REMINERALIZATION PACKAGE

ENGINEERING TECHNICAL STANDARDS & PROCEDURES

PT KILANG PERTAMINA INTERNASIONAL

DIREKTORAT PROYEK INFRASTRUKTUR

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REVISION HISTORY

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Page / Section *Hal. / Bagian*	Date *Tanggal*	Description *Deskripsi*	Revision by *Direvisi oleh*
1 –14	12/21	Add: Content translation in Bahasa *Penambahan: Penerjemahan konten dalam Bahasa*	YD/RDT/SUN/ZKT
4 of 14	12/21	Change: 1. INTRODUCTION. ”… that meets the needs of Projects. Perubahan: 1. PENGANTAR. “…yang memenuhi persyaratan untuk Proyek.	YD/RDT/SUN/ZKT
1 – 14	12/21	Change: format and document numbering related to restructuring of Pertamina Perubahan: format dan penomoran dokumen terkait restrukturisasi Pertamina	YD/RDT/SUN/ZKT

TABLE OF CONTENTS

DAFTAR ISI

1. INTRODUCTION

1.1 This Design Criteria establishes the minimum requirements for safe and reliable Design Criteria for Remineralization Package that meets the needs of Projects.

1. PENGANTAR

1.1 Design Kriteria ini menetapkan persyaratan minimum yang aman dan mimiliki nilai kehandalan untuk Design Kriteria terkait *R*emineralization *Package* yang memenuhi kebutuhan Proyek.

2. SCOPE

2.1 This Process design criteria covers document the minimum mandatory requirements of design criteria for the Remineralization Package required for operation with a lifetime of 20 years.

2.2 This document covers the general design criteria requirement of the new Remineralization Package.

2. LINGKUP

2.1 Kriteria desain Proses ini mencakup dokumen persyaratan wajib minimum kriteria desain untuk *Remineralization Package* yang diperlukan untuk operasi dengan masa pakai 20 tahun.

2.2 Dokumen ini mencakup persyaratan kriteria desain umum dari *Remineralization Package* baru.

3. CONFLICTS AND DEVIATIONS

3.1 Any conflicts between this standard and other applicable Engineering Technical Standards & Procedures (ETSP), or OWNER standard, codes, and forms shall be resolved in writing by OWNER.

3.2 All direct requests to deviate from this standard (ETSP) in writing to OWNER, who shall follow internal OWNER procedure and forward such requests to OWNER for approval.

3. KONFLIK DAN DEVIASI

3.1 Apabila terdapat konflik antara standar ini dengan *Engineering Technical Standards & Procedures* (ETSP) yang berlaku lainnya, atau standar PEMILIK, *codes* dan formulir, maka harus diselesaikan secara tertulis oleh PEMILIK.

3.2 Semua permintaan penggunaan standar yang berbeda dari standar ini (ETSP), harus diajukan kepada PEMILIK secara tertulis dengan mengikuti prosedur internal PEMILIK untuk mendapatkan persetujuan.

4. ABBREVIATIONS

4.1 Abbreviations used for this document shall have the following definitions:

ASME	American Society of Mechanical Engineers
CO_2	Carbon Di Oxide
ETSP	Engineering Technical

4. SINGKATAN

4.1 Singkatan yang digunakan pada dokumen ini harus memiliki definisi sebagai berikut:

ASME	*American Society of Mechanical Engineers*
CO_2	*Carbon Di Oxide*
ETSP	*Engineering Technical*

	Standards & Procedures
GPH	Gallon Per Hour
GPM	Gallon Per Minute
H_2O	Water
pH	Potens Hidrogen
ppb	Part per billion
ppm	Part per million
RDMP	Refinery Development Master Plan
TDS	Total Dissolved Solids

5. DEFINITIONS

5.1 The following words shall have these special meanings when used herein:

OWNER	Owner of the Plant is defined as PT Kilang Pertamina Internasional.
CONTRACTOR/ CONSULTANT	Defined as The Organization to which PT Kilang Pertamina Internasional assign the work.
shall	Indicates that the statement is mandatory.
should	Indicates a recommendation.
CO_2	A Chemical substance, when it is added in small concentration to an environment such as water, it effectively balances the pH in water handling system.

	Standards & Procedures
GPH	*Gallon Per Hour*
GPM	*Gallon Per Minute*
H_2O	*Water*
pH	*Potens Hidrogen*
ppb	*Part per billion*
ppm	*Part per million*
RDMP	*Refinery Development Master Plan*
RU	*Total Dissolved Solids*

5. DEFINISI

5.1 Penggunaan kata-kata berikut harus memiliki arti khusus sebagai berikut:

PEMILIK	Pemilik Kilang didefinisikan sebagai PT Kilang Pertamina Internasional.
KONTRAKTOR/ KONSULTAN	Didefinisikan sebagai Organisasi yang ditunjuk oleh di PT Kilang Pertamina Internasional untuk melakukan suatu pekerjaan.
shall	Menunjukkan bahwa pernyataan itu wajib.
should	Menunjukkan rekomendasi.
CO_2	Sebuah zat kimia yang ketika ditambahkan dalam konsentrasi kecil ke *environment* seperti air, secara efektif menyeimbangkan keseimbangan pH

			water handling system.
Lime or Calcite	A Chemical substance, when it is added in small concentration to an environment such as water, it effectively increases and balances the pH in water handling system.	*Lime* atau *Calcite*	Suatu zat kimia yang ketika ditambahkan dalam konsentrasi kecil ke *environment* seperti air, secara efektif meningkatkan dan menyeimbangkan keseimbangan pH dalam *water handling system.*
Sodium Hyphochloride	A Chemical substance, when it is added in small concentration to an environment such as water, it effectively to reduce the odor of water, surface purification and water disinfection	*Sodium Hyphochloride*	Zat kimia yang ketika ditambahkan dalam konsentrasi kecil ke *environment* seperti air, secara efektif mengurangi bau pada air, *surface purification* dan desinfeksi air.

6. STANDARD & CODE AND REFERENCE DOCUMENTS

The following Codes, Standard and Specifications apply to this specification. When an edition date is not indicated for a code or standard or any update in codes and standards in this specification document, the latest edition and addendum in force at the time of purchase shall apply. Material & equipment shall be as a specification or an equal approved by OWNER.

6.1 American Society of Mechanical Engineers

ASME VIII Div. 1	Boiler and Pressure Vessel Code

6. STANDAR & KODE DAN DOKUMEN REFERENSI

Kode, standar, dan spesifikasi berikut berlaku untuk spesifikasi ini. Kode dan standar harus menggunakan edisi yang terbaru atau edisi yang berlaku pada saat pembelian. Material & peralatan harus sesuai spesifikasi atau setara dengan yang disetujui oleh PEMILIK.

6.1 *American Society of Mechanical Engineers*

ASME VIII Div. 1	*Boiler and Pressure Vessel Code*

7. CRITERIA DESIGN

7. KRITERIA DESAIN

7.1 General

This Design Criteria document covers the water remineralization applies of lime dissolution system by addition of Lime / Calcite. CO2 Injection and Sodium Hypochlorite for Desalinated Water as feed in the Refinery Unit.

This Design Criteria document covers the Remineralization Package equipment vessels, piping and appurtenances comprising a water remineralization system, but does not discuss the detailed design of the equipment comprising these systems.

7.2 Remineralization Package Equipment

Single bed is filled with Lime / calcite vessels completed with lines for Chemical injections package and also pumps are the most commonly used.

A remineralization is a system, which uses additional chemical and chemicals injection process to potable water that balance the pH value in the range of 7.0; to achieve a well balance of ion concentration and ensure water would not be corrosive for the pipe work.

Remineralization Package have 1 Type only with 1 vessel on operation and 1 vessel on preparing material.

7.3 Process Design Data Requirements

a) Feed water is Desalinated water (Flow rate and specification)

b) Product Required Specification (flow rate & specification)

c) Feed water condition (Pressure and Temperature)

d) Lime Dissolving Vessel Replacement System requirements (Service time per vessel, effluents condition)

7.1 Umum

Dokumen Kriteria Desain ini mencakup penerapan remineralisasi air dari lime dissolution system dengan penambahan Lime/Calcite. InjeksiCO2 dan Sodium Hypochlorite untuk Desalinated Water sebagai feeddi Refinery Unit.

Dokumen Kriteria Desain ini mencakup Remineralization Package equipment vessels, perpipaan dan perlengkapan yang terdiri dari water remineralization system, tetapi tidak membahas desain rinci peralatan yang terdiri dari sistem ini.

7.2 Peralatan *Remineralization Package*

Single bed diisi dengan Lime/calcite vessels lengkap dengan lines untuk Chemical injections package dan juga pompa yang paling umum digunakan.

Remineralization adalah sistem yang menggunakan bahan kimia tambahan dam proses injeksi ke air minum yang menyeimbangkan nilai pH di kisaran 7,0; untuk mencapai keseimbangan konsentrasi ion yang baik dan memastikan air tidak korosif untuk *pipe work*.

Remineralization Package hanya memiliki 1 Type dengan 1 *vessel* pada operasi dan 1 vessel pada persiapan material.

7.3 Persyaratan Data Desain Proses

a) *Feed water* adalah *Desalinated water* (laju aliran dan spesifikasi)

b) Spesifikasi Kebutuhan Produk (laju aliran & spesifikasi)

c) Kondisi *Feed water* (Tejanan dan Suhu)

d) Persyaratan *Lime Dissolving Vessel Replacement System* (*Service time per vessel, effluents condition*)

e) Utility Conditions (Electric Power and Demineralization water)

f) System Configuration

g) Design Capacity of Package

h) Chemicals requirements (consumption, concentration and specification).

7.4 Lime Dissolution Vessel & CO_2 Pressurized Vessel

Vessels shall be design as Standard Design from ASME BPV Section VIII, Div.1 Latest Edition.

7.5 Design Criteria for Ion Exchange Resin System

7.5.1. Regeneration System Selection

There are only 1(one) vessel to water dissolution by adding Lime or Calcite, CO_2 and Sodium hyphochloride.

Service time shall be 2160 hours or 90 days in operation for each bed.

Lime regeneration shall be executed every 90 days uses backwash outlet nozzle that is provided in each vessel.

7.5.2. Chemical Efficiencies

3 types of chemicals used:

a) Lime or calcite

b) CO_2

c) Sodium Hypochloride

7.5.3. Vessel Sizing

The vessels should be made from typical, well-known materials of construction such as rubber-lined carbon steel or fiberglass. The vessel should have distribution / collector systems that give a good

e) Kondisi *utility* (Tenaga Listrik dan *Demineralization water*)

f) Konfigurasi Sistem

g) Kapasitas Desain dari *package*

h) Kebutuhan bahan kimia (konsumsi, konsentrasi dan spesifikasi).

7.4 *Lime Dissolution Vessel & CO_2 Pressurized Vessel*

Vessels harus didesain sesuai dengan Desain Standar ASME BPV Bagian VIII, Div.1 Edisi Terbaru.

7.5 Kriteria Desain untuk *Ion Exchange Resin System*

7.5.1. Pemilihan *Regeneration System*

Hanya ada 1 (satu) *vessel* untuk pelarutan air dengan menambahkan *lime* atau *calcite*, CO_2 dan Sodium hyphochloride.

Service time harus 2.160 jam atau 90 hari beroperasi untuk setiap *bed*.

Lime regeneration harus dilakukan setiap 90 hari dengan menggunakan *backwash outlet nozzle* yang disediakan di setiap *vessel*.

7.5.2. *Chemical Efficiencies*

3 tipe bahan kimia yang digunakan:

a) *Lime atau calcite*

b) CO_2

c) *Sodium Hypochloride*

7.5.3. Vessel Sizing

Vessels harus dibuat dari material konstruksi yang tipikal dan terkenal seperti *rubber-lined carbon steel* atau *fiberglass*. *Vessel* harus memiliki sistem distribusi/kolektor yang memberikan distribusi cairan

distribution of fluids during all phases of the operation. For this reason, a maximum vessel diameter of 3.5m (11.5 feet) is recommended. It is advisable to install sight-glasses in order to check resin levels and separation in the case of layered beds and mixed beds.

The design of the vessels should give a maximum resin bed depth, while limiting the pressure drop across the resin bed to ~1 bar. The optimum column diameter must be a balance between the resin bed height, the ratio of resin height to diameter (H/D) and the linear velocity. H/D should be in the range of 2/3 to 3/2.

yang baik selama semua fase operasi. Untuk alasan ini, diameter *vessel* maksimum 3,5m (11,5 kaki) direkomendasikan. Dianjurkan untuk memasang *sight-glasses* untuk memeriksa tingkat resin dan pemisahan dalam hal *layered beds* dan *mixed beds.*

Desain dari *vessel* harus memberikan *maximum resin bed depth*, selagi membatasi penurunan tekanan disetiap *resin bed* hingga ~1 bar. Diameter kolom optimum harus seimbang antara tinggi *resin bed*, rasio tinggi resin terhadap diameter (H/D) dan kecepatan linier. H/D harus dalam kisaran 2/3 hingga 3/2.

8. APPENDIX

ATTACHMENT 1 - Sample of Process Data Sheet Remineralization Package

8. LAMPIRAN

LAMPIRAN 1 - Contoh *Process Data Sheet Remineralization Package*

APPENDIX - A

SAMPLE OF PROCESS DATA SHEET REMINERALIZER PACKAGE

PERTAMINA

ENGINEERING CENTER REFINING DIRECTORATE	JOB NO. 26070-203	DOCUMENT NO. MXA-337-JA014		REV. B01
		SHEET 1	OF	5

DATA SHEET

PROCESS DATA SHEET
REMINERALIZATION SYSTEM PACKAGE (A-337-14)

REFINERY DEVELOPMENT MASTER PLAN (RDMP) PROJECT
REFINERY UNIT V BALIKPAPAN

PT PERTAMINA (PERSERO)
2017, 2018

REV.	DATE	PAGE	DESCRIPTION	PREP'D	CHK'D	REVW'D	CONCUR	APP'D	ENG. MAN	CLIENT
B01	9-May-18	5	RE-ISSUED FOR BID	RB	RK	PD	-	TM	SM	
B00	30-Oct-17	5	ISSUED FOR BID	PKD	RC	-	-	RC	SM	
00B	24-Mar-17	4	ISSUED FOR APPROVAL	MF5	MH	EFN	SM	DC	JP	
00A	16-Dec-16	6	ISSUED FOR REVIEW	MF5/SAS6	MH	EFN	SM	DC	JP	

Electronic documents, once printed, are uncontrolled and may become outdated.

Amendment date	Revision Number	Amender initials	Sheet Revised	Amendment	Note / Reference
December 16, 2016	00A	MF5/SAS6	ALL	Creating Package For Remineralizing System	
March 24, 2017	00B	MF5		Delete tank & distribution pump from package	
				Update remineralization capacity from 10 m3/hr to 62.5 m3/hr	
October 30, 2017	B00	PKD	3,4,5	- Update remineralization capacity from 62.5 m3/hr to 252 m3/hr as per PFD M5-337-J0004-Rev B02. - Inlet pressure and pH/Specific gravity value updated for outlet condition. - Sodium hypochorite tank and pump specification added in page 5 of 5.	
May 9, 2018	B01	RB	3, 4, 5	Updated remineralization system capacity.	

PERTAMINA	ENGINEERING CENTER REFINING DIRECTORATE	CHEMICAL INJECTION PACKAGE REMINERALIZATION SYSTEM PACKAGE

Customer	: RDMP RU V Balikpapan								
Plant Location	: Balikpapan, East Borneo, Indonesia								
Job No.	: 26070-203								
Data Sheet No.	: MXA-337-JA014								
Service of Unit	: Remineralization Package (A-337-14)								
Sheet	: Sheet 3 of 5								
Revision	: B01								
BASIS DESIGN									
Inlet Condition					**Outlet Condition**				
pH	:	7.2 - 8.2			pH	:	6.5 - 8.5		
TDS	: Max	10	ppm		TDS	:	500 max	ppm	NOTE 2
Ca (as ppm CaCO3)	:	N/A			Ca (as ppm CaCO3)	:	50 - 100		NOTE 2
Odor	:	Odorless			Odor	:	Odorless		
DESIGN & OPERATING CONDITIONS									
CAPACITY	:	75	M3/H		FLUID CONDITION	:	LIQUID		
INLET TEMP. (MIN/NORM/MAX)	:	26/30/32	°C		FEED / PRODUCT	:	DESALINATED/POTABLE WATER		
INLET PRESSURE	:	4.52	KG/CM2G		SPECIFIC GRAVITY	:	0.996		
OUTLET TEMP. (MIN/NORM/MAX)	:	26/30/32	°C		VISCOSITY	:	0.8		
OUTLET PRESSURE	:	1.5	KG/CM2G		VAP. PRESSURE	:			
CHEMICALS									
LIMESTONE/CALCITE BED									
DISSOLUTION RATE (NOTE 2)	:	1	MG/L/1 PPM ALK (NOTE 2)						
REQUIREMENTS (NOTE 2)	:	50-100	MG/L						
SERVICE TIME	:	2160 (90 X 24)	HOURS/TOTAL BED						
SUPPORTING BED	:		NOTE 1,2						
CO2 INJECTION									
INJECTION	:	0.44	MG/L/1 PPM ALK						
REQUIREMENTS	:	33 - 44	MG/L	NOTE 2					
SERVICE TIME	:		HOURS	NOTE 2					
CO2 SKID TYPE	:			NOTE 3					
NAOCL (SODIUM HYPO) INJECTION									
TARGET INJECTION CONC	:	5	PPM	NOTE 2					
TANK SIZE	:	400	L/TANK	NOTE 1					
SERVICE TIME	:	168 (7 X 24)	HOURS/TANK						

NOTE :

1. SPARING PHILOSOPHY PHILOSOPHY WILL BE 1 EQUIPMENT OPERATING, AND 1 EQUIPMENT PREPARING MATERIAL.
2. PRELIMINARY ESTIMATION. VENDOR TO FINALIZE.
3. ESTIMATION SHALL BE BASED ON COMMERCIALLY AVAILABLE CO2 TANK. MINIMUM 90 DAYS OF SERVICE IS EXPECTED

PERTAMINA	ENGINEERING CENTER REFINING DIRECTORATE	CHEMICAL INJECTION PACKAGE REMINERALIZATION SYSTEM PACKAGE

Customer	: RDMP RU V Balikpapan								
Plant Location	: Balikpapan, East Borneo, Indonesia								
Job No.	: 26070-203								
Data Sheet No.	: MXA-337-JA014								
Service of Unit	: Remineralization Package (A-337-14)								
Sheet	: Sheet 4 of 5								
Revision	: B01								
PROCESS REMINERALIZATION BED DATA SHEET									
ITEM NUMBER	: A-337-14-C1 A/B				MATERIAL	:			NOTE 1
SERVICE	: LIME/CALCITE BED			NOTE 3	INSULATION / THICKNESS				NOTE 1
TYPE	: VERTICAL CYLINDER					:			
NUMBER OF UNIT	: 2 (TWO)			NOTE 2	SPARE PHILOSOPHY				
BED VOL, M3	:	10		NOTE 2	NUMBER OF UNIT(S)	:	2 UNITS		NOTE 2
DESIGN TEMP.	:	85	DEG C		OPERATING	:	1 UNIT		
PRESS	:	10	KG/CM2 G		SPARE	:	1 UNIT		
OPERATION TEMP.	:	30	DEG C						
PRESS.	:	4.5	KG/CM2 G						
PRESSURE DROP ALLOWABLE		0.5	KG/CM2 G AT NORMAL						
PROCESS CO2 INJECTION DATASHEET									
ITEM NUMBER	: A-337-14-C02 A/B				MATERIAL	:			NOTE 1
SERVICE	: CO2 PRESSURIZED VESSEL/TANK				INSULATION / THICK	:			NOTE 1
TYPE	: BY VENDOR								
NUMBER OF UNIT	: 2 (TWO)			NOTE 4	SPARE PHILOSOPHY				
DIM (ID x TT) mm	:			NOTE 3	NUMBER OF UNIT(S)	:	2 UNITS		NOTE 4
CAPACITY				NOTE 3	OPERATING	:	1 UNIT		
HOLDUP TIME	:		HOURS	NOTE 3	SPARE	:	1 UNIT		
DESIGN TEMP.	:		DEG C	NOTE 3					
PRESS	:		KG/CM2 G	NOTE 3					
OPERATION TEMP.	:		DEG C	NOTE 3					
PRESS.	:		KG/CM2 G	NOTE 3					

NOTE :

1. WILL BE SPECIFIED BY OTHER DISCIPLINES
2. BED VOLUME TO BE FINALIZED BY VENDOR. VENDOR SHALL OPTIMIZE NUMBER OF OPERATING VESSEL AS PER VENDOR EXPERIENCE AND EXPERTISE. HOWEVER, OWNER REQUIRES AT LEAST 1 (ONE) VESSEL IS STANDBY
3. EQUIPMENT DESIGN SELECTION AND SIZING TO BE CONFIRMED BY VENDOR. REQUIRES AT LEAST 1 (ONE) VESSEL IS STANDBY
4. VENDOR SHALL OPTIMIZE NUMBER OF CO2 STORAGE AS PER VENDOR EXPERIENCE AND EXPERTISE. AT LEAST 1 VESSEL/TANK IS STANDBY.

PERTAMINA — ENGINEERING CENTER, REFINING DIRECTORATE

CHEMICAL INJECTION PACKAGE
REMINERALIZATION SYSTEM PACKAGE

1	Customer	: RDMP RU V Balikpapan							
2	Plant Location	: Balikpapan, East Borneo, Indonesia							
3	Job No.	: 26070-203							
4	Data Sheet No.	: MXA-337-JA014							
5	Service of Unit	: Remineralization Package (A-337-14)							
6	Sheet	: Sheet 4 of 5							
7	Revision	: B01							
8	**PROCESS REMINERALIZATION BED DATA SHEET**								
9	ITEM NUMBER	: A-337-14-C1 A/B				MATERIAL	:		NOTE 1
10	SERVICE	: LIME/CALCITE BED			NOTE 3	INSULATION / THICKNESS	:		NOTE 1
11	TYPE	: VERTICAL CYLINDER					:		
12	NUMBER OF UNIT	: 2 (TWO)			NOTE 2	SPARE PHILOSOPHY			
13	BED VOL, M3	: 10			NOTE 2	NUMBER OF UNIT(S)	:	2 UNITS	NOTE 2
14	DESIGN	TEMP. : 85		DEG C		OPERATING	:	1 UNIT	
15		PRESS : 10		KG/CM2 G		SPARE	:	1 UNIT	
16	OPERATION	TEMP. : 30		DEG C					
17		PRESS. : 4.5		KG/CM2 G					
18	PRESSURE DROP ALLOWABLE	0.5		KG/CM2 G AT NORMAL					
19									
20	**PROCESS CO2 INJECTION DATASHEET**								
21	ITEM NUMBER	: A-337-14-C02 A/B				MATERIAL	:		NOTE 1
22	SERVICE	: CO2 PRESSURIZED VESSEL/TANK				INSULATION / THICK	:		NOTE 1
23	TYPE	: BY VENDOR							
24	NUMBER OF UNIT	: 2 (TWO)			NOTE 4	SPARE PHILOSOPHY			
25	DIM (ID x TT) mm	:			NOTE 3	NUMBER OF UNIT(S)	:	2 UNITS	NOTE 4
26	CAPACITY				NOTE 3	OPERATING	:	1 UNIT	
27	HOLDUP TIME	:		HOURS	NOTE 3	SPARE	:	1 UNIT	
28	DESIGN	TEMP. :		DEG C	NOTE 3				
29		PRESS :		KG/CM2 G	NOTE 3				
30	OPERATION	TEMP. :		DEG C	NOTE 3				
31		PRESS. :		KG/CM2 G	NOTE 3				
32									

NOTE :

1. WILL BE SPECIFIED BY OTHER DISCIPLINES
2. BED VOLUME TO BE FINALIZED BY VENDOR. VENDOR SHALL OPTIMIZE NUMBER OF OPERATING VESSEL AS PER VENDOR EXPERIENCE AND EXPERTISE. HOWEVER, OWNER REQUIRES AT LEAST 1 (ONE) VESSEL IS STANDBY
3. EQUIPMENT DESIGN SELECTION AND SIZING TO BE CONFIRMED BY VENDOR. REQUIRES AT LEAST 1 (ONE) VESSEL IS STANDBY
4. VENDOR SHALL OPTIMIZE NUMBER OF CO2 STORAGE AS PER VENDOR EXPERIENCE AND EXPERTISE. AT LEAST 1 VESSEL/TANK IS STANDBY.