2	2018.04.06	FOR CONSTRUCTION	W.K.K	W.K.K	W.K.K	S.Y.P	
1	2018.02.09	GENERAL REVIEW	W.K.K	W.K.K	W.K.K	S.Y.P	
0	2017.04.28	FOR CONSTRUCTION (벽산엔지니어링 수행)	A.T.J	A.T.J	B.Y.W	P.S.H	
REV.NO	DATE	DESCRIPTION	DRN	DGN	CHK	APP.	CL/APP.

EUGENE
유진초저온

유진초저온(주) 평택오성 냉동물류단지 신축공사 중 LNG 설비 공사

한국가스기술공사
KOREA GAS TECHNOLOGY CORPORATION

TITLE :

REQUISITION FOR SAFETY RELIEF VALVE

SCALE	PHASE	DOCUMENT NO.	REV.
NONE	-	평택LNG-IN-013-001	2

CONTENTS

1. GENERAL
2. EQUIPMENT/MATERIALS
3. RELEVANT STANDARDS AND CODES OF PRACTICE
4. GENERAL REQUIREMENTS
5. SCOPE OF CONTRACTOR'S WORKS
6. DEVIATIONS AND ALTERNATIVES
7. NON-CONFORMITY
8. REJECTION
9. RESPONSIBILITY
10. REQUIRED SITE DELIVERY
11. UNITS OF MEASUREMENT
12. SPECIFICATION SHEET OF PSV
13. ENGINEERING DOCUMENT REQUIREMENT

ATTACHMENT-1 : MATERIAL DETAIL DELIVERY SCHEDULE
ATTACHMENT-2 : SPECIAL TOOL LIST
ATTACHMENT-3 : SPARE PART LIST
ATTACHMENT-4 : DRAWING & DOCUMENT DELIVERY LIST
ATTACHMENT-5 : TEST & INSPECTION PROCEDURE
ATTACHMENT-6 : INSTRUMENT DATA SHEET
ATTACHMENT-7 : RELATED SPECIFICATION
Tech. Spec. for Safety Relief Valve-Cryogenic Service [평택LNG-IN-013-002]
Tech. Spec. for Safety Relief Valve-General Service [평택LNG-IN-013-003]

APPENDIX -1 QUALITY CONTROL INSTRUCTION

1. General

This Specification covers the specific requirements of the equipment and/or materials of the instrumentation for the "OSEONG Superfreeze Storage".
This specification will present the Contractor with minimum requirements and information, however, it is the Contractor's responsibility to develop the design in further detail and to satisfy the process design conditions without physical or functional deterioration.

2. EQUIPMENT/MATERIALS

Equipment and/or materials to be covered by this specification are ;

Pressure Safety & Relief Valve specified by "SPECIFICATION SHEET"

3. RELEVANT STANDARDS AND CODES OF PRACTICE

The safety and relief valve and accessories covered by this specification shall be designed, inspected and tested in accordance with, but not limited to, the following listed codes, standards of latest edition in effect at time of placement purchase order, unless otherwise stated in this specification; Refer to attachment technical Specification.
[평택LNG-IN-013-002 and 평택LNG-IN-013-003]

4. GENERAL REQUIREMENTS

4.1. Supplier shall apply the safety certificates of manufacturer title before supplying manufacture or customs clearance for import.(representative can perform)

4.2. Supplier shall submit details of any special storage requirements, which must be attached during loading and handling, transiting, site storage and construction.

4.3. Supplier shall identify the codes and standards to be applied with the supplied materials and equipment.

4.4. The units of measurements to be used shall be as per section "11. UNITS OF MEASUREMENT"

4.5. This specification may be modified under the mutual agreement in case this specification need to be modified at bidding stage and/or after contract.

4.6. Supplier shall submit 1USB+7Copies of final drawing and documents within 2 month before delivery.

4.7. Supplier's Eligibility

Supplier have been supplied and/or manufactured for LNG service with the size & rating equal to or more than the required size & rating in this specification.

Supplier shall include all supporting evidence for above eligibility in this proposal.

4.8. Definitions

The following definitions are provided to clarify the specific meaning of some specific terms used in this requisition.

- Owner : EUGENE Superfreeze Co., Ltd.
- Purchaser : Korea Gas Technology Corporation
- Supplier : Vendor/ Manufacturer/ Sub-Supplier

5. SCOPE OF SUPPLIER'S WORKS

5.1. The following items identified by marking(◆) shall be scope of Supplier's works.

5.2. Supply of equipment and/or materials as described in paragraph 2. Supplier shall submit the completed "MATERIAL DETAIL DELIVERY SCHEDULE" forms attached in this specification (ATTACHMENT-1)(◆)

5.3. Special tools, if required(◆)

One (1) test gag per one (1) valve shall be supplied for the hydrostatic test of the pipe line.

One (1) complete set of special tool and device necessary for the installation, testing and maintenance of equipment and accessories shall be provided. These shall be easily identified and supplied in a suitable box. Supplier shall submit the completed "SPECIAL TOOL LIST" forms attached in this specification. (ATTACHMENT -2)

5.4. Spare parts (◆)

Supplier shall submit a spare part list to be used for the satisfactory 2-year normal operation and attach the related documents. After Owner/Purchaser checks the spare part list. The selection of items in the spare part list may be changed according to Owner/Purchaser's decision. The spare parts to be supplied shall be in accordance with "SPARE PARTS LIST" (ATTACHMENT-3). These spare parts shall be attached with a tag showing the parts name and parts No. And these shall be easily identified and supplied in a suitable box.

Supplier shall supply the spare parts for starting and commissioning, if required.

5.5. Supplier's documents and drawing(◆)

Supplier shall submit the documents and drawings in accordance with "13.ENGINEERING DOCUMENT REQUIREMENTS".

The completed "DRAWING & DOCUMENT DELIVERY LIST" (ATTACHMENT-4) shall be attached with Supplier's drawing and

documents when Supplier will submit them.
Supplier's drawings/documents submitted for approval will be returned to Supplier within one month.
If Owner/Purchaser's comments on these drawings and documents, Contractor shall observe all comments and revise the drawings/documents in accordance with such comments and shall re-submit them within two(2) weeks after return of reviewed drawings/documents.
The language to be used shall be English or Korean.

5.6. Quality Assurance(◆)

Prior to fabrication, Supplier shall prepare an inspection and test plan (ITP) and submit it to Owner/Purchaser for approval. Owner/Purchaser will determine and denote inspection points to be performed (such as hold, witness and/or review points) on the ITP submitted by Supplier. Supplier shall notify Owner/Supplier of the inspection date according to inspection point of ITP approved by Owner/Purchaser in advance Min.15days in domestic and Min.30days in overseas.
All manufacturing, processing, testing, inspection and operation affecting the equipment may be subject to Quality Assurance surveillance by Owner/Purchaser or his representative.
Test shall be maintained for a sufficient period of time to complete examination of parts.
This procedure shall be required at least the descriptions shown on the attached
"TEST & INSPECTION PROCEDURE" (ATTACHMENT-5)

- Material certificates
- Visual/Quality inspection
- Shell pressure test
- Dye penetrant check for welding
- Low temperature operation test
(10% of total safety valve for cryogenic service)
- Dimensional check
- Pneumatic leakage test
- Seat leakage test
- Set pressure test

Inspection and test shall be performed under witness of Owner/Purchaser at Supplier's factory, however in case of products of stamp certified manufacturers, mill sheets or inspection and test reports can be considered as witness test under advance decision.
Supplier shall bear all test and inspection cost.
The test shall cover material test, dielectric test, pressure test and functional performance test for the equipment and accessories. All test reports shall be documented and submitted to Owner/Supplier for release of shipment condition.
Supplier shall submit the completed "TEST & INSPECTION PLAN" forms attached in this specification.

5.7. Painting and coating(◆)

Surface painting/coating and rust prevention shall be applied to the final coating in shop.

- Coating
  a) Coating is generally done using the spray method
  b) Put the object to be coated in a suitable position for painting
  c) Workers must put on protective equipment when they start work
  d) When you paint specifically at request of a customer the painting should be done according to coating specification

- The following surfaces shall not be painted unless otherwise specified ;
  a) Non-ferrous material such as aluminum, copper, copper alloy, lead,
  b) Stainless steel and galvanized steel
  c) Non-metallic material such as rubber, glass, plastics,
  d) Machine surface such as threads, valve stem, gasket surface,
  e) Name plate, identification tag and internal surface of equipment

5.8. Marking(◆)

Each valve shall be marked with a nameplate stamped by the works and inspection agency. The markings shall be in accordance with MSS SP 25 and shall include the following :

a) Nominal. size;

b) Pressure class rating;

c) Body material identification (heat or cast number) ;

d) Supplier's name and trademark;

e) Disk, seat materials;

f) Tag number;

If paint is used for additional markings for short or long term protection, it shall be free of chlorine, lead or zinc.

5.9. Packing and transportation(◆)

After testing, each valve shall be dried, cleaned, prepared and suitably protected for dispatch, in a way to minimize damage during transit and storage.

Flanged valves shall have flange covers to prevent damage to internals and sealing surfaces.

Valves shall be sealed in polyethylene covers containing dessicant.

Packing shall be suitable for outdoor storage in a sultry atmosphere for an extended period up to one year.

If special packing/transportation is needed for large and heavy valves, Owner/Purchaser's approval shall be obtained prior to dispatch.

6. DEVIATIONS AND ALTERNATIVES

Owner/Purchaser has no responsibility to discover any deviation entered in Supplier's proposal other than mentioned in the said deviation or alternative list.

Supplier shall submit the deviation or alternative list for approval when the equipment and/or material to be supplied by Supplier does not comply with the requirements stipulated by this specification.

7. NON-CONFORMITY

Supplier shall be notified of any non-conformity identified during manufacture, test and inspection. The decision regarding the item's disposition shall be made by the Contractor.

8. REJECTION

Notwithstanding any inspection or test carried out, if any material fails to meet the requirements of this specification, it shall be rejected by OWNER.

9. RESPONSIBILITY

The Contractor shall be fully responsible for the quality of the products supplied by him.

Should these products be found defective within a period of 36 months from date of commercial operation, the Contractor shall repair and/or replace them as required by Owner.

10. REQUIRED SITE DELIVERY

; It will be informed later

11. UNITS OF MEASUREMENT

The following abbreviations shall be used ;

APPLICATION	UNIT	ABBREVIATIONS
Piping	Inch	″
Length	Meter	m
	Millimeter	mm
Area	Square meter	m^2
Volume/Capacity	Cubic meter	m^3
Time	Second	S
	Minute	Min
	Hour	H
	Day	D
Velocity	Meters / second	m/s
Acceleration	Meter / square second	m/s^2
Mass	Kilogram	kg
	Ton	T
Flow rates		
- Mass	Kilograms / second	kg/s
	Kilograms / hour	kg/h
- Volumeteic	Cubic meter / hour	m^3/h
Sound level	Decibel	dBa
Density	Kilograms / cubic meter	kg/m^3
Pressure		
- Barometric	Passcal, Kilopascal	Pa, kPa
- Fluid	Pascal, Kilopascal, Megapascal	Pa, kPa, MPa
Temperature	Kelvin	K
	Degree centigrade	℃
Energy		
- Electrical	Kilowatts. hour	KW.h
- Mechanical	Joule, Kilojoule, Megajoule	J, kJ, MJ
- Thermal	Joule, Kilojoule, Megajoule	J, kJ, MJ
Heat capacity	Joule per Kelvin	J/K
Heat flow	Kilocalories per hour. Square meter	$Kcal/h.m^2$
Heat transfer coefficient	Watts/(Square meter. Kelvin)	$W/(m^2.K)$
	Watts/(Square meter. Degree Centigrade)	$W/(m^2.℃)$
Viscosity	Pascal. second	Pa.s
Current	Amperes	A
	Milliampere	mA
Power	Watts	W
	Kilowatts	kW
Voltage	Volt	V
	Kilovolts	kV
Frequency	Hertz	Hz
Elec. resistance	Ohm	Ω
Elec. conductance	Siemens	S

12. SPECIFICATION SHEET OF PSV

12.1. SCOPE OF EQUIPMENT / MATERIALS SUPPLY

12.1.1. Pressure safety valves

Cryogenic Service : 14 sets

General Service : 1 sets

12.2. OUT OF SUPPLY SCOPE

Bolts / nuts and flange gaskets for installation of valves

12.3. DESIGN AND MATERIALS

12.3.1. Type

Pressure safety valves : Refer to Data sheet

12.3.2. Flow capacity

Supplier shall calculate flow capacity of the valves based on the operating condition and the valve size specified in this specification.

Calculation of flow capacity shall be in accordance with API RP 520 Part 1 “Sizing, Selection and Installation for Pressure-Relieving Devices in Refineries” and/or API 2000 “Venting atmospheric and low pressure storage tanks”

12.3.3. The supplied valves shall be designed and manufactured in accordance with API STD 526 “Flanged Steel Safety-Relief Valves”

12.3.4. Seat tightness of safety valves shall be the following

Safety valves for cryogenic service: Zero (0) bubbles per minute

12.3.5. Material: Refer to Data sheet

12.3.6. Connection size and rating : Refer to Data sheet

12.3.7. Gasket: Supplier shall be provided information on gasket contact surface.

12.3.8. The gasket contact surface shall be formed by a continuous spiral groove generated by a 1.6 mm radius round-nosed tool at a feed rate between 0.7 and 0.9 mm per revolution.

12.3.9. This shall result in a roughness height of 125 AARH(Arithmetic Average Roughness Height). For the further details, refer to ANSI B46.1

12.3.10. To prevent damage of gasket contact surface during transportation and storage, each set shall be protected together with a hardboard or suitable material.

12.4. Tag Numbers

12.4.1. For Cryogenic service

PSV-10104/ PSV-10201/ PSV-10203/ PSV-10204/ PSV-20101/ PSV-20102/ PSV-20103/ PSV-20104/ PSV-20106/ PSV-20201/ PSV-20203/ PSV-20206/ PSV-90107/ PSV-90108

12.4.2. For Genreal service

PSV-40103

13. ENGINEERING DOCUMENT REQUIREMENT

NO.	DRAWINGS AND DATA REQUIRED	FOR BID	FOR APPROVAL / INITIAL		FINAL		REMARK
			NO. OF COPIES	DUE DATE	NO. OF COPIES	DUE DATE	
1	Material Detail Delivery Schedule		*1		*2		
2	Manufacturing specification	*1	*1		*2		
3	Special Tool List with sketch	*1	*1		*2		
4	Spare part List with sketch	*1	*1				
5	Deviation or Alternative List	*1					
6	Dimensional detail DWG with complete Parts list		*1		*2		
7	Test & Inspection Plan (Shop/Site)		*1		*2		
8	Test & Inspection Procedure		*1		*2		
9	Shop Testing Schedule		*1		*2		
10	Test & Inspection Report		*1		*2		
11	Packing and Marking Procedure		*1		*2		
12	Installation Instruction		*1		*2		
13	Monthly manufacturing status report		*1				
14	Shipping information / list		*1		*2		
15	Recommendation for site storage		*1		*2		
16	Catalogue	*1			*2		
17	Shipping Schedule and/or Packing List				*2		
18	Installation Manual				*2		
19	Operation & Maintenance Manual				*2		
20	Quality Control/Quality Assurance Program	*1	*1		*2		
21	Packing and Painting Specification		*1		*2		

Note :

1. Drawings and data 'For Approval' are required within four weeks after placement of order, unless otherwise specified.
2. 'Certified Correct' data and drawings are required within two weeks after return of 'Commented' data and drawings.
3. Quotation must include cost of above data.

Legend R : Original C : Copy DVD: Digital Versatile Disc

*1 : 7C (Within 1 Month after Owner's approval for Manufacturer)

*2 : 5CD+7C (Within 2 Month before delivery)

ATTACHMENT-1 :

MATERIAL DETAIL DELIVERY SCHEDULE

ATTACHMENT - 1

MATERIAL DETAIL DELIVERY SCHEDULE

****

NO	DESCRIPTION	SIZE	Q'TY	WEIGHT	PART OR TAG NO	SUPPLEMENT DATE	REMARKS

ATTACHMENT-2 :

SPECIAL TOOL LIST

ATTACHMENT - 2

SPECIAL TOOL LIST

****

NO	DESCRIPTION	SIZE / MATERIAL	Q'TY	SKETCH DWG	RELATED DWG. NO.	USE	REMARKS / PRICE

ATTACHMENT-3 :

SPARE PART LIST

ATTACHMENT - 3

SPARE PART LIST

****

NO	DESCRIPTION	SIZE	Q'TY	SKETCH DWG (ATTACHMENT)	RELATED DWG. NO.	USE	REMARKS

ATTACHMENT-4 :

DRAWING & DOCUMENT DELIVERY LIST

ATTACHMENT - 4

DRAWING & DOCUMENT DELIVERY LIST

****

DRAWING & DOCUMENT DELIVERY LIST																	DATE OF ISSUE: REV:			
OSEONG SUPERFREEZE STORAGE LNG PLANT			TITLE :	NOTE : S = SUBMIT DATE R = RETURNED DATE A = ACTION 1 = APPROVED 2 = APPROVED EXCEPT AS NOTED 3 = MAKE CORRECTIONS RESUBNIT 4 = INFORMATION ONLY RVS = REVISED, FA = FOR APPROVAL FI = FOR INFORMATION M = MICRO FILM RESUBMIT												SUPPLIER :			
NO	DRAWING	REV.	TITLE	1'st			2'nd			3'rd			4'th			SUBMIT DATE OF CONT.	FINAL DISTRIBUTION DATE	FA FI	M	REMARKS
				S	R	A	S	R	A	S	R	A	S	R	A					

ATTACHMENT-5 :

TEST & INSPECTION PROCEDURE

ATTACHMENT - 5

TEST & INSPECTION PROCEDURE

****

TEST & INSPECTION PROCEDURE	DOCUMENT NO	

A TABLE OF CONTENTS

1.0 SUITABILITY SCOPE ----------

2.0 SUITABILITY CRITERIA & STANDARD ----------

3.0 TEST & INSPECTION ----------

4.0 TEST & INSPECTION METHOD

4.1 PROCEDURE ----------

4.2 DECISION CRITERIA ----------

5.0 TEST & INSPECTION METHOD ----------

ATTACHMENT-6 :

INSTRUMENT DATA SHEET

KOGAS-Tech
KOREA GAS TECHNOLOGY CORPORATION

SAFETY RELIEF VALVE

SHEET 1 OF 4

CLIENT : 유진 초저온 ㈜
PROJECT : 평택오성냉동물류단지 신축공사 중 LNG설비
JOB NO. :
LOCATION : PYEONG-TAEK, KOREA

NO	BY	DATE	REVISION
0	A.T.J	04-28-17	FOR CONSTRUCTION
1	W.K.K	2018-02-08	GENERAL REVIEW
2	W.K.K	2018-04-06	FOR CONSTRUCTION

SPEC. NO. 평택LNG-IN-013-001 | REV. 2
CONTRACT | DATE 2018-04-06
REQ. or P.O
BY W.K.K | CHK'D W.K.K | APPR. S.Y.P

SERVICE	1	Tag Number			PSV-10104		PSV-10201		PSV-10203		PSV-10204	
	2	Service			LNG from Tank Trailer		LNG from TK-10101A/B/C/D		LNG to TK-10101A/B/C/D		LNG to HE-20101/02	
	3	Line No. / Vessel No.			3/4"-LNG-10101-1R1J-C100		3/4"-LNG-10102-1R1J-C100		3/4"-LNG-10103-1R1J-C100		3/4"-LNG-10103-1R1J-C100	
	4	P&ID No.			평택LNG-PR-012-101-2		평택LNG-PR-012-102		평택LNG-PR-012-102		평택LNG-PR-012-102	
	5	Full Nozzle / Semi Nozzle			FULL		FULL		FULL		FULL	
	6	Safety or Relief			SAFETY		SAFETY		SAFETY		SAFETY	
	7	Conv., Bellows, Pilot Operat.			CONVENTIONAL		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL	
	8	Bonnet Type			CLOSED		CLOSED		CLOSED		CLOSED	
BODY CONNECTION	9	Size : Inlet	Outlet		3/4"	1"	3/4"	1"	3/4"	1"	3/4"	1"
	10	Flange Rating & Screwed			300#	300#	300#	300#	300#	300#	300#	300#
	11	Type of Facing			RF-125AARH		RF-125AARH		RF-125AARH		RF-125AARH	
MATERIALS	12	Body and Bonnet			316SS		316SS		316SS		316SS	
	13	Seat and Disc			NOTE.2		NOTE.2		NOTE.2		NOTE.2	
	14	Resilient Seat Seal			PTFE		PTFE		PTFE		PTFE	
	15	Guide and Rings			316SS		316SS		316SS		316SS	
	16	Spring			316SS		316SS		316SS		316SS	
	17	Bellows			-		-		-		-	
	18											
OPTIONS	19	Cap : Screwed or Bolted			SCREWED		SCREWED		SCREWED		SCREWED	
	20	Lever : Plane or Packed			N/A		N/A		N/A		N/A	
	21	Test Gag			YES		YES		YES		YES	
	22	KGS Stamp			YES		YES		YES		YES	
	23											
	24											
BASIS	25	Code			API RP 520		API RP 520		API RP 520		API RP 520	
	26	Fire			YES		YES		YES		YES	
	27	Other			THERMAL EXPANSION		THERMAL EXPANSION		THERMAL EXPANSION		THERMAL EXPANSION	
	28											
OPERATING CONDITION	29	Fluid (State)			LNG (L)		LNG (L)		LNG (L)		LNG (L)	
	30	Required Capacity (kg/h)			3		6		2		1	
	31	Mol. Wt.	Density(kg/m3)			392		392		376		376
	32	Oper. Press.(MPa.g)	Set Press.(MPa.g)		0.5	0.7	0.04	0.4	0.26	1.7	0.9	1.7
	33	Oper. Temp.('C)	Release Temp.('C)		-157	-120.3	-157	-120.3	-156.5	-111.9	-156.5	-111.9
	34	Back Press.	Constant		0.07		0.04		0.17		0.17	
	35	(MPa.g)	Variable									
	36		Total (MPa.g)		0.07		0.04		0.17		0.17	
	37	% Allowable Overpressure	(%)		10		10		10		10	
	38	Overpressure Factor										
	39	Compressibility Factor										
	40	Latent Heat of Vaporization										
	41	Ratio of Specific Heats										
	42	Operating Viscosity (cP)										
	43	Barometric Pressure (MPa.a)										
	44											
OTHERS	45	Calc. Area (sq. in.)			VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	46	Selected Area (sq. in.)			VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	47	Orifice Designation			VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	48	Manufacturer			VTA		VTA		VTA		VTA	
	49	Model No.			VTA		VTA		VTA		VTA	
	50	Phase			VTA		VTA		VTA		VTA	

△2

Notes :

1. THE SPECIFIED DATA ARE ONLY REFERENCE. SO, CALCULATION SHEETS SHALL BE SUBMITED BY MANUFACTURER ACCORDING TO KOREAN REGULATION & LAW
2. SEAT : METAL SEAT(ASTM A351 CF3M or EQ.) or SOFT SEAT(REINFORCED PTFE, GRAPHIT, or EQ.)
   DISC : ASTM A351 CF3M or EQ.

KOGAS-Tech
KOREA GAS TECHNOLOGY CORPORATION

CLIENT : 유진 초저온 ㈜
PROJECT : 평택오성냉동물류단지 신축공사 중 LNG설비
JOB NO. :
LOCATION : PYEONG-TAEK, KOREA

SAFETY RELIEF VALVE

SHEET 2 OF 4

NO	BY	DATE	REVISION
0	A.T.J	04-28-17	FOR CONSTRUCTION
1	W.K.K	2018-02-08	GENERAL REVIEW
2	W.K.K	2018-04-06	FOR CONSTRUCTION

SPEC. NO. 평택LNG-IN-013-001 | REV. 2
CONTRACT | DATE 2018-04-06
REQ. or P.O
BY W.K.K | CHK'D W.K.K | APPR. S.Y.P

SERVICE	1	Tag Number		PSV-20101		PSV-20102		PSV-20103		PSV-20104	
	2	Service		LNG from HE-20101A		LNG from PP-10201A/B		LNG to HE-20102		LNG from HE-20101B(S)	
	3	Line No. / Vessel No.		1"-NG-20101-1R1J-P40		3/4"-LNG-20105-1R1J-C100		3/4"-LNG-20106-1R1J-C100		1"-NG-20103-1R1J-P40	
	4	P&ID No.		평택LNG-PR-012-201		평택LNG-PR-012-201		평택LNG-PR-012-201		평택LNG-PR-012-201	
	5	Full Nozzle / Semi Nozzle		FULL		FULL		FULL		FULL	
	6	Safety or Relief		SAFETY		SAFETY		SAFETY		SAFETY	
	7	Conv., Bellows, Pilot Operat.		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL	
	8	Bonnet Type		CLOSED		CLOSED		CLOSED		CLOSED	
BODY CONNECTION	9	Size : Inlet	Outlet	1"	2"	3/4"	1"	3/4"	1"	1"	2"
	10	Flange Rating & Screwed		300#	300#	300#	300#	300#	300#	300#	300#
	11	Type of Facing		RF-125AARH		RF-125AARH		RF-125AARH		RF-125AARH	
MATERIALS	12	Body and Bonnet		316SS		316SS		316SS		316SS	
	13	Seat and Disc		NOTE.2		NOTE.2		NOTE.2		NOTE.2	
	14	Resilient Seat Seal		PTFE		PTFE		PTFE		PTFE	
	15	Guide and Rings		316SS		316SS		316SS		316SS	
	16	Spring		316SS		316SS		316SS		316SS	
	17	Bellows		-		-		-		-	
	18										
OPTIONS	19	Cap : Screwed or Bolted		SCREWED		SCREWED		SCREWED		SCREWED	
	20	Lever : Plane or Packed		N/A		N/A		N/A		N/A	
	21	Test Gag		YES		YES		YES		YES	
	22	KGS Stamp		YES		YES		YES		YES	
	23										
	24										
BASIS	25	Code		API RP 520		API RP 520		API RP 520		API RP 520	
	26	Fire		YES		YES		YES		YES	
	27	Other		BLOCKED OUTLET		THERMAL EXPANSION		THERMAL EXPANSION		BLOCKED OUTLET	
	28										
OPERATING CONDITION	29	Fluid (State)		NG (V)		LNG (L)		LNG (L)		NG (V)	
	30	Required Capacity (kg/h)		1717		1		1		1717	
	31	Mol. Wt.	Density(kg/m3)	17.82			376		376	17.82	
	32	Oper. Press.(MPa.g)	Set Press.(MPa.g)	0.85	1.7	0.9	1.7	0.9	1.7	0.85	1.7
	33	Oper. Temp.('C)	Release Temp.('C)	-67	-20.8	-156.5	-111.9	-156.5	-111.9	-67	-20.8
	34	Back Press.	Constant	0.17		0.17		0.17		0.17	
	35	(MPa.g)	Variable								
	36		Total (MPa.g)	0.17		0.17		0.17		0.17	
	37	% Allowable Overpressure (%)		10		10		10		10	
	38	Overpressure Factor									
	39	Compressibility Factor									
	40	Latent Heat of Vaporization									
	41	Ratio of Specific Heats									
	42	Operating Viscosity (cP)									
	43	Barometric Pressure (MPa.a)									
	44										
OTHERS	45	Calc. Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	46	Selected Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	47	Orifice Designation		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	48	Manufacturer		VTA		VTA		VTA		VTA	
	49	Model No.		VTA		VTA		VTA		VTA	
	50	Phase		VTA		VTA		VTA		VTA	

Notes :

1. THE SPECIFIED DATA ARE ONLY REFERENCE. SO, CALCULATION SHEETS SHALL BE SUBMITED BY MANUFACTURER ACCORDING TO KOREAN REGULATION & LAW
2. SEAT : METAL SEAT(ASTM A351 CF3M or EQ.) or SOFT SEAT(REINFORCED PTFE, GRAPHIT, or EQ.)
   DISC : ASTM A351 CF3M or EQ.

KOGAS-Tech
KOREA GAS TECHNOLOGY CORPORATION

SAFETY RELIEF VALVE

SHEET 3 OF 4

CLIENT : 유진 초저온 ㈜
PROJECT : 평택오성냉동물류단지 신축공사 중 LNG설비
JOB NO. :
LOCATION : PYEONG-TAEK, KOREA

NO	BY	DATE	REVISION
0	A.T.J	04-28-17	FOR CONSTRUCTION
1	W.K.K	2018-02-08	GENERAL REVIEW
2	W.K.K	2018-04-06	FOR CONSTRUCTION

SPEC. NO. 평택LNG-IN-013-001 | REV. 2
CONTRACT | DATE 2018-04-06
REQ. or P.O
BY W.K.K | CHK'D W.K.K | APPR. S.Y.P

	1	Tag Number		PSV-20106		PSV-20201		PSV-20203		PSV-20206	
	2	Service		NG from HE-20102		LNG from PP-10201A/B		NG from HE-20201B		NG from HE-20201A	
	3	Line No. / Vessel No.		1.5"-NG-20102-1R1J-P40		3/4"-LNG-20202-1R1J-C100		1.5"-NG-20105-1R1J		1.5"-NG-20104-1R1J	2
SERVICE	4	P&ID No.		평택LNG-PR-012-201		평택LNG-PR-012-202		평택LNG-PR-012-202		평택LNG-PR-012-202	
	5	Full Nozzle / Semi Nozzle		FULL		FULL		FULL		FULL	
	6	Safety or Relief		SAFETY		SAFETY		SAFETY		SAFETY	
	7	Conv., Bellows, Pilot Operat.		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL	
	8	Bonnet Type		CLOSED		CLOSED		CLOSED		CLOSED	
BODY CONNECTION	9	Size : Inlet	Outlet	1 1/2"	3"	3/4"	1"	1 1/2"	3"	1 1/2"	3"
	10	Flange Rating & Screwed		300#	300#	300#	300#	300#	300#	300#	300#
	11	Type of Facing		RF-125AARH		RF-125AARH		RF-125AARH		RF-125AARH	
MATERIALS	12	Body and Bonnet		316SS		316SS		316SS		316SS	
	13	Seat and Disc		NOTE.2		NOTE.2		NOTE.2		NOTE.2	
	14	Resilient Seat Seal		PTFE		PTFE		PTFE		PTFE	
	15	Guide and Rings		316SS		316SS		316SS		316SS	
	16	Spring		316SS		316SS		316SS		316SS	
	17	Bellows		-		-		-		-	
	18										
OPTIONS	19	Cap : Screwed or Bolted		SCREWED		SCREWED		SCREWED		SCREWED	
	20	Lever : Plane or Packed		N/A		N/A		N/A		N/A	
	21	Test Gag		YES		YES		YES		YES	
	22	KGS Stamp		YES		YES		YES		YES	
	23										
	24										
BASIS	25	Code		API RP 520		API RP 520		API RP 520		API RP 520	
	26	Fire		YES		YES		YES		YES	
	27	Other		BLOCKED OUTLET		THERMAL EXPANSION		BLOCKED OUTLET		BLOCKED OUTLET	
	28										
OPERATING CONDITION	29	Fluid (State)		NG (V)		LNG (L)		NG (V)		NG (V)	
	30	Required Capacity (kg/h)		2800		1		2800		2800	
	31	Mol. Wt.	Density(kg/m3)	17.82			376	17.82		17.82	
	32	Oper. Press.(MPa.g)	Set Press.(MPa.g)	0.85	1.7	0.9	1.7	0.85	1.7	0.85	1.7
	33	Oper. Temp.('C)	Release Temp.('C)	-45	4.6	-156.5	-111.9	5	58.9	5	58.9
	34	Back Press.	Constant	0.17		0.17		0.17		0.17	2
	35	(MPa.g)	Variable								
	36		Total (MPa.g)	0.17		0.17		0.17		0.17	
	37	% Allowable Overpressure	(%)	10		10		10		10	
	38	Overpressure Factor									
	39	Compressibility Factor									
	40	Latent Heat of Vaporization									
	41	Ratio of Specific Heats									
	42	Operating Viscosity (cP)									
	43	Barometric Pressure (MPa.a)									
	44										
OTHERS	45	Calc. Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	46	Selected Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	47	Orifice Designation		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)	
	48	Manufacturer		VTA		VTA		VTA		VTA	
	49	Model No.		VTA		VTA		VTA		VTA	
	50	Phase		VTA		VTA		VTA		VTA	

Notes :

1. THE SPECIFIED DATA ARE ONLY REFERENCE. SO, CALCULATION SHEETS SHALL BE SUBMITED BY MANUFACTURER ACCORDING TO KOREAN REGULATION & LAW
2. SEAT : METAL SEAT(ASTM A351 CF3M or EQ.) or SOFT SEAT(REINFORCED PTFE, GRAPHIT, or EQ.)
   DISC : ASTM A351 CF3M or EQ.

KOGAS-Tech
KOREA GAS TECHNOLOGY CORPORATION

CLIENT : 유진 초저온 ㈜
PROJECT : 평택오성냉동물류단지 신축공사 중 LNG설비
JOB NO. :
LOCATION : PYEONG-TAEK, KOREA

SAFETY RELIEF VALVE

SHEET 4 OF 4

NO	BY	DATE	REVISION
0	A.T.J	04-28-17	FOR CONSTRUCTION
1	W.K.K	2018-02-08	GENERAL REVIEW
2	W.K.K	2018-04-06	FOR CONSTRUCTION

SPEC. NO. 평택LNG-IN-013-001 | REV. 2
CONTRACT | DATE 2018-04-06
REQ. or P.O
BY W.K.K | CHK'D W.K.K | APPR. S.Y.P

	1	Tag Number		PSV-40103		PSV-90107		PSV-90108		
	2	Service		TK-40101		NI to IA Header		NI to LNG Unloading Hose		2
	3	Line No. / Vessel No.		1.5"-NG-40101-1P1		3/4"-NI-90109-1R1J		3/4"-NI-90110-1R1J		
SERVICE	4	P&ID No.		평택LNG-PR-012-401		평택LNG-PR-015-901-2		평택LNG-PR-015-901-2		
	5	Full Nozzle / Semi Nozzle		FULL		FULL		FULL		
	6	Safety or Relief		SAFETY		SAFETY		SAFETY		
	7	Conv., Bellows, Pilot Operat.		CONVENTIONAL		CONVENTIONAL		CONVENTIONAL		
	8	Bonnet Type		CLOSED		CLOSED		CLOSED		
BODY CONNECTION	9	Size : Inlet	Outlet	1-1/2"	2"	3/4"	1"	3/4"	1"	
	10	Flange Rating & Screwed		150#	150#	300#	300#	300#	300#	
	11	Type of Facing		RF		RF-125AARH		RF-125AARH		
MATERIALS	12	Body and Bonnet		Carbon Steel		316SS		316SS		
	13	Seat and Disc		NOTE.2		NOTE.2		NOTE.2		
	14	Resilient Seat Seal		PTFE		PTFE		PTFE		
	15	Guide and Rings		316SS		316SS		316SS		
	16	Spring		316SS		316SS		316SS		
	17	Bellows		-		-		-		
	18									
OPTIONS	19	Cap : Screwed or Bolted		SCREWED		SCREWED		SCREWED		
	20	Lever : Plane or Packed		N/A		N/A		N/A		
	21	Test Gag		YES		YES		YES		
	22	KGS Stamp		YES		YES		YES		
	23									
	24									
BASIS	25	Code		API RP 520		API RP 520		API RP 520		
	26	Fire		-		-		-		
	27	Other		BLOCKED OUTLET		BLOCKED OUTLET		BLOCKED OUTLET		
	28									
OPERATING CONDITION	29	Fluid (State)		NG (V)		NI (V)		NI (V)		
	30	Required Capacity (kg/h)		1800		106		6		
	31	Mol. Wt.	Density(kg/m3)	17.82		28.01		28.01		
	32	Oper. Press.(MPa.g)	Set Press.(MPa.g)	0.75	1.7	0.6	0.98	0.5	0.7	
	33	Oper. Temp.('C)	Release Temp.('C)	5	68.3	15	40.6	15	48	2
	34	Back Press.	Constant	0.17		0.01		0.07		
	35	(MPa.g)	Variable							
	36		Total (MPa.g)	0.17		0.01		0.07		
	37	% Allowable Overpressure (%)		10		10		10		
	38	Overpressure Factor								
	39	Compressibility Factor								
	40	Latent Heat of Vaporization								
	41	Ratio of Specific Heats								
	42	Operating Viscosity (cP)								
	43	Barometric Pressure (MPa.a)								
	44									
OTHERS	45	Calc. Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		
	46	Selected Area (sq. in.)		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		
	47	Orifice Designation		VTA (NOTE 1)		VTA (NOTE 1)		VTA (NOTE 1)		
	48	Manufacturer		VTA		VTA		VTA		
	49	Model No.		VTA		VTA		VTA		
	50	Phase		VTA		VTA		VTA		

Notes :

1. THE SPECIFIED DATA ARE ONLY REFERENCE. SO, CALCULATION SHEETS SHALL BE SUBMITED BY MANUFACTURER ACCORDING TO KOREAN REGULATION & LAW
2. SEAT : METAL SEAT(ASTM A351 CF3M or EQ.) or SOFT SEAT(REINFORCED PTFE, GRAPHIT, or EQ.)
   DISC : ASTM A351 CF3M or EQ.

ATTACHMENT-7 :

[Refer to below Document]

1. TECHNICAL SPECIFICATION FOR SAFETY RELIEF VALVE-CRYOGENIC SERVICE
   [평택LNG-IN-013-002]

2. TECHNICAL SPECIFICATION FOR SAFETY RELIEF VALVE-GENERAL SERVICE
   [평택LNG-IN-013-003]

2	2018.04.06	FOR CONSTRUCTION	W.K.K	W.K.K	W.K.K	S.Y.P	
1	2018.02.09	GENERAL REVIEW	W.K.K	W.K.K	W.K.K	S.Y.P	
0	2017.04.28	FOR CONSTRUCTION (벽산엔지니어링 수행)	A.T.J	A.T.J	B.Y.W	P.S.H	
REV.NO	DATE	DESCRIPTION	DRN	DGN	CHK	APP.	CL/APP.

EUGENE
유진초저온

유진초저온(주) 평택오성 냉동물류단지 신축공사 중 LNG 설비 공사

한국가스기술공사
KOREA GAS TECHNOLOGY CORPORATION

TITLE :

TECHNICAL SPECIFICATION FOR SAFETY RELIEF VALVE - CRYOGENIC SERVICE

SCALE	PHASE	DOCUMENT NO.	REV.
NONE	-	평택LNG-IN-013-002	2

CONTENTS

1. GENERAL
2. CODES AND STANDARDS
3. DEFINITIONS
4. QUALITY ASSURANCE
5. INSPECTION AND TESTING
6. PROCUREMENT OF MATERIALS AND SERVICES
7. ATTACHMENTS

ANNEX. A : QUALITY PLANT REQUIREMENTS
ANNEX. B : GENERAL TESTING AND ACCEPTANCE LEVELS
ANNEX. C : CRYOGENIC TESTING AND ACCEPTANCE REQUIREMENTS

1. GENERAL

This specification applies to the design, manufacture, test and inspection, and others of the purchasing specification of cryogenic safety relief valves used in "OSEONG Superfreeze Storage"

2. CODES AND STANDARDS

2.1. Korea Gas Laws

- High pressure gas safety control act
- Urban gas business act
- Safety control & business regulation of liquified petroleum gas act.

2.2. American Petroleum Institute (API)

- API 550 “Manual on Installation of Refinery Instruments and Control Systems”
- API RP520 “Sizing, Selection and Installation for Pressure-Relieving Devices in Refineries”
- API RP 521 "Guide for pressure-relieving and depressurising system"
- API STD 526 “Flanged steel safety-relief valves”
- API STD 527 “Seat tightness of pressure relief valves”
- API 598 “Valve inspection and Testing”
- API 607 "Fire Test for Soft-Seated quarter-turn Valves"
- API 620 “Recommended rules for design and construction of large, welded, low pressure storage tanks”
- API 1510 “Design and construction of LP-gas installation at marine and pipeline terminals, natural gas processing plants, refineries and tank farms”
- API STD 2000 “Venting atmospheric and low pressure storage tanks“

2.3. American Society for Mechanical Engineers(ASME) / American National Standard Institute (ANSI)

- ASME Boiler and Pressure Vessel Code including all mandatory addenda Section I, "Power Boilers" Section VIII, "Pressure Vessels" Division 1
- ASME/ANSI B1.20.1 "Pipe Threads, General Purpose (Inch)"
- ASME/ANSI B16.5 "Pipe Flanges and Flanged Fittings"
- ASME/ANSI B16.10 "Face to face and End to end dimensions of Valves"
- ASME/ANSI B16.20 "Ring-Joint Gaskets and Grooves for Steel Pipe Flanges"
- ASME/ANSI B16.25 "Buttwelding Ends"
- ASME/ANSI B16.34 "Valves - Flanged and Buttwelding End"
- ASME/ANSI B31.3 "Chemical Plant and Petroleum Refinery Piping"
- ASME/ANSI B46.1 “Surface texture (surface roughness, Waviness and lay)
- ASME B16.47 "Large Diameter Carbon Steel Flanges"

2.4. American Society for Testing and Materials (ASTM)

- ASTM A182 "Standard specification for forged or rolled Alloy-Steel pipe flanges, forged fittings, valves and parts for High-Temperature Service"
- ASTM A320 "Standard specification for Alloy-Steel Materials for Low-Temperature Service"
- ASTM A351 "Standard specification for castings, austenitic, austenitic ferritic for pressure-containing parts"
- ASTM B26 “Standard specification for Aluminum-Alloy Sand Castings”

- ASTM E165 "Standard test method for liquid penetrant examination"
- ASTM E446 “Standard reference radiographs for steel castings up to 2 in. (51mm) in thickness

2.5. National Fire Protection Association (NFPA)

- NFPA 4.8.4 “Pressure and Vacuum relief valves for LNG containers”
- NFPA 5.4 “Relief devices on Vaporizers”
- NFPA 6.8 “Safety and relief valves for piping”
- NFPA 59A "Standard for the production, storage and handing of liquefied natural gas (LNG)"

2.6. Manufacturers Standardization Society (MSS)

- SP 25 “Standard Marking Systems for Valves, Fittings, Flanges and Unions”
- SP 55 “Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping components” - Visual method
- SP 67 “Butterfly Valves”

2.7. Deutche Industries Normen (DIN)

- 50049 “Materials Testing Certificates”

2.8. Steel Structures Painting Council (SSPC)

- SP12 “Surface preparation and cleaning of steel and other hard materials by high and ultrahigh-pressure water jetting prior to recoating”

2.9. British Standard (BS)

- 6364 "Cryogenic test procedure & seat leakage test requirements"

3. DEFINITIONS

3.1. Safety Relief valve

3.1.1. Safety valve

A valve capable of blowing fluid (vapor or gas) at its nominal blowing capacity by being automatically actuated when its inlet pressure reach a preset pressure and by returning to the normal state when the pressure is dropped.

3.1.2. Relief valve

A valve capable of blowing fluid (liquid) at its nominal blowing capacity by being automatically opened in proportion to the pressure portion exceeding the set pressure when the inlet pressure exceeds its preset pressure and by returning to the normal state

3.2. Set Pressure

The blowing pressure determined in the design of a safety valve requiring a blowing pressure, or the blow-starting pressure determined in the design of a safety valve requiring a blow-starting pressure, and the pressure marked in the nameplate of a safety valve.

3.3. Design Pressure

A pressure used to determine the minimum thickness of a container or physical characteristics in its various parts

3.4. Maximum Allowable Working Pressure (MAWP)

The maximum pressure allowable on the top of a container of which thickness has been calculated on the basis of the material used for its fabrication

3.5. Accumulated Pressure

A pressure accumulated in a safety relief valve until a fluid is being blown out from it.

This pressure is the maximum pressure allowable in the facility

3.6. Blow-Starting Pressure

The static fluid pressure at the moment of starting to blow from a safety valve, and the inlet pressure when a very small amount of the fluid discharge is detected at the outlet side

3.7. Blow-Stopping Pressure

The pressure at the inlet side of a safety valve at the moment when the valve is closed by the pressure drop, fluid blowing is practically stopped, and the lift of the valve disc is zero

3.8. Blow-Down Pressure

The pressure difference between the blowing pressure and the blow-stopping pressure of a safety valve requiring a blowing pressure, or the pressure difference between the blow-starting pressure and the blow-stopping pressure of a safety valve requiring a blow-starting pressure

3.9. Required Capacity

The fluid amount that shall be blown out in each case of all pressure increase factors practically possible

3.10. Relieving Capacity

Each valve's intrinsic relieving fluid amount that is larger than the required capacity

4. QUALITY ASSURANCE

4.1. The manufacturer or Supplier an approved quality assurance system for the design, manufacturing, testing and installation of the proposed valves. The systems shall conform to ISO 9000 series or similar standards.

4.2. Valves shall be manufactured to a quality plan listing the activities to be checked and the appropriate hold, witness and review points.

5. INSPECTION AND TESTING

5.1. The inspection and testing requirements shall form the basis of a quality plan agreed between Owner and the Contractor (see Annex A).

5.2. General inspection and testing shall be as given in Annex B.

5.3. Cryogenic inspection and testing shall be as given in Annex C.

6. PROCUREMENT OF MATERIALS AND SERVICES

6.1. The supply of materials and services shall be subject to the conditions

of the contract at the time of placing the orders and in conformance to the requirements of Owner.

7. ATTACHMENTS

ANNEX .A QUALITY PLAN REQUIREMENTS

ANNEX. B GENERAL TESTING AND ACCEPTANCE LEVELS

ANNEX. C CRYOGENIC TESTING AND ACCEPTANCE REQUIREMENTS

ANNEX. A

QUALITY PLAN REQUIREMENTS

A.1 Quality requirements are given in table 1.

	TABLE 1 - QUALITY PLAN REQUIREMENTS	
	ACTIVITY BY MANUFACTURER / CONTRACTOR Key : H = Hold, W = Witness, R = Review	OWNER
0.	Preproduction meeting of Owner / Contractor	
1.	Design or type approval.	
2.	Prepare material certificates for pressure containing parts.	
3.	Prepare welding procedures.	
4.	Prepare repair procedures.	
5.	Selective alloy test on finished valves.	
6.	Prepare heat treatment charts.	
7.	Verify ferrite content of 10% of all components.	
8.	Verify mechanical strength, properties (including impact tests).	
9.	Visually examine all cast surfaces. (100%)	
10.	Verify positions and extent of X-ray examination for each type valve.	
11.	Radiography test shall be performed on all parts of the selected 5% the cast quantity for each class(at least 1 piece)	
12.	All welded joint shall be tested in 100% with X-ray.	
13.	Radiograph all butt weld ends prior to bevelling. (100%)	
14.	All exterior and accessible interior surfaces of the valve body shall be penetrant tested 100%. All sealing welds shall be penetrant tested 100%.	

	TABLE 1 - QUALITY PLAN REQUIREMENTS	
	ACTIVITY BY MANUFACTURER / CONTRACTOR Key : H = Hold, W = Witness, R = Review	OWNER
15.	Carry out dimensional checks to specified standards including surface finish of gasket surfaces, thickness of body and weld ends.	
16.	Verify 5% of each type of valve for stellite deposition or other specified plating or coating thickness, material, finish. (at least 1 piece)	
17.	Ultrasonically inspect all forged valves used for pressure containment.	
18.	Shell pressure test each valve to ANSI B16.34, for not less than 5 minutes.	
19.	Valve porosity test each valve with 0.55MPa.g air/soap bubble.	
20.	Valve seat and packing test each valve with air/soap bubble (for bidirectional valves carry out test in both directions).	
21.	Performance test actuated valves e.g., torque, stroke time, limit switches	
22.	Cryogenic leak test shall be performed 5% of each type vlave (at least 1 piece). For test procedure see agreed test and acceptance methods.	
23.	Cryogenic performance test shall be performed 5% of each type vlave. (at least 1 piece)	
24.	Clean, dry and protective coat each valve.	
25	Mark, tag and identify each valve.	
26	Prepare valve dossiers (to contain material certification, heat treatment charts, maintenance, service manuals, recommended spare parts for commissioning. Final approved GA with dentification of parts, shell pressure test, leak test, NDT results, cryogenic leak and performance test reports).	
27.	Pack / dispatch	

A.2 Inspection / Testing table

CONTENTS	CONTRACTOR	OWNER	RELATED SFECIFICATION
MATERIAL COMPOSITION (ALLOY VERIFICATION)	○	△	2,3,7,16
MECHANICAL PROPERTIES	○	△	8
IMPACT REQUIREMENTS	○	△	6,8
NON-DESTRUCTIVE TESTING	○	△	10,11,12,17
REPAIR OR CAST STEEL VALVES	○	△	4
PRESSURE TESTING	○	○	18
CRYOGENIC TESTING	○	○	21,22
DIMENSIONAL CHECK	○	○	1,15
VISUAL INSPECTION	○	○	9,23,24,25,26
LIQUID PENETRANT EXAMINATION	○	○	14
OPERATION AND SEAT LEAKAGE TEST (TIGHTNESS TEST)	○	○	19,20
PERFORMANCE TEST	○	○	21,23,26

○ : Witness of Test and Inspection

△ : Review

ANNEX. B

GENERAL TESTING AND ACCEPTANCE LEVELS

B.1 SCOPE

There are a number of additional testing requirements needed to qualify the cryogenic valves. These requirements and their acceptance levels are listed in the subsequent paragraphs.

B.2 MATERIAL COMPOSITION

B.2.1 Full traceability of the material and its composition shall be required for pressure retaining components i.e. body, cap, nozzle, bonnet, bolting, guide and ring, spring, bellows, seat and disc.

B.2.2 Chemical analysis of each cast and heat batch shall be required for all pressure retaining cast sections.

B.2.3 Chemical analysis of each melt and heat batch shall be required for all pressure retaining forged or bar sections.

B.2.4 On finished parts, product analysis shall be carried out on 3 valves per type to record elements of C Mo Cr N Mn. If there are less than 3 valves per type, at least 1(one) valve shall be carried out.

B.2.5 Samples for product analysis shall be taken from the top and bottom of the body, flanged and welded ends.

B.2.6 Samples for product analysis shall be taken from forged components, such as bolts.

B.3 MECHANICAL PROPERTIES

B.3.1 Mechanical tests shall be carried out on representative samples of

each cast and heat batch in the fully heat treated condition as specified. The properties shall meet the relevant material specifications.

If test bars are cast attached to the main body, they shall not be detached until after completion of heat treatment.

If separate test bars are used, they shall be cast from the same batch of steel as the castings and shall have the same heat treatment.

B.4 IMPACT REQUIREMENTS

B.4.1 Impact testing shall be carried out on pressure retaining parts, using Charpy 'V' specimens, at -196℃. The samples shall be taken from each cast and heat batch or heat treatment condition, and shall meet the requirements specified.

B.4.2 The impact test and acceptance level shall be to ASME VIII Div 1, paragraphs UHA and UG84. For austenitic stainless steels the lateral expansion, for each of 3 specimens, shall be not less than 0.381 mm. The energy levels recorded shall be stated on the material certificates.

B.5 NON DESTRUCTIVE TESTING/EXAMINATION

B.5.1 Visual examination in accordance with MSS SP 55 shall be carried out on all valves. The components shall include all pressure-retaining parts, valve seats and sealing rings, gaskets, bolts.

B.5.2 100% radiographic inspection shall be carried out on 5% of each casting used for each valve type, with not less than one valve test.

B.5.3 If unacceptable defects are found in a valve from a batch of casting examined in accordance with B.5.2, a further 10% of the

batch of valves shall be 100% radiographically inspected at the Contractor's cost. If unacceptable defects are found in this further inspection, the entire batch shall be rejected.

B.5.4 The radiographed valves shall be marked with 'X'.

B.5.5 100% radiography shall be carried out on all welded joints including seat areas, rings, welded bonnet joints, butt weld (BW) ends. At the BW ends the radiography shall also be carried out before the bevels are prepared.

B.5.6 Radiographs shall be compared with ASTM E446 for thickness 2" and below, and ASTM E186 for thickness above 2".

B.5.7 The defect acceptance levels on welded joints shall be in accordance with ANSI B31.3.

B.5.8 The acceptance criteria for castings shall be as given in Table 2.

TABLE 2 – ACCEPTANCE CRITERIA FOR CASTINGS

Discontinuity Type	Acceptable Severity Level	Area of Castings
A, B, C	Class 1	BW ends, seat areas and critical areas
D, E, F, G	Non permitted	Complete casting
A,B C	Class 3 Class 2	Non critical areas

B.5.9 The dye penetrant examination shall be in accordance with ASTM E165 and the applicable parts of ASME V.

NOTE 1: On castings a surface finish of 400-500 μin is desirable.

NOTE 2: The welded surfaces may require some grinding prior to application.

B.5.10 Liquid penetrant examination shall be carried out on 100% of valves on the exterior and the accessible interior surfaces of body and bonnet of castings, all finished machined BW ends and welds on the extended bonnet.

B.5.11 Acceptance criteria shall be in accordance with ANSI B16.34

B.5.12 Liquid penetrant materials shall not contain chemicals harmful to the body, bonnet or trims, e.g., chlorides, halides. After test all contaminants shall be removed by suitable solvents.

B.5.13 All forged valves or components for the pressure retaining parts shall be examined by ultrasonic examination. Maximum length or depth of forgings examined shall be not more than 1.5 m.

B.5.14 The bolting materials shall be subjected to Brinell hardness, Charpy V notch impact, visual and dye penetrant checks.

B.5.15 Brinell hardness tests shall be carried out on 10% of all bars in each size and heat with acceptance level as given in the relevant ASTM material specification.

B.5.16 A Charpy V notch impact test shall be carried out on the bar having the highest hardness value found in B.5.15 for each batch, size and cast of material. The impact test acceptance level shall be to ASME VIII Div 1, paragraphs UHA and UG84. For austenitic stainless steels the lateral expansion, for each of 3 specimens, shall be not less than 0.381 mm. The energy levels recorded shall be stated on the material certificates.

B.5.17 Bolting made from bar of diameter greater than 1" shall be subject to 100% visual and dye penetrant examination in accordance with ASTM E165 and the applicable parts of ASME V.

B.5.18 All components manufactured from material impact tested

at - 196 ℃ shall be marked 'C'.

B.6. REPAIR OF CAST STEEL VALVES

B.6.1 When necessary repairs of castings by welding shall be in accordance with the requirements and acceptance levels of ANSI B16.34 and as given in B.6.2. to B.6.7.

B.6.2 All repair welding shall comply with the approved welding procedures and shall be carried out by the approved welders. The approvals shall be by Owner (or appointed representative).

B.6.3 The welding procedures and qualifications shall be in accordance with ASME IX. Qualification tests for castings shall be carried out on cast test plates and radiographs shall be compared to reference radiographs as given in ASTM E446.

B.6.4 Defects shall be removed to sound metal before welding and excavated areas subjected to dye penetrant test. If additional heat treatment is carried out on the castings, the heat treatment data shall be supplied with the certificates.

B.6.5 The defect description and acceptance standards shall be in accordance with relevant ASTM, ANSI/ASME standards. The following defects shall not be acceptable:

a) cracks (linear or angular),

b) lack of penetrant,

c) inter or side wall fusion,

d) excessive porosity,

B.6.6 After repair and any heat treatment, the castings or welded joints shall be re-examined to the original non-destructive testing and acceptance criteria.

All repairs shall be recorded and contained in the valve data books.

B.6.7 All major defect repairs shall be "hold points" on the quality plans.

B.7 PRESSURE TESTING

All valves shall be subjected to pressure tests given in Table 3, under ambient conditions with the acceptance levels indicated.

TABLE 3 - PRESSURE TESTS

Requirement	Shell pressure test	Seat Leakage Test			
		Set Pressure			
		Greater than 0.34MPa.g	0.34MPa.g or less	Greater than 0.34MPa.g	0.34MPa.g or less
Test Medium	Kerosene or equivalent	Air or Nitrogen	Air or Nitrogen	Water	Water
Test Pressure	1.5 times the cold rating	90% of set pressure	0.034MPa.g less than set pressure	90% of set pressure	0.034Mpa.g less than set pressure
Time	5 minutes minimum	2″ or smaller : 1min. 2-1/2″, 3″ or 4″:2min. 6″ or larger : 5min.	2″ or smaller : 1min. 2-1/2″, 3″ or 4″:2min. 6″ or larger : 5min.	1 min.	1 min.
Acceptance	ANSI 16.34	Metal seat : According to API 527 Soft seat : No leakage (0 Bubbles per minute)	Metal seat : According to API 527 Soft seat : No leakage (0 Bubbles per minute)	Metal seat : -1″ or larger : not exceed 10㎤/hr/inch of inlet size -1″ less : not exceed 10㎤/hr Soft seat : No leakage for 1min.	Metal seat : -1″ or larger : not exceed 10㎤/hr/inch of inlet size -1″ less : not exceed 10㎤/hr Soft seat : No leakage for 1min.

ANNEX. C

CRYOGENIC TESTING AND ACCEPTANCE REQUIREMENTS

C.1 CRYOGENIC TESTS

In accordance with BS 6364.

The test will be excuted with the pieces type.

C.2 PURPOSE

One valve of each to each diameter and rating shall undergo a qualification test at low temperature (-196℃).

The first valve tested will be picked of the first batch of shipment and will be selected by the inspector after delivery tests at ambient temperature.

All test shall be witnessed by OWNER`S representatives.

C.3 TEST AND ACCEPTANCE CRITERIA

C.3.1 Test procedure : BS 6364

C.3.2 Required test items

Seat leakage test requirements shall be done as per BS 6364 and API 527.

Operation (Popping and set pressure) test requirements shall be done API 526 and ASME VIII.

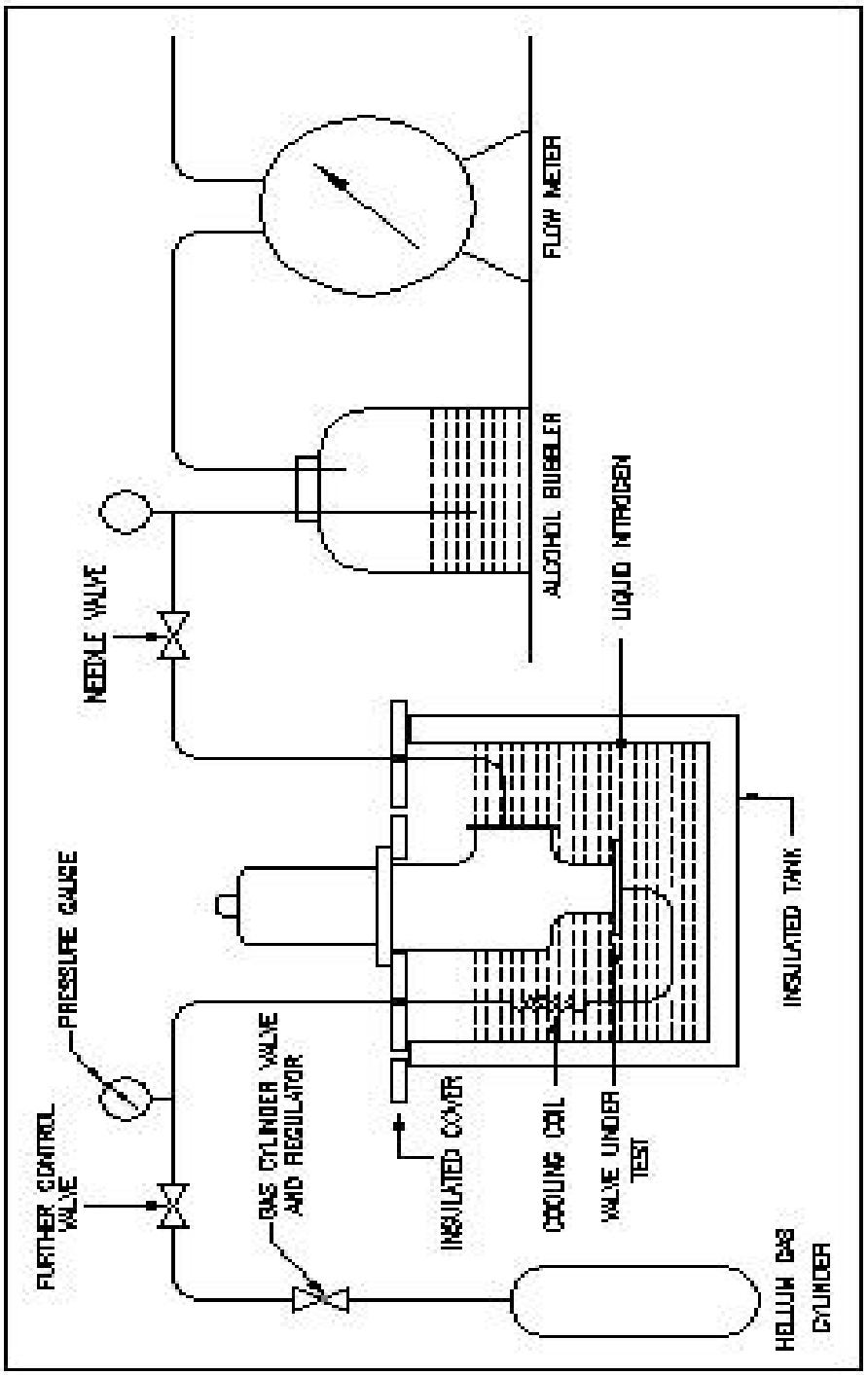
C.3.3 Allowable leakage rate shall be calculated from ambient test and then shall be confirmed tightness from calculated leakage rate.

C.4 TEST SCOPE

a) Five (5%) of all valves for each valve class (nominal valve size and pressure rating) shall be sampled and cryogenic-tested.

b) In case the test result fails to satisfy the requirements, 10% of related classes shall additionally be sampled and tested. In case the test results fails again to satisfy the requirements, the whole lot of the related valve class shall be rejected. (Satisfaction of cryogenic test requirements means that the test results of initial proving test, cryogenic performance test, ambient temperature restoration test, and disassembly test satisfy their corresponding standards.)

SPECIFICATION
CONTINUATION SHEET



TYPICAL ARRANGEMENT OF LOW TEMPERATURE TYPE TEST RIG

2	2018.04.06	FOR CONSTRUCTION	W.K.K	W.K.K	W.K.K	S.Y.P	
1	2018.02.09	GENERAL REVIEW	W.K.K	W.K.K	W.K.K	S.Y.P	
0	2017.04.28	FOR CONSTRUCTION (벽산엔지니어링 수행)	A.T.J	A.T.J	B.Y.W	P.S.H	
REV.NO	DATE	DESCRIPTION	DRN	DGN	CHK	APP.	CL/APP.

EUGENE
유진초저온

유진초저온(주) 평택오성 냉동물류단지
신축공사 중 LNG 설비 공사

한국가스기술공사
KOREA GAS TECHNOLOGY CORPORATION

TITLE :

TECHNICAL SPECIFICATION FOR SAFETY RELIEF VALVE - GENERAL SERVICE

SCALE	PHASE	DOCUMENT NO.	REV.
NONE	-	평택LNG-IN-013-003	2

CONTENTS

1. GENERAL
2. CODES AND STANDARDS
3. DEFINITIONS
4. DESIGN AND CONSIDERATIONS FOR PRESSURE RELIEF SYSTEM SELECTION
5. PRESSURE RELIEVING SYSTEMS APPLICATIONS
6. RELIEF VALVE SIZING CRITERIA
7. ACCESSORIES
8. INSTALLATION REQUIREMENTS
9. ATMOSPHERIC AND LOW PRESSURE STORAGE TANKS
10. MATERIALS AND CONSTRUCTION
11. TAGGING

1. GENERAL

1.1. This specification applies to the design, manufacture, test and inspection, and others of the purchasing specification of safety relief valves used in "OSEONG Superfreeze Storage"

1.2. Pressure relieving systems are to be employed to prevent the over-pressurization of any system. The principal operation hazards which could lead to over pressure are as follows

- Exposure to fire
- Blocked discharge
- Sun or thermal pressure relief
- Instrument failure (pressure control, etc.)
- Utility failure (electric power, cooling water, steam, instrument air, etc.)
- Chemical reaction
- High pump discharge pressure due to reduced flows
- Pressure increase due to reduction of system friction losses at reduced flows.
- Equipment malfunctions
- Reflux flow failure
- Abnormal process heat input
- Accumulation of non-condensable
- Operating errors
- Design errors

There are only a few of the above listed conditions which may occur in any one particular situation. In each installation therefore, the sizing of the safety device is based on the one condition which requires the greatest relief capacity. Refer also to API RP 520, Part I.

1.3. The required relieving rate shall be that rate required to prevent system over-pressurization from the operational hazards listed in 1.2 above. Each operational hazard must be reviewed and all possible contingencies evaluated to determine the single largest risk. In evaluating the risk generated by exposure to fire, the required vapor release rate shall be in accordance with API RP-520.

1.4. Spare relief valves shall be installed on all services, with the following exceptions:

1.5. Thermal relief.

1.5.1. On multiple valve installations, one or more additional valves each of which shall have the same capacity as the largest working valve may be installed.

1.5.2. When spare standby equipment is supplied for relief valve equipment, the relief valve installed on the standby equipment meets this requirement.

1.5.3. When relief valves equipment is used infrequently (during startups, regeneration, etc.).

2. CODES AND STANDARDS

The following laws, codes, and standards referred to in this specification shall be their latest editions. Any item inconsistent with this specification shall be approved by EUGENE prior to manufacturing those valves.

2.1. Korean Industrial Standard (KS)

- KS B 6216 Steam Boilers and Pressure Vessels - Spring Loaded Safety Valves
- KS B 6352 Measuring Methods for Coefficient of Discharge of Safety Valves

- KS B 0227 30° Trapezoidal Screw Threads
- KS B 0816 Methods for Liquid Penetrant Testing and Classification of the Indication
- KS B 0418 Permissible Deviations in Dimensions without Tolerance Indication for Steel
- Casting

2.2. Korean Gas-Related Laws and Regulations

- Unified Notification of Standard for High-Pressure Gas Safety Control (Specially-Designated Production Facilities of High-Pressure Gas)
- Urban Gas Business Act
- Safety Control and Business Regulation of Liquefied Petroleum Gas Act

2.3. American Petroleum Institute Specification (API)

- API RP 520 Design and installation of pressure relieving system in refineries
- API RP 525 Testing procedure for pressure relieving devices discharging against variable back pressure
- API RP 526 Flanged steel safety relief valves
- API RP 527 Commercial set tightness of safety relief valves with metal to metal seat
- API RP 521 Guide for pressure-relieving and depressuring system
- API RP 598 Valve inspection and testing
- API RP 600 Steel gate valves-flanged and butt-welding ends
- API RP 605 Large diameter carbon steel flanges

2.4. American National Standard Institute (ANSI)

- ANSI B16. 5 Steel pipe flanges and flanged fittings
- ANSI B16.34 Valve-flanged, threaded, and welding end
- ANSI B16.10 Face to face and end to end dimension of valves
- ANSI B16.20 Ring joint gaskets & grooves for steel pipe flanges

2.5. American Society for Testing and Materials (ASTM)

- A516 Standard specification for pressure vessel plates
- A182 Standard specification for forged or rolled alloy-steel pipe flanges, forged fitting, and valves and parts for high-temperature service
- E165 Standard test method for liquid penetrant examination
- E709 Standard guide for magnetic particle examination

2.6. Steel Structures Painting Council (SSPC)

- SP12 Surface preparation and cleaning of steel and other hard materials by high and ultrahigh-pressure water jetting prior to recoating

3. DEFINITIONS

3.1. Safety Relief valve

3.1.1. Safety valve

A valve capable of blowing fluid (vapor or gas) at its nominal blowing capacity by being automatically actuated when its inlet pressure reach a preset pressure and by returning to the normal state when the pressure is dropped.

3.1.2. Relief valve

A valve capable of blowing fluid (liquid) at its nominal blowing capacity by being automatically opened in proportion to the pressure portion exceeding the set pressure when the inlet pressure exceeds its preset pressure and by returning to the normal state

3.2. Set Pressure

The blowing pressure determined in the design of a safety valve requiring a blowing pressure, or the blow-starting pressure determined in the design of a safety valve requiring a blow-starting pressure, and the pressure marked in the nameplate of a safety valve.

3.3. Design Pressure

A pressure used to determine the minimum thickness of a container or physical characteristics in its various parts

3.4. Maximum Allowable Working Pressure (MAWP)

The maximum pressure allowable on the top of a container of which thickness has been calculated on the basis of the material used for its fabrication

3.5. Accumulated Pressure

A pressure accumulated in a safety relief valve until a fluid is being blown out from it.

This pressure is the maximum pressure allowable in the facility

3.6. Blow-Starting Pressure

The static fluid pressure at the moment of starting to blow from a safety valve, and the inlet pressure when a very small amount of the fluid discharge is detected at the outlet side

3.7. Blow-Stopping Pressure

The pressure at the inlet side of a safety valve at the moment when the valve is closed by the pressure drop, fluid blowing is practically stopped, and the lift of the valve disc is zero

3.8. Blow-Down Pressure

The pressure difference between the blowing pressure and the blow-stopping pressure of a safety valve requiring a blowing pressure, or the pressure difference between the blow-starting pressure and the blow-stopping pressure of a safety valve requiring a blow-starting pressure

3.9. Required Capacity

The fluid amount that shall be blown out in each case of all pressure increase factors practically possible

3.10. Relieving Capacity

Each valve's intrinsic relieving fluid amount that is larger than the required capacity

4. DESIGN CONSIDERATIONS FOR PRESSURE RELIEF SYSTEM SELECTION

The following guidelines shall be followed in the selection of a pressure relief system:

4.1. Conventional Safety - Relief Valve

4.1.1. This valve shall be of the direct spring loaded, top guided, high lift nozzle type. This valve shall have a closed bonnet internally vented to the discharge side of the valve. Opening pressure, closing pressure, lift and relieving capacity are directly affected by changes of back pressure. This type is most commonly used in both liquid and hydrocarbon vapor service.

4.1.2. Conventional relief valves may be used in non-corrosive service provided :

a) Variations in superimposed back pressure are less than 10 percent of the valve's set pressure. When superimposed back pressure exists, its maximum value must be subtracted from the set pressure to determine the net spring setting.

b) The Sum of the maximum superimposed back pressure and the built up back pressure is less than 10 percent of the set pressure to safeguard the valve's capacity requirements.

c) The superimposed back pressure in the discharge header of a closed relief valve can vary under different operating conditions. In balanced type relief valve's the effect is cancelled out by utilization of a bellows plus an auxiliary piston. (The latter one is an additional balancing feature in case the bellows breaks or leaks).
In conventional type relief valve's variation in superimposed back pressure will directly effect the valve's set pressure. The relief valve is normally set at the design pressure of the vessel which is 10% or 0.103MPa (whichever is greater) beyond the maximum pressure. The coincidence of the process operation at its maximum pressure and the superimposed back pressure having its minimum value is considered exceptional and superimposed back pressure variations up to 10 percent of the set pressure are acceptable for conventional type relief valves. If variations in operating pressure and superimposed back pressure cannot be controlled with in the stated limits, then a balanced relief valve must be used.

d) To prevent chattering, conventional relief valve discharge systems should be designed for maximum built-up back pressure of 10% of set pressure, when relieving with an accumulation of 10%. In case of 20% accumulation built-up back pressure up to 20% of set pressure is permissible. As an alternative, a balanced valve may be used.

4.1.3. Conventional relief valves may be used in corrosive services provided rupture disks are installed upstream of the relief valve and the valve and rupture disk combination are in accordance with Part UG-132 Section 8, Division I of the ASME Unfired Pressure Vessel Code.

4.2. Bellows Type Safety Relief Valves

Bellows type safety relief valves shall be used in cases where spring and trim should be protected against severe fouling and corrosion, provided the conditions of Paragraph 4.1 are met.

4.3. Balanced Bellows with Balancing Piston Type Safety Relief Valves shall be used in cases where conventional or bellows type cannot be used.

4.3.1. Balanced valves shall be used when back pressure exceeds 10% of set point. Balanced spindle types are preferred.

4.3.2. On all valves equipped with bellows the bonnet should be vented to atmosphere. The valve shall be installed so that the bonnet vent does not allow released vapors to impinge on lines, equipment or towards personnel walkways. The vent piping should discharge horizontally to avoid entry of rain water and debris and should terminate in a position which is accessible for leak testing. In areas of sources of ignition the valve and/or bonnet vent line should be located 30m from the ignition source. Where the valve is installed a minimum of 15m above grade, the horizontal distance to the closest point of ignition should be 15m.

4.3.3. In cases where bellows failure would release flammable, toxic or corrosive liquids through the vent, a short nipple and elbow should be used to direct the leakage to an open funnel which is piped to grade and ties into a catch basin or manhole with a sealed inlet connection. For severely toxic fluids the vent should be tied into a closed low pressure system. Minimum length venting piping should be used. The effects of any back pressure

must be thoroughly examined since in such a case superimposed back pressure is additive to the spring force.

4.4. Multiple Valves

4.4.1. Normally a manufacturer's standard pressure relief valve with an orifice area equal to or larger than the calculated orifice area would be specified. Where the required area exceeds that of the largest single relief valve available, it will be necessary to install two or more standard pressure relief valves.

4.4.2. Multiple relief valve installation may also be employed for the following reasons:

a) If the next larger valve has a greater area than the required minimum (i.e., the valve is oversized), the valve may "chatter".

b) In such a case, a combination of smaller valves with staggered set points can be used which will more closely approximate the required area.

c) The ASME Code Section VIII, Division I requires only one valve to be set at the maximum allowable working pressure of the vessel. The others can be set at a higher pressure but not to exceed 105% of the maximum allowable working pressure for operating failures and 110% of the maximum allowable working pressure for fire exposure. It may be desirable to install several relief valves and "step" the pressure settings in order to reduce the quantity of product lost during a valve release.

d) In general, do not mount multiple safety valves on a common tee-type header nozzle. Directly mounting on the vessel or line is preferred because:

① Supporting problems.

② Line loss.

③ Discharge reaction.

④ Inlet pressure drop causes "chatter".

4.5. Pilot Operated Valves are superior to the conventional relief valve in the pressure range below 0.103MPa. They are used for spheres, spheroids and refrigerated LPG tanks which operate at these conditions.

4.5.1. Pilot operated relief valves for gas service shall be non-flowing pilots.

4.5.2. Non-flowing pilot-operated relief valves may be used for all general gas services, and shall be furnished with test connection. For sour gas service, these relief valves must meet NACE Standard MR-01-75.

4.5.3. All Pilot Operated Relief Valves for gas service shall have self-contained, single staged pilots, mounted on the main valve body; with field test connections. All pilots shall have internal pressure pick-up and back-flow prevents, except as noted.

4.5.4. Pilot Operated Relief Valves for liquid service below 9.807MPa set pressure shall be modulating type. Above 9.807MPa, they shall be non-flowing pilot.

4.6. Seat Tightness

4.6.1. Metal-to-metal seats shall normally be specified as "commercial tightness" which permits a certain leakage at a specified percent of set pressure.

4.6.2. "Bubble tightness" which permits no leakage should only be used under special conditions. O-rings or other soft seats used to obtain tight shut-off have a shorter life and are normally limited to 230℃ and 10.297MPa maximum pressure.

4.6.3. Testing for tightness shall be in accordance with API Standard 527.

4.6.4. Thermal relief valves shall be soft seated except in extreme temperatures or non-compatibility with the fluid.

4.7. Rupture Discs

4.7.1. The bursting pressure of tensioned rupture discs varies ±5% from the predicted pressure at the desired temperature. This, together with the fact that rupture discs can fail from fatigue, requires a larger spread between the operating pressure and the bursting pressure than with relief valves. It is normal to allow a margin of 30% between operating and set pressure when using tensioned rupture discs. For this reason, prescored, reverse buckling rupture discs are preferred.

4.7.2. Rupture discs are sometimes installed upstream of the pressure relief valve to avoid leakage of highly toxic or high cost materials or to minimize corrosion or fouling of the valves. In these cases a pressure gauge and restricted vent are required between the rupture disc and the pressure relief valve to permit checking of the disc for failure or leakage and to release any back pressure build up that would prevent it bursting at the designed pressure.

5. PRESSURE RELIEVING SYSTEMS APPLICATIONS

5.1. Pressure Vessels

Relieving devices shall be furnished in accordance with requirements set forth in the latest edition of the ASME CODE-SECTION VIII DIVISION 1- UNFIRED PRESSURE VESSELS, PARAGRAPHS UG - 125 TO UG - 135 when said devices are installed on the following types of equipment:

5.1.1. Vessels operating between 1 and 20.595MPa. Vessels known as evaporators or heat exchangers. All other pressure vessels, over 150 mm in diameter.

5.1.2. The ASME Code does not contain any specific recommendations as to the minimum number of relief valves required for an installation. The engineer sizing relief valves shall determine the number of valves used based on calculations, economics and specific job requirements.

5.1.3. For vessel protection, the first valve normally shall be set at least 10% or 0.098MPa, whichever is greater, above the maximum operating pressure (this normally establishes the design pressure of the protected equipment). Where very unstable processing conditions exist, this differential shall be at least 0.172MPa or 10% above the maximum operating pressure, whichever is greater.

5.1.4. All pressure vessels shall be protected by pressure relieving devices that shall prevent the pressure from rising more than 10 percent above the maximum allowable working pressure except:

a) When multiple relief valve's are provided with staggered setting and set according to the Code they shall prevent the pressure from rising more than 16 percent above the maximum allowable working pressure for any operating contingency.

b) Where single or multiple relief valve's shall be installed to protect against excessive pressure caused by exposure to fire or other unexpected sources of external heat, they shall be capable of preventing the pressure from rising more than 21 percent above the maximum allowable working pressure, when set in accordance with the code.

5.1.5. If the vessel is one of a series interconnected by piping without block valves or with only car-sealed open (CSO) block valves, and if the piping is of adequate size to handle either vapor flow or liquid displaced by the vapor generated and not subject to plugging, then the system may be considered as one unit in calculating the required relief valve capacity. One or more valves in any one location can be considered as protection for the entire

system. CSO valves generally should not be used where the single contingency of inadvertent closing of the CSO valve would directly result in overpressure of any equipment by more than 1. 5 times the design pressure.

5.2. Power Boilers

Relieving devices shall be furnished in accordance with the requirements set forth in the LATEST EDITION OF THE ASME BOILER AND PRESSURE VESSEL CODE, SECTION 1, POWER BOILERS;- when these devices are installed on the following type vessels:

5.2.1. Pressure vessels in which steam is generated by the application of heat resulting from the combustion of fuel. Unfired pressure vessels in which steam is generated. Separately fired steam superheaters.

5.2.2. Major Code requirements are as follows:

a) Each boiler shall have at least one pressure relief valve. If it has more than 500 square feet (46 m2) of water heating surface, it shall have two or more pressure relief valves.

b) High temperature water boilers shall be equipped with safety-relief valves with closed bonnets.

c) One or more safety valves on the boiler proper shall be set at or below the maximum allowable working pressure. (MAWP)

d) If more than one valve is used, the highest pressure setting shall not exceed the maximum allowable working pressure by more than 3 percent. The complete range of pressure settings of all the saturated steam relief valves on a boiler shall not exceed 10 percent of the highest pressure to which any valve is set.

e) The relief valve capacity for each boiler shall be such that the pressure relief valve(s) will discharge all of the steam that can be generated by the boiler without allowing the pressure to rise more than 6 percent above the highest pressure at which

any valve is set and in no case to more than 6 percent above the maximum allowable working pressure. The code limits the capacity of each valve based on a maximum inlet pressure of 103% of set pressure.

f) Every superheater and every reheater shall be equipped with relieving devices in accordance with the Code paragraph entitled, Superheater Safety Valve Requirements. The relieving requirements and their relationship to the boiler relieving requirements are established in the same paragraph.

5.3. Shell and Tube Equipment

5.3.1. The low pressure side shall be protected by a Relief Valve if the MAWP on the high side is more than 1.5 times the MAWP of the low side, and piping on the low side can not handle the discharge from a split tube without exceeding the allowable accumulation over the low pressure side MAWP.

5.3.2. A pressure relief valve shall be used to protect either side of the equipment where the source of the medium to that side is such that the pressure can build up in excess of the pressure indicated above.

5.3.3. The pressure relief valve shall be sized for the difference between total discharge from the split tube and that portion which can be handled by the piping on the low pressure (LP) side (in addition to normal flow on LP side) without exceeding 1.5 times LP side MAWP.

5.3.4. Calculation of the capacity of the low pressure piping should allow for vaporization (if any) of the high pressure liquid. The opening created by the split is assumed to be equal to twice the tube cross sectional area. MAWP differential is to be used in calculations.

5.3.5. Where pressure relief is required to protect against possible heat

exchanger tube rupture, disc assemblies shall be considered for the LP side if the MAWP on the high pressure side is equal to or greater than 6.865MPa and the ratio of high pressure to low pressure exceeds 1.5 or if the differential between high pressure and low pressure equals or exceeds 6.865Mpa.

5.3.6. In the case of a double pipe exchanger with no internal flanges, protection against overpressure is not required. There are no internal joints to fail and the pipe can be removed for periodic inspection. (Very high differential pressures may require special consideration).

5.4. Pumps

5.4.1. Relief valves are required when the shut-off head of the pump exceeds the MAWP, TP of discharge piping, downstream equipment or pump casing. Positive displacement pumps normally require protection while centrifugal pumps may not. The capacity of a pump discharge relief valve should equal the capacity of the pump, except that for a centrifugal pump with known pump curve, advantage can be taken of the reduction in capacity as the pump backs up on its performance curve and a smaller valve could be considered.

5.4.2. Relief valves on pumps are usually discharged to a closed system. In some cases they may be discharged to the suction or suction vessel. This can usually be done if the difference between normal and maximum suction pressure is small compared to the pump differential pressure. Discharge of relief valves into the pump suction line should be avoided if possible as recirculation of fluid through the pump may cause heating.

5.4.3. Reciprocating and gear pumps require a relief valve up-stream of the discharge isolating valve, relieving to the suction tank.

5.4.4. Internal relief valves on positive displacement pumps are normally

not acceptable except in the following cases:

a) Capacity of pumps is less than 2.5 m3/h.

b) Service of pump is non-corrosive and non-toxic.

c) Internal valve setting is less than 1.667 MPa.g

5.5. Process Furnaces

5.5.1. Relief valves are required on furnaces only when the outlet contains a control valve or other back pressure device, or could otherwise be overpressured. Furnaces which operate at high pressure maintained by a restriction in the transfer line must be protected since the restriction may coke up. Furnaces having block valves in the outlet which are car-sealed open do not require relief valves. The block valve shall be installed with the stem in the horizontal position. A check valve shall be installed in the outlet line where there is a possibility of back-pressuring the furnace from any contingency such as a tube rupture in a downstream vessel.

5.5.2. Preferred location for a pressure relief valve is on the furnace outlet, upstream of the block valve. Where the feed to the furnace is 100% vapor, the relief device should always be placed on the outlet since the furnace tubes, if "dead-ended", could fail thermally at or below normal operating pressure.

5.5.3. Relief devices should only be installed at furnace inlet when all the following conditions are met:

a) Feed consist wholly or partly of liquid.

b) There is a possibility of coking relief valve inlet if it were located at the furnace outlet, and no steam or other purge is available to keep the inlet of the relief valve clean.
If the furnace is multipass, provisions must be made that no pass is isolated from the relief valve by closure of a valve.
Relief valves on furnaces should be sized for normal operating

flow and temperature.

5.6. Condensing Turbines

Condensers and the exhaust end of condensing turbine casings are not normally designed for full steam supply pressure and must be protected by a pressure relief valve against over-pressure which could result from of cooling water or other operating failure.

5.7. Non-condensing Turbines

5.7.1. Large non-condensing turbines which operate against a high back pressure usually require a pressure relief valve to protect the turbine casing against exhaust valve closure and back pressure fluctuations.

5.7.2. A pressure relief valve must be provided where the casing can be over-pressured and should be sized for normal steam flow and exhaust to atmosphere. Set pressure should exceed normal exhaust pressure by 10% or 0.167MPa, whichever is greater, but it should never exceed the design pressure of the turbine casing.

5.8. Compressors

5.8.1. To protect discharge piping, downstream equipment of compressor casing, pressure relief valves, are required for all positive displacement or centrifugal compressors where pressure during surge or closed discharge can exceed safe limits.

5.8.2. For positive displacement compressors, interstage pressure relief valves as well as discharge pressure relief valves must be provided.

5.8.3. Set pressure should exceed rated discharge pressure by 0.167MPa or 10%, whichever is greater. In case of reciprocating

compressors a greater differential than 10% may be required due to pressure surges.

5.8.4. Interstage relief valves should be set at least as high as the compressor settling-out pressure, to avoid lifting at shutdown.

5.8.5. Pressure relief valve capacity should equal compressor capacity. For centrifugal compressors, the combination of set point and capacity should be such as to avoid surge conditions during emergency.

5.8.6. Compressor outlet pressure relief valve should not discharge to the compressor suction but must instead discharge to a safe area or flare.

5.9. Thermal Relief of Piping

Thermal relief valves in water service shall discharge to the downstream side of a suitable block valve or to blowdown.

5.10. Pressure Reducing Stations

Pressure relief valves should be installed on low pressure side of pressure reducing valves when piping and equipment on the low pressure side are not suitable for the conditions which exist on the high pressure side.

5.11. Vessels That Do Not Require Pressure Relief Devices

Pressure relief valves are not required for protection against fire on vessels which normally contain no liquid, since the vessel could fail from overheating of its shell regardless of whether or not relief valves are provided.

Examples are air surge and storage drums used on large, piston operated valves.

6. RELIEF VALVE SIZING CRITERIA

6.1. Relief valve capacity for intermediate and low pressure vessels shall be calculated for each of the operational hazards which may be reasonably expected to occur and the largest orifice are which would be required shall determine the relief valve size.

6.1.1. Relief valve sizing calculations shall be in accordance with API RP-520 Part I. All calculations shall be documented and submitted to Owner for review.

6.1.2. Permissible Accumulation and Overpressure

a) Accumulation (above maximum allowable working pressure)

- 3% for single or multiple valve installations where ASME Code, Section I (Power Boiler) applies.
- 10% for single valve installations where ASME Code - Section VIII Division I (Pressure Vessels) applies.
- 16% for multiple valve installations where ASME Code - Section VIII Division I (Pressure Vessels) applies.
- 21% fire exposure on unfire pressure vessels.

b) Overpressure (above set-point) Refer to the latest edition of ASME Code, Section I, (Power Boilers) or Section VIII (Unfired Pressure Vessels) whichever applies.

6.1.3. Tolerances for Set Pressure

The tolerances for set pressure are specified in the ASME Codes. Section I is stringent and is adequate for those vessels covered by Section I. However, Section VIII Division I Specified that "the set pressure tolerances, plus or minus, for safety or relief valves, shall not exceed 0.015 MPa for pressure up to and including 0.49MPa ; and 3 percent for pressures above 0.49MPa."

6.1.4. Blowdown

ASME Code Section I covering steam generators and power boilers, specifies blowdown tolerances, which are from 2% to 4% of set pressure.

ASME Code Section VIII Division I does not specify blowdown tolerance. Unless otherwise specified, relief valve manufacturers consider 5% to 10% with an average of 7% of set pressure, a reasonable commercial tolerance. The Relief Valve Manufacturer should be consulted for the blowdown setting.

7. ACCESSORIES

7.1. Pressure Relief Valve Accessories

7.1.1. Lifting Levers

Under Section I of the ASME CODE, each safety valve shall have a lifting device by which the valve disc may be positively lifted from its seat when there is at least 75 percent of the relief valve set pressure.

Under Section VIII Division I of the ASME Code, lifting devices shall be furnished only for steam or air service, the lifting devices shall be such that the disc may be positively lifted from the seat when the pressure in the vessel is at least 75 percent of relief valve's set pressure.

7.1.2. Test Gag

Pressure relief valves shall normally be specified without gags.

Exceptions are pressure relief valves used on vessels meeting requirements of ASME Power Boiler Code Section I. These vessels must be tested with pressure relief valves in place. Therefore, a set of test gags should be ordered with the pressure relief valves.

The gags must be removed from the valve after testing.

7.2. Rupture Discs

Rupture discs shall be supplied with safety head (holders) so they can be pre-assembled and properly tensioned in the shop prior to installation in the field.

8. INSTALLATION REQUIREMENTS

8.1. Special care must be taken in design of pressure relieving systems and their installation. One of the most common faults with pressure relief valve installations is "Chattering" which is the uncontrolled rapid opening and closing of the valve. "Chattering" causes damage to the valve and, in some cases, to the associated piping. There are three basic reasons for Chattering:

8.2. Too high inlet piping losses, which may cause the relief pressure to reach the blow-down reseating pressure. To avoid this, inlet piping losses shall be limited to 3 percent of set pressure.

8.2.1. Built-up back pressure which may cause important changes in kinetic effects. Balanced type valves cancel this effect. Conventional type valves shall have built-up back pressure limited as per. 4.1.

8.2.2. Oversizing of a pressure relief valve, resulting in too small a flowing force to keep the valve in its open position against the spring force. This is valid for both conventional and balanced type valves.

8.3. Design Requirements for Relief Valve Piping

8.3.1. When relieving at rated capacity, the pressure drop between vessel and pressure relief valve shall be less than 3% of set pressure for both conventional and bellows type valves, to prevent chattering. This requirement is especially important for set pressures below 0.343MPa

8.3.2. The inlet line must be at least the size of the pressure relief valve inlet and shall be as short as possible. When multiple relief valves are manifolded, the cross section area of the manifold piping must be equal to or greater than the sum of all the inlet areas of valves open to the manifold.

8.3.3. When fouling of valve inlets is possible, provisions shall be made for steam blowback or a special heater. If continuous steam purge into the inlet line between vessel and pressure relief valve is used, a steam velocity of 1.5 m/second is recommended.

8.3.4. When the process fluid is highly viscous, pressure relief valve and its inlet and discharge piping shall be steam jacketed or traced to assure that a maximum viscosity of 400 centipoise is not exceeded.

8.3.5. Pressure relief valves in liquid service are always discharged to a closed system. Pressure relief valves in vapor service may be discharged to atmosphere at a point at least 30 m from the closest source of ignition. In cases where the relief valve is installed at least 15 m above grade the horizontal distance to the closest point of ignition shall be 15 m. Discharge shall be 3 m above the nearest equipment or manway within 15 m.

8.3.6. Exceptions are as follows :

a) Corrosive vapors which are liquids at ambient conditions shall be discharged to a closed system. Corrosive materials which are vapor at ambient conditions may be discharged directly to the atmosphere. Toxic vapors shall be vented to a closed system. If it can be shown by actual calculation, approved by ENGINEER, that ground level concentrations will be below safe limits then toxic vapors may be discharged directly to atmosphere. Atmospheric pollution considerations may dictate special handling requirements for obnoxious vapors.

b) Pressure relief valves normally in vapor service, but which in certain contingencies might discharge liquid, shall be piped to a closed system.

c) Vapors which may condense can be released to the atmosphere only if the hydrocarbon is 100% vapor as it enters the relief valve. If condensation could occur in a long riser, special considerations such as steam tracing may be necessary.

d) Vapors above their auto-ignition temperature may be released to the atmosphere. In these cases, remotely controlled manually operated snuffing steam shall be tied into the discharge riser.

e) Relief valve stacks discharging to atmosphere shall be provided with a drain opening at the low point of the stack to remove rain and condensates.

f) These openings shall be fitted with an elbow and piping to direct discharge away from the pressure vessel or other pressure component and in a safe direction.

8.3.7. Closed discharge system shall be designed per API RP 520.

8.4. Valving

8.4.1. Block valves for maintenance isolation may be installed in both the inlet and outlet piping in accordance with ASME Code Section VIII. Full opening ball valves are preferred as block valves since they do not have the shortcomings of a gate valve's gate separating from its stem. Where gate valves are used as block valves, they shall be installed with the stem horizontal. No block valves shall be installed in steam generators per ASME Code (Power Boilers) Section I.

8.4.2. Port areas of inlet and outlet block valves shall not be less than

the nominal areas of the respective openings of the pressure relief valve. Pressure drop of block valves shall be included in piping calculations.

8.4.3. Block valves on relief valves in service shall be car sealed open.

8.4.4. Block valves on installed spare relief valves or valve connection(s) shall be car-sealed closed.

8.4.5. Block valves must be provided with a position indicator and shall be painted orange.

8.5. Drainage

8.5.1. Provide 1" drain between inlet block valve and pressure relief valve and 1" vent between pressure relief valve and outlet block valve.

8.5.2. Collection of liquid and condensate in discharge systems can impose appreciable problems involving increased back pressure, reduced relieving capacity, and/or freezing and hammering effects. Discharge system piping should be self-draining toward the discharge end. Pocketing of discharge lines shall be avoided.

8.5.3. Use of traps or other devices with operating mechanisms shall be avoided. Where pressure relief valves handle viscous materials, or materials that can solidify as they cool to ambient temperature, the discharge line shall be heat-traced.

8.5.4. All pressure relief valves shall be accessible to permit inspection and maintenance. In cases where weight of pressure relief valves exceed 23 kg and site is unaccessible by cranes, davits shall be installed. If davits are omitted designer must consider expandability of facility to be sure that crane access will not be eliminated at some future date.

9. ATMOSPHERIC AND LOW PRESSURE STORAGE TANKS

9.1. Storage tank relief valves for low pressure service shall be pilot operated relief valves. The pilot pressure connection shall be external on the vessel and not on the relief valve. Connecting flanges shall be ANSI 150 lbs. RF.

9.2. For application and installation of pressure relief systems refer to:

9.2.1. General

a) API Standard 620 "Recommended Rules for Design and Construction of large, Welded, Low-pressure Storage Tanks", Section 6: Pressure - and Vacuum Relieving Devices.

b) API Standard 2000 "Venting Atmospheric and Low-pressure Storage Tanks".

NOTE : For refrigerated vertical tanks of over 6.86kPa design, exposed wetted surfaces for fire heat input shall either be limited to 260 square meters following API Std. 2000 Table 2 or to 50 percent of the tank perimeter times a maximum height of 10 m above grade, whichever is the greatest.

9.2.2. For Liquified - Hydrocarbon Gases

a) API Standard 1510 "Design and Construction of LP-Gas Installation at Marine and Pipeline Terminals, Natural Gas Processing Plants, Refineries, and Tank Farms". Paragraphs 7.1, 8.7, 8.14, R-7, and R-11.

b) NFPA No. 59A (supersedes API Standard 2510A) "standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG)" Item: 336, 6221a, 670, and Appendix "A".

10. MATERIALS AND CONSTRUCTION

Flanged relief valves will be enclosed spring (except for air and steam) with bolted bonnet, screwed cap, full nozzle type with stainless steel nozzle, disc, guide and spindle, and cast carbon steel bodies. Alloy steel bodies or trim other than stainless steel may be used, if required, for the particular service. Body pressure ratings for all flanged valves shall be the same rating as valve inlet flange. Light-weight bodies will not be acceptable. Areas of flange discharge opening shall not be less than four times area of valve seat. Screwed valves may have screwed bonnets and may be used where small orifice areas are required. Screwed valves will not be full-nozzle type. Air or steam flanged relief valves may have an open spring. Carbon steel springs will be supplied for all valves in temperature service 230℃ and below. Tungsten steel springs will be supplied for valves in service above 230℃ maximum relieving temperature. Other spring materials may be used with prior ENGINEER's approval, if required, for the particular service. Pilot operated valves are acceptable if design is approved by the ENGINEER.

11. TAGGING

Each device shall contain a permanent corrosion resistant tag(s)

APPENDIX -1

QUALITY CONTROL INSTRUCTION

APPENDIX-1 QUALITY CONTROL INSTRUCTION

CONTENTS

1.0 Purpose

2.0 Operating Procedure

3.0 Preparing Method of I.T.P

4.0 Preparing application of Inspection

5.0 Attachments

1.0 Purpose

This Quality Control Instruction describes instruction for preparing an inspection & test plan (I.T.P) submitted to owner by Supplier of purchasing items EUGENE

2.0 Operating Procedure

Prior to fabrication. Supplier shall prepare an inspection & test plan (I.T.P) and submit it to owner for approval in accordance with this instruction.

Owner have the rights to determine / denote their inspection points for selected description of inspection & test.

Supplier shall notify owner(EUGENE) of the inspection date according to inspection point approved by owner in accordance with paragraph 4.0 in this instruction.

3.0 Preparing method of I.T.P

Supplier shall prepare an I.T.P according to the requirements of purchasing specification.
The contents of I.T.P shall include, in particular, the followings;

A. Designation and identification of the major structure, parts, subassemblies or systems of equipment to be supplied.
B. Inspection and test operation will be performed after fabrication. These operating procedure shall include Code & Standards, operating method, acceptance criteria, etc,, and shall be attached as an annex in I.T.P
C. I.T.P and operating procedure should be mentioned and approved by supplier's authorized person for Quality Control function.
D. The instruction of the I.T.P shall be documented as attachment #1.

4.0 Preparing an application of Inspection

Supplier shall notify the inspection and/or test date scheduled in advance Min. 15days in domestic and Min. 30days in oversea.

The inspection application is to contain the followings;

A. Project Name
B. Supplier order Number to his sub-vendor, if any
C. Related I.T.P Number
D. Item description to be inspected
E. Identification of inspection to be operated
F. Location where the operation takes place
G. Time schedule for the operation

5.0 Attachments

A. SHOP INSPECTION AND TEST PLAN : 2 SHEETS
B. SHOP INSPECTION REQUEST LETTER : 1 SHEET

Note : This Quality Control Instruction is only for reference, The owner who won the Contract for this work shall re-make this Quality Control Instruction in his own way.

ATTACHMENT #1-1

DOCU. NO. : QCI-001(I)
REV. NO. : 2
PAGE : 4 / 6

공장시험 및 검사계획서 SHOP INSPECTION AND TEST PLAN	번호(Doc. No.) :
	페이지(PAGE) :

발 주 자 :
Owner

사 업 명 :
Project Name

공 사 명 :
Job Name

품 명 :
Item Name

범 례
R : 검토점 (Review Point)
W : 입회점 (Witness Point)
H : 필수확인점 (Hold Point)

개정번호 Rev. No.	일자 Date	작성자 Pre'd by	검토자 Rev'd by	승인자 App'd by	구매자 Purchaser	감리자 Consu-ltant	발주자 Owner	비 고 Remarks
		제작자(Supplier)						

ATTACHMENT #1-2

공장시험 및 검사계획서 SHOP INSPECTION AND TEST PLAN (I.T.P)								번호(Doc. No.) : 페이지(Page) :		
번호 No.	대상품목 Item Name	검사항목 Description of Insp./Test	적용규격 Ref. Doc.	검사구분 (Inspection Point)			제작자 Supplier	검사(Inspection)		비 고 Remarks
				제작자 Supplier	감리자 Consult.	발주자 Owner		장 소 Location	일 자 Date	

주) . 입회점 (W) : 특정인원이 입회하도록 지정된 검사 및 시험공정으로 검사요청 후 특정인원이 참석치 않았을 경우에는 입회없이도 수행할수 있다.
(This Point is designated to be witnessed by an inspector. If a notice of absence is notified prior to performing the operation, and the operation may be performed without being witnessed.)

. 필수확인점(H) : 검사 및 시험을 입회하지 않겠다는 서면통보가 없는 한 특정인원의 입회없이는 수행할 수 없는 검사 및 시험공정.
(The inspection and operation that is not allowed to perform until an inspector gives a formal authorization to proceed.)

ATTACHMENT #2

<table>
<tr><td colspan="5">검사입회요청서 (SHOP INSPECTION REQUEST SHEET)</td></tr>
<tr><td rowspan="4">수
신</td><td>FAX. NO. :</td><td rowspan="4">발
신</td><td colspan="2">FAX. NO. :</td></tr>
<tr><td rowspan="3">수신 : Owner
참조 :
ATTN :</td><td colspan="2">TEL. :</td></tr>
<tr><td>DOC. NO</td><td>DATE :</td></tr>
<tr><td colspan="2">제작자명 (Supplier) :
담당자명 (Charger) :</td></tr>
<tr><td colspan="2">사업명 : (Project Name) :</td><td colspan="3">검사일시 (Inspection Date) :</td></tr>
<tr><td colspan="2">발주번호 (Po. No) :</td><td colspan="3">검사장소 (Inspection Place) :</td></tr>
<tr><td colspan="5">시험 및 검사계획서 번호 / 개정번호 (I.T.P No. / Rev. No.) :</td></tr>
</table>

No.	검사대상품목 (Item Name)	수량 (Q'ty)	검사항목 (Description of Inspection Item)	비 고 (Remark)