate or reduce hazards as far as is reasonably practicable
   (2) apply appropriate protection measures against hazards which cannot be eliminated
   (3) where appropriate, inform users of residual hazards and indicate whether it is necessary to take appropriate special measures to reduce the risks at the time of installation and/or use..

5. Manufacture Engineering Team shall maintain Technical Design Specifications, including standards, that will be applied and, where the standards referred to in PED 2014/68/EU ***or PE(S)R 2016*** are not applied in full, the means that will be used to ensure the essential safety requirements (ESR) of the PED 2014/68/EU ***or PE(S)R 2016.***

6. In order to ensure that PED ***or PE(S)R 2016*** essential safety requirements are met, the designer shall control and verify the design of valve in accordance with the design procedure of his QAM. The manufacturing and inspection of valves shall be controlled in accordance with corresponding manufacturing, QC/ QA techniques and relevant procedures set out at the design stage.

7. The PK V&E must inform the Notified Body that has approved the quality system of any intended adjustment to the quality system. The quality records and technical design specifications shall be retained for ten years after the completion of the last valve manufacturing. The quality records shall include the following documents and records approved and issued by a notified body;
   (1) approved quality system documents;
   (2) decision for notified body;
   (3) periodic audit report, unexpected visit reports;
   (4) where appropriate, EC type examination certificate, EC design examination certificate.

Annex 3> Organization Chart of Management System



Annex 4> Related Procedure

No.	Document Name	Document No.	Remarks
1	Document Control	MSP-401	
2	Records Control	MSP-402	
3	Management of Change (MOC)	MSP-501	
4	Risk Assessment	MSP-502	
5	Contingency Planning	MSP-503	
6	Communication	MSP-505	
7	Objective and Management Review	MSP-506	
8	Indoctrination and Training	MSP-601	
9	Control of Facility and Resource	MSP-602	
10	Customer Process	MSP-701	
11	Design and Development	MSP-702	
12	Purchase Control	MSP-703	
13	Process control	MSP-704	
14	Control of Identification and Traceability	MSP-705	
15	Product Control	MSP-706	
16	Measurement and Test Equipment control	MSP-708	
17	Planning Control	MSP-710	
18	Vendor Evaluation and Selection	MSP-711	
19	Audit	MSP-801	
20	Monitoring and Measurement control	MSP-802	
21	Inspection and test	MSP-803	
22	Control of Nonconforming Item	MSP-804	
23	Continuous Improvement	MSP-805	
24	Corrective and Preventive Action and Investigation	MSP-806	
25	Data Analysis	MSP-807	