

SPD0017ERN
PROCESS DESIGN MANUAL
PERFOMANCE GUARANTEE

REV. : [4](#)

DATE : [2013. 05. 31](#)



**SAMSUNG
ENGINEERING**

SAMSUNG ENGINEERING CO., LTD

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 2 OF 18
DATE : 2013.05.31		

Contents

1. Scope	3
2. Guarantee Items And Figures.....	3
2.1 Performance Guarantee.....	3
2.1.1 Plant capacity.....	3
2.1.2 Product yield	3
2.1.3 Product specification.....	3
2.1.4 Raw material	3
2.1.5 Catalyst performance and life.....	4
2.1.6 Chemical consumption.....	4
2.2 Utility Guarantee	4
2.2.1 Guarantee item	4
2.2.2 Guarantee figure	4
2.2.3 Exception of Utility Consumption Guarantee.....	5
2.3 Equipment Performance Guarantee.....	6
3. Analytical Method	6
4. Performance Test Operation And Reporting.....	6
4.1 Test Operation Procedure	6
4.2 Reporting	7
5. Application of Guarantee for Modification of Existing Plant.....	7
6. Liability	7
7. Revision History.....	9
8. Tables and Figures	10
8.1 Table 2-1 Items and Figures of Process Performance Guarantee for Typical Processes	10
8.1.1 Petroleum Refining	10
8.1.2 Gas Chemical	13
8.1.3 Natural Gas	15
8.2 Table 2-2 Items and Figures Pertaining to Equipment Performance Guarantees	16
8.2.1 Table 2-2 (1). Reactor with Catalyst.....	16
8.2.2 Table 2-2 (2). Catalyst	16
8.2.3 Table 2-2 (3). Tower	16
8.2.4 Table 2-2 (4). Tray	17
8.2.5 Table 2-2 (5). Drum	17
8.2.6 Table 2-2 (6). Heat Exchanger.....	17
8.2.7 Table 2-2 (7). Fired Heater	18
8.2.8 Table 2-2 (8). Steam Ejector	18

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 3 OF 18
DATE : 2013.05.31		

1. Scope

The process engineer is responsible for the basic design work. This manual sets forth the content and the extent of the performance guarantee on the processes and process equipment that are normally major parts of the basic design task SECL conducts on every projects. With regard to the performance guarantee of licensed processes, the licensor is responsible for determining the items, figures and analytical methods. Therefore, explanation on that part is not given here.

It should also be noted that, because of possible binding with a lot of technical and financial obligations, scope of performance guarantee must be carefully reviewed based on various factors such as the nature of process, industry experience on that particular processes, vendor's data, project conditions, etc.

The process engineer must also pay special attention to the control of air pollution, noise, waste water, and other environmental issues which are regulated by laws, regulations, international standards, etc., even though they are not listed herein. Most process engineers are not trained to deal with environmental issues. Therefore, it is necessary at times to deal with an expert in this field.

2. Guarantee Items And Figures

The performance guarantee can be classified into the following three categories:

- Process Performance Guarantee
- Utility Consumption Guarantee
- Equipment Performance Guarantee

Guarantee values for these categories are to be given in the Guarantee Agreement and/or Engineering Agreement.

2.1 Performance Guarantee

Table 2-1 shows various items and figures pertaining to the Guarantee Agreements which has been produced with clients. In general, process Engineer needs to confirm the process table listed therein.

2.1.1 Plant capacity

The process engineer often can guarantee that as much as 100% of the design basis charge is possible in most cases. The turn down ratio specified in the design basis can also be guaranteed in some cases.

2.1.2 Product yield

Approximately 95 - 99% of the design basis products yield [can be](#) often [guaranteed](#).

2.1.3 Product specification

The process engineer may be able to guarantee the products specified in the design basis. However, in some cases, a margin of the product specifications is used for safety to guarantee product specifications. Therefore, the process engineer must carefully establish guarantee figures prior to the determination of the design basis.

2.1.4 Raw material

In the case of chemical plants designed to synthesize chemical products, the process engineer may need to offer a guarantee on the quantity of synthesized products and required raw materials. This means that it is necessary to guarantee the selectivity in terms of yields of reaction. Besides, the process engineer must carefully calculate raw material consumption because it is closely associated with catalyst performance and

	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4
DATE : 2013.05.31		PAGE 4 OF 18

catalyst life. Approximately 102 - 105% of raw materials with respect to the design basis could be guaranteed. Actual guarantee value will need to be determined based on the type of process, project conditions and, industry experience, etc.

2.1.5 Catalyst performance and life

Since the performance and life of a catalyst are major factors and process performance is largely influenced by that, process engineer must carefully guarantee on the catalyst quality and efficiency. This is the case that where the Contractor develops process, catalyst and offers them to the client. In other hand, the process engineer can ask the licensor and/or the catalyst manufacturer their guarantee on the performance and life of a catalyst.

2.1.6 Chemical consumption

Chemical consumption is also a factor that may largely influential to process performance and it is sometimes related to the performance of a catalyst. Approximately 102 - 105% of chemical consumption with respect to the design basis could be guaranteed. Actual guarantee value will need to be determined based on the type of process, project conditions and, industry experience, etc.

2.2 Utility Guarantee

2.2.1 Guarantee item

Utility requirements vary depending upon the process, the scope of the Contractors work, and many other factors. However, the guaranteed utility consumption for which the process engineer is responsible, will generally consist of the following:

- Steam and condensate
- Boiler feed water
- Electricity
- Fuel [gas](#)
- Cooling water / [Sea water \(If project specification requires.\)](#)

Due to the nature of the utility facility operation, it is impossible to calculate beforehand the optimal material consumption such as antifoam agent, corrosion inhibitors, polymerization inhibitors, neutralization agents, etc. Consequently, the Contractor can not guarantee the chemical consumption applicable to the operating state of the plant.

[Some project might request EPC contractor to confirm additional Utility guarantee item as per below.](#)

- [Demineralized water / Desalinated water or Raw water](#)
- [Instrument air / Plant air](#)
- [Nitrogen](#)
- [Potable water / Utility water](#)
- [Nitrogen](#)

2.2.2 Guarantee figure

The guaranteed figure should be the average utility consumption of continuously operating equipment. These data are at the load of 100% throughput, and do not usually include the maximum & minimum consumption of each utility of designing utility facility. These data are useful in calculating the plant operating costs.

In calculating the utility consumption, the following items must be observed.

(1) Climatic condition

Assumed values for various climatic conditions such as atmospheric temperature, atmospheric pressure, wind velocity, rainfall, etc., shall be clearly indicated in the calculation.

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 5 OF 18
DATE : 2013.05.31		

(2) Heat loss

Heat loss of furnaces, reactors, drums, heat exchangers, and towers, etc., shall be calculated based on the above climatic conditions.

In the case of licensed processes, licensors usually do not guarantee utility consumption of a process plant. Accordingly, the process engineer must make allowance for heat loss and utility consumption, which must be calculated by himself. Regarding guarantee figures for utility consumption, the process engineer usually allows a margin of 5 - 10% over and above the calculated values which include heat losses to meet the utility consumption in the plant. Also, process engineer shall define the intermittent users and it shall be included to the utility consumption, properly.

2.2.3 Exception of Utility Consumption Guarantee

Process engineer should specify any condition and exception also in accordance with his calculation onto the utility consumption guarantee description.

The exceptions are, for example, as followings:

(1) Process plant

- a. Intermittent service or periodical service for catalyst regeneration
- b. Intermittent or periodical decoking/soot blowing for furnace
- c. Intermittent or periodical flushing/cleaning
- d. Drain, slop, blow down, and dropout
- e. Intermittent or periodical, chemical or additive injection
- f. Tank mixer and heater for raw material/intermediate/product day or storage tanks
- g. Line tracing/heater
- h. Utilities required for process purpose such as steam for stripping and injection in the process units.
- i. Steam for tracing, quenching, jacketing
- j. Water consumption for cooling gland seals.

Remark: Above listed items perform periodically or continuously during normal operation, the process engineer shall determine whether exception of utility consumption, or not. It needs to be verified based on project specification.

(2) Utility and Off-site Facility

- a. Chemical injection, sootblowing, and sampling for boiler unit
- b. Lube oil Cleaning for power generation unit
- c. Backwash/chemical injection for water treatment/circulation unit
- d. Adsorbent regeneration for air separation unit
- e. Liquid nitrogen vaporizer and N2 booster compressor
- f. Tank mixer/heater/line tracing for fuel oil unit
- g. Steam for tracing, quenching, jacketing and burner atomizing.
- h. Fuel gas for pilot burners.
- i. Receiving, storage, and shipping of raw material or Product
- j. Blending, mixing and additive injection
- k. Packing and filling of product
- l. Fire protection and fire fighting
- m. Telecommunication
- n. Building lighting and plant lighting
- o. HVAC for building
- p. Sanitary and first-aid
- q. Maintenance or repair shop
- r. Laboratory

Remark: Above listed items perform periodically or continuously during normal operation, the process engineer and the electrical engineer shall determine whether exception of utility consumption, or not. It needs to be verified based on project specification.

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 6 OF 18
DATE : 2013.05.31		

(3) Others

- a. Utilities required in accident, emergency and all other abnormal conditions.
- b. Utilities for building service such as drinking and sanitary water, air conditioning, lighting and all other utilities supplied.
- c. Electric power required for lighting and instruments.
- d. Electrical tracing.

Remark: Above listed items perform periodically or continuously during normal operation, the process engineer and electrical engineer shall determine whether exception of utility consumption, or not. It needs to be verified based on project specification.

2.3 Equipment Performance Guarantee

The process engineer guarantees that the equipment designed by him should be capable of operating under the specified conditions according to the flow diagrams and will operate satisfactorily during normal, start-up, shut-down and specified reduced operations.

The Contractor sometimes designs equipment only. The process engineer guarantees that the equipment is capable of handling such quantities and of producing such quantities/qualities of products specified in the design basis.

Table 2-2 shows the items and figures for the Equipment Performance Guarantee to which the process engineer can generally conform on the equipment listed therein.

3. Analytical Method

The process engineer shall determine analytical methods for checking substances of which he guarantees the specifications. Table 2-1 shows analytical methods for checking guaranteed specifications that SECL has concluded with various clients. In general, the process engineer can confirm the processes listed in the table.

4. Performance Test Operation And Reporting

4.1 Test Operation Procedure

Many preparation works must be done to carry out a guarantee test. Such preparations consist of a Mechanical Test, Trial Test, Start-up Preparation and Trial Operation. The items discussed here are those things that the process engineer must carefully take care when conducting the Performance Test Operating itself.

- (1) The plant employs catalysts and chemicals supplied or approved by the Contractor. Sufficient quantity of such catalysts and chemicals should be available to conduct the Test Operation.
- (2) The plant employs feedstocks, raw materials and utilities meeting the specifications set forth in the design basis. Sufficient quantity of such feed-stocks, raw materials and utilities should be available to conduct the Test Operation.
- (3) The plant has been constructed in accordance with the specifications, drawings, and other data furnished by the Contractor.
- (4) The plant is operated and maintained in accordance with the operation manual furnished by the Contractor.
- (5) All process conditions shall be aligned with the design basis of the plant.
- (6) It is recognized that exact duplication of design data is improbable under test conditions. Operating data obtained during the Test Operation will serve, therefore, as the basis for processing calculations using established and reputable factors and methods. The results obtained in these calculations shall be converted to those which would have been obtained if test conditions had duplicated the design conditions.
- (7) The Contractor and the Client must jointly prepare test data sheets and a final

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 7 OF 18
DATE : 2013.05.31		

confirmation must be made on sampling points, sampling frequency and analytical methods, etc.

- (8) The overall acceptable accuracy of material balance, allowable accuracy of instruments, exceptional condition due to any reason to be specified in test procedure report and to be agreed by Client and/or by Contractors.

4.2 Reporting

- (1) When the Contractor has judged that the operation of the relevant unit is ready for the Test Operation, the Contractor will inform the Client of the date on which the Contractor desires to start the relevant Test Operation.
- (2) In the case where the results of the Test Operation have met the performance guarantee figures, the Contractor shall be deemed to have fulfilled the said performance guarantee, and the protocols of fulfillment of the Test Operation shall be signed by the representatives from the Client and the Contractor.
- (3) If one or more of the performance figures specified in the agreement have not been proven for reasons attributable to the Contractor during the Test Operation, the Contractor shall inform measures within a few days after receipt of the Client's statement informing the Contractor that the plant has not passed the Test Operation.

5. Application of Guarantee for Modification of Existing Plant

The survey results covering the attitude of foreign process licensors and engineering contractors toward modifying the existing plant facilities are as follows:

- Basically, a process performance guarantee and utility guarantee will not be offered.
- When license fees must be paid, a licensor or a engineering firm may offer a guarantee to an extent which can balance the license fee payment.

Consequently, the Contractor will not offer a process performance guarantee or utility guarantee for modified plants. However, if guarantee is unavoidable and it is necessary to offer some form of guarantee to modified plants due to the Client's strong request, the process engineer must obtain prior approval from the project manager who is in charge for offering such guarantee to the Client. and then offer it to the Client.

Guarantee figures for such a case are given in Table 5-1.

Table 5-1. Typical Guarantee Figures of Performance for Modification

Guarantee Item	Local Guarantee Figure	Global Guarantee Figure
(1) Plant Capacity (2) Product Yield (3) Product Specification (4) Energy Conservation Effect	100% of design value 98% of design value 100% of design value 85% of design value	100% of design value (expected) Expected figures only Expected figures only 80% of design value

- (a) Local guarantee means the guaranteed scope of application of the modification. It is equivalent to an equipment performance guarantee.
- (b) Global guarantee means the guaranteed scope of the modification and also of the existing plant. It is equivalent to a process performance guarantee.

Actual percentage (%) values will need to be re-estimated based type of process, project specific conditions, requirements, etc.

6. Liability

Some representative liabilities are as follows: They are Patent Infringement, Delay in Completion,

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 8 OF 18
DATE : 2013.05.31		

Delayed Delivery, and Performance Liability, etc.

Since liabilities related to the performance guarantee are significant particularly for the process engineer, he must carefully judge the content of liability. As the forms of liability are largely diversified as the numbers of jobs are involved, the project manager who is in-charge will need to make a final decision on the selection and approval of the form of liability applicable to the Client. Some representative forms of liability are listed in Table 6-1 with the maximum liquidated damage liability for each kind.

Table 6-1. Contractor's Liability for Performance Guarantee

Scope of Work	Maximum Liability	Condition
(1) Engineering	(a) X% of engineering fee	(a) In the case where a fee is taken
	(b) Man power service for modifying data sheets, drawings and specifications without compensation	(b) All other cases
(2) Engineering and Procurement	Y% of contract price	
(3) Engineering, Procurement and Construction	Z% of contract price	

The figures of X, Y, and Z shall be determined by the project manager.

	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 9 OF 18
DATE : 2013.05.31		

7. Revision History

Rev. No.	Rev. Date	Rev. Page	Reason for revision
0	98.04. 17	ALL	- First Issue - Department : Process Engineering Team - Prepared by : C. S. Chung M.H. Oh - Reviewed by : B.I Lee S.B Cho J.C Ro - Approved by : S.G. Oh
1	05.10.10	3~8 page 5~6 page Table2-1	-Revised Format -Added 2-2 (3) -Remove the year of ASTM test method - Department : Process Engineering Team - Prepared by : E.D. Lee - Reviewed by : M.H. Oh Y.E Gu J.C Ro - Approved by : C. S. Chung
2	09.06.01	8 page	-Revised Format - Added test procedure - Department : Process Engineering Team - Prepared by : S.U.Hong - Reviewed by : E.D.Lee Henry S. J.C Ro - Approved by : C. S. Chung
3	2010. 11. 25		- Document number change due to new numbering system - Original Dept. : Process Engineering Dept. II - Prepared by : C.H.Yun - Checked by : Jong-Heon Park, - Approved by : Y.Y. Koo
4	2013. 05. 31		- Added guarantee clause - Original Dept. : Process Engineering Dept. - Prepared by : W.K. KANG - Checked by : L.J. Jung - Approved by : S.B LEE

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 10 OF 18
DATE : 2013.05.31		

8. Tables and Figures

8.1 Table 2-1 Items and Figures of Process Performance Guarantee for Typical Processes

8.1.1 Petroleum Refining

(1) Table 2-1 (1-1). Crude Distillation Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Crude oil charge rate	Tank gauging and/or flow meter
2. Product Yield	95% of design value(min.) 99% of design value(min.)	Overhead Product Liquid products	Flow meter Tank gauging and/or flow meter
3. Product Spec.			
(1) Fractionation	Design value	ASTM distillation Gap between 95% vol and 5% vol points	ASTM D 86
(2) Flash point	Design value	Kerosene Gas oil Residue	ASTM D 56 ASTM D 93 ASTM D 92
(3) Distillation	Design value	Naphtha, Kerosene, Gas oil	ASTM D 86
(4) Reid vapor pressure	Design value (max.)	Naphtha	ASTM D 323
(5) C5 content	Design value (max.)	LPG	ASTM D 2163

(2) Table 2-1 (1-2). Vacuum Distillation Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Metalloid
1. Plant Capacity	Design value (min.)	Charge rate	Tank gauging and/or flow meter
2. Product Yield	99% of design value(min.)	Liquid products	Tank gauging and/or flow meter
3. Product Spec. Penetration	Design value (Max.)	Residue	ASTM D 5

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 11 OF 18
DATE : 2013.05.31		

(3) Table 2-1 (1-3). Gas concentration unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Charge rate	Tank gauging and/or flow meter
2. Product Yield	98% of design value(min.)	Liquid products	Tank gauging and/or flow meter
3. Product Spec. (1) C ₂ , C ₃ , C ₄ content (2) C ₃ content	Design value (max.) Design value (max.)	Liquid products Gaseous products	ASTM D 2163 ASTM D 2163

(4) Table 2-1 (1-4). Amine Treating Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Recycle gas, Fuel gas, LPG	Flow meter
2. Product Spec. (1) H ₂ S content	Design value (max.)	Recycle gas, Fuel gas, LPG	ASTM D 2725

(5) Table 2-1 (1-5). Hydrogen Desulfurization Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Charge rate	Tank gauging and/or flow meter
2. Product Spec.			
(1) Sulfur content	Design value (max.)	Naphtha Kerosene Gas oil	ASTM D 1266 or D 2622 ASTM D 1552 or D 2622 ASTM D 1552 or D 2622
(2) Flash point	Design value (min.)	Naphtha, Kerosene Gas oil	ASTM D 93 ASTM D 92
3. Chemical Consumption			
(1) Hydrogen	110% of design value(max.)	Hydrogen make-up gas	Flow meter
4. Catalyst life	8,000 hr (min.)	Catalyst activity	Specified laboratory test Accumulative throughput

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 12 OF 18
DATE : 2013.05.31		

(6) Table 2-1 (1-6). Solvent Deasphalting Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Vacuum residue rate	Tank gauging and/or flow meter
2. Product Yield	98% of design basis(min.)	Deasphalted oil	Tank gauging and/or flow meter
3. Product Spec. (1) Color (2) Softing point (3) Penetration (4) Metal content (5) Sulfur content	Design value (max.) Design value (min.) Design value (max.) Design value (max.) Design value (max.)	Deasphalted oil Asphalt Asphalt Deasphalted oil Deasphalted oil	ASTM D 1500 ASTM D 36 ASTM D 5 ASTM D 2788 ASTM D 1552

(7) [Table 2-1 \(1-7\). Dewaxing Unit](#)

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Production rate	Tank gauging and/or flow meter
2. Product Spec.	-	-	-
(1) Specific gravity	Design value	SN 60~80 SN 100 SN 200~250 SN 500 Drilling fluid	ASTM D 1298-2
(2) Viscosity	Design value (min.)		
(3) Distillation	Design value		ASTM D 86 ASTM D 2887
(4) Flash point	Design value (max.)		ASTM D 92-1 ASTM D 93

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 13 OF 18
DATE : 2013.05.31		

8.1.2 Gas Chemical

(1) Table 2-1 (2-1). Hydrogen Manufacturing Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Product Yield	Design value (min.)	Product hydrogen gas	Flow meter
2. Product Gas Spec. (1) Hydrogen purity (2) CO + CO ₂ content	Design value (min.) Design value (max.)	Product hydrogen gas Product hydrogen gas	ASTM D 1946 UOP 603-71
3. Raw material	103% of design value (max.)	Feedstock	Tank gauging and/or flow meter
4. Catalyst life	8,000 hr (min.)	Catalyst activity Hydrotreater ZnO adsorber Gasification shift converter Methanator	Specified laboratory test Calendar day

(2) Table 2-1 (2-2). Substitute Natural Gas

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Product Yield	Design value (min.)	Product gas rate	Flow meter
2. Product Spec.			
(1) Heating value	Design value * 1.0%	Product gas	Calculation from composition ASTM D 1946
(2) CO ₂ content	105% of design value (max.)	Product gas	ASTM D 1946
3. Heat Efficiency	98% of Design value (min.)	Feed stock flow rate Fuel flow rate Product gas rate Liquid heating value Gas heating value	Flow meter Flow meter Flow meter ASTM D1405 Calculation from composition ASTM D 1946
4. Catalyst Life	8,000 hr (min.)	Catalyst activity Hydrotreater ZnO adsorber Gasification Methanator	Specified laboratory test Calendar day

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 14 OF 18
DATE : 2013.05.31		

(3) Table 2-1 (2-3). Sulfur Recovery Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Acid gas charge rate	Flow meter
2. Sulfur Recovery Efficiency	99% of design value (min.)	Product liquid sulfur rate Combustion air flow rate H ₂ S,SO ₂ content in tail gas COS,CS ₂ content in tail gas	Sulfur pit gauging Flow meter JGC Method 71-75T JGC Method 23-75T
3. Product Spec.			
(1) Purity	Design value (min.)	Product sulfur	100 - (ash + moisture + organic matter)
(2) Ash content	Design value (max.)	Product sulfur	ASTM D-482
(3) Moisture content	Design value (max.)	Product sulfur	Oven Drying Test (JIS M 8513-76)
(4) Organic matter content	Design value (max.)	Product sulfur	Heating Loss Test (JIS M 8513-76)
4. Catalyst life	8,000 hr (min.)	Catalyst activity	Specified laboratory test Calendar day

(4) Table 2-1 (2-4). SRU Tail Gas Treating Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	SRU tail gas rate	Calculation from SRU load
2. Product Spec. Total sulfur	Design value (max.)	Treated gas	Shell method SMS 2336
3. Catalyst Life	8,000 hr (min.)	Catalyst activity	Specified laboratory test Calendar day

	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 15 OF 18
DATE : 2013.05.31		

(5) Table 2-1 (2-5). Flue Gas Desulfurization and/or Denitrification Unit

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Flue gas charge rate	Flow meter
2. Treated Gas Spec. (1) SOx content	Design value (max.)	Treated gas	*ASTM D-3226-73T
(2) NOx content	Design value (max.)	Treated gas	ASTM D-1608
3. Catalyst Life	8,000 hr (min.)	Paranox catalyst or Honey comb catalyst	Specified laboratory test calendar day

Note :

* : This ASTM method was repeated in 1978. But substitutive method is not yet authorized.
Regarding "Sulfur dioxide in workplace atmosphere", refer to ASTM D-3449-79.

8.1.3 Natural Gas

(1) Gas Treating Unit

Guarantee Item	Guarantee Figure	object of Calculation	Analytical & Measuring Method
1. Plant Capacity	Design value (min.)	Natural gas charge rate	Flow meter
2. Product Yield			
(1) Treated gas	99% of design value (min.)	Treated gas rate	Flow meter
(2) LPG	97% of design value (min.)	LPG product rate	Tank gauging and/or flow meter
(3) Condensate	Design value (min.)	Condensate product rate	Tank gauging and/or flow meter
3. Light Hydrocarbon Recovery	Design value (min.)	Recovery rate of C3,C4 in natural gas feed	Calculation
4. Product specification			
(1) Moisture dew point	Design value (max.)	Moisture in product gas at atmospheric pressure	Dew point meter
(2) C5 + content	Design value(max.)	Product gas Product LPG	ASTM D 1946 ASTM D 2163

	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 16 OF 18
DATE : 2013.05.31		

(3) C2 - content	Design value(max.)	Product LPG	ASTM D 2163
(4) Reid vapor pressure	Design value(max.)	Condensate	ASTM D 323

8.2 Table 2-2 Items and Figures Pertaining to Equipment Performance Guarantees

8.2.1 Table 2-2 (1). Reactor with Catalyst

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Capacity	Design value (min.)	Charge flow rate	Flow meter
2. Pressure Drop	Design value (max.)	Inlet/Outlet pressure difference	Pressure gauge

Note: These figures can be applied when the performance guarantee of the catalyst itself is the responsibility of others to the Contractor.

8.2.2 Table 2-2 (2). Catalyst

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Capacity	Design value (min.)	Charge flow rate	Flow meter
2. Yield	Design value (min.)	Product flow rate	Flow meter
3. Product Quality	Design value (max./min.)	Products	Specified analytical method
4. Life	Design value (min.)	Catalyst activity during the specified period	Specified laboratory test

Note: These figures can be applied only to the catalysts supplied by process licensors and are usually included in their process performance guarantees.

8.2.3 Table 2-2 (3). Tower

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Capacity	Design value (min.)	Charge flow rate	Flow meter
2. Yield	95 - 99% of design value (min.)	Product flow rate	Flow meter
3. Product Spec.	Design value (min.)	Product	Specified analytical method

Note: These figures can be applied in the case where the calculations of processes such as fractionation, absorption, extraction, etc., around towers are conducted by the Contractor.

 SAMSUNG ENGINEERING	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 17 OF 18
DATE : 2013.05.31		

8.2.4 Table 2-2 (4). Tray

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Operating Range	Design value	Charge flow rate	Flow meter
2. Pressure Drop	110% of design value (max.)	Tray/Tray pressure difference	Pressure gauge

8.2.5 Table 2-2 (5). Drum

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Capacity	Design value (min.)	Charge flow rate	Flow meter
2. Pressure Drop	110% of design value (max.)	Top/Bottom pressure difference	Pressure gauge
3. Liquid Entrainment	Design value (max.)	Liquid entrainment in treated gas	Specified measuring method
4. Water Content	Design value (max.)	Water content in oil	Specified analytical method

8.2.6 Table 2-2 (6). Heat Exchanger

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Flow Rate	Design value (min.)	Charge flow rate (Shell/Tube side)	Flow meter
2. Overall Heat Transfer Coefficient	Design value (Ud min.)	Inlet/outlet temperature of Shell/Tube side fluid	Thermometer and calculation
3. Pressure Drop	Allowable pressure drop(max.)	Inlet/Outlet pressure difference	Pressure gauge

	PROCESS DESIGN MANUAL PERFORMANCE GUARANTEE	SPD0017ERN REV. : 4 PAGE 18 OF 18
DATE : 2013.05.31		

8.2.7 Table 2-2 (7). Fired Heater

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Flow Rate	Design value (min.)	Charge flow rate	Flow meter
2. Heat Absorption Rate	Design value (min.)	Heat transfer rate	Thermometer and calculation
3. Pressure Drop of Process Side	Allowable pressure drop (max.)	inlet/Outlet pressure difference	Pressure gauge
4. Thermal Efficiency	Design value (min.)	Fuel consumption and heat absorption rate	Flow meter and calculation

8.2.8 Table 2-2 (8). Steam Ejector

Guarantee Item	Guarantee Figure	Object of Calculation	Analytical & Measuring Method
1. Capacity	Design value (min.)	Gas & vapor flow rate	Flow meter
2. Vacuum	Design value (abs, max.)	System pressure	Pressure gauge
3. Steam Consumption	110% of design value (max.)	Steam flow rate	Flow meter