

ภาคผนวก ข

เอกสารประกอบผลการปฏิบัติตาม
มาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม

ภาคผนวก ข.1

เงื่อนไขสัญญาจ้างผู้รับจ้างหรือผู้รับเหมาให้ปฏิบัติ
ตามแผนปฏิบัติการด้านสิ่งแวดล้อม และด้านความปลอดภัย

Dated 13th December 2016

1. KUWAIT PETROLEUM AVIATION
(THAILAND) LIMITED
2. FOSTER WHEELER (THAILAND) LIMITED

Standard Terms and Conditions for EPCM Services Appointment in Thailand

Relating to Q8 Aviation CBT JP8 Operations Conversion Project, Thailand

Reference JSG/12062/4146-1661-9525

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This Agreement is made on

Parties

- (1) Foster Wheeler (Thailand) Limited whose registered office address is at 1st Floor, Talaythong Tower, 53 Moo 9, Sukhumvit Road, Thungskula, Sriracha, Chonburi 20230, Thailand (Consultant); and
- (2) Kuwait Petroleum Aviation (Thailand) Limited whose registered office address is at 388 Exchange Tower, Level 29, Sukhumvit Road, Klongtoey Sub-District, Klongtoey District, Bangkok Metropolis 10110, Thailand (Owner).

BACKGROUND

- (A) The Owner intends to proceed with the Project.
- (B) The Owner wishes to appoint the Consultant to act as designer and construction manager in relation to the Project and the Consultant has agreed to act as designer and construction manager in relation to this Project on the terms of this Agreement.

1 Definitions and Interpretation

- 1.1 In this Agreement unless the context otherwise requires the following words and expressions shall have the following meanings:

Affiliate	any direct, indirect, subsidiary or associated undertakings and/or any directly or indirectly controlled entities of the Owner or any parent company or group company of the Owner.
Agreement	this agreement (together with all schedules and appendices to it).
Business Day	any day other than a Sunday or public holiday in Thailand.
Country	the country in which the Site (or most of it) is located and where the Services are to be executed.
Defect	refers to the Services which do not comply with any provision of this Agreement and/or are incomplete due to the Consultant's default or failure.
Defects Liability Period	is the period of 12 months commencing on the date of Taking Over under the last Trade Contract to achieve Taking Over.

Direction	includes agreement, approval, assessment, authorisation, certificate, decision, demand, determination, explanation, instruction, notice, order, permission, rejection, request or requirement.		reasonable endeavours, proper precautions and the consideration or reasonable alternatives with the intention of avoiding the effects of the force majeure by that party, and which could not have been reasonably foreseen, and (subject to satisfying the requirements of the foregoing) is any one of the following events:
Documents	all the information, formulae, data, drawings, deliverables, models, plans, elevations, sections, perspectives, specifications, schedules, studies, calculations, bills of quantity, method statements, designs, reports, prints, samples and other documents and information (including any stored electronically) and software or similar items and technology including improvements in the same used in or otherwise which have been or will be prepared, procured or provided by or on behalf of the Consultant in connection with the Project (including any documentation incidental thereto).		<p>a) natural catastrophes such as earthquakes, typhoon and volcanic activity (but excluding for the avoidance of doubt any adverse weather conditions); or</p> <p>b) cyclones, fire, flood, epidemic, pandemic; or</p> <p>c) acts of war, acts of public enemies, terrorist acts, riots or civil commotions.</p>
Excepted Risk	means:	Government Agency	any government or governmental, semi-governmental, administrative, municipal, fiscal or judicial body, department, commission, authority, tribunal, agency or entity having jurisdiction over the Services, the Site or the Project.
	(a) ionising radiations or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radioactive, toxic, explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof; and	Gross Negligence	means any act or failure to act committed by any person, entity or party which, in addition to consulting negligence, is such a wanton and/or reckless conduct or omission that it constitutes utter disregard for harmful, foreseeable and avoidable consequences but shall not include an error of judgment or mistake made in good faith.
	(b) any act of terrorism.	HSEC Policies and Standards	are the policies and standards of the Owner provided to the Consultant (as may be updated by the Owner from time to time).
Fee	the fee set out in Schedule 2 as the fee payable by the Owner to the Consultant for performing the Services in accordance with this Agreement.	Industry Practice	the practices, policies, methods, standards and acts that would reasonably be expected from a qualified, competent, skilled and experienced engineer and designer and construction manager and otherwise commensurate with current industry practice, for a project of a similar nature to the Project.
Final Date for Payment	has the meaning ascribed to it in clause 7.5.	Information	any information, data, specifications, drawings, reports, accounts or other documents in any form
Final Statement of Taking Over	means a statement to be issued by the Consultant (as countersigned by the Owner) to a Trade Contractor in the course of performing the Services pursuant to this Agreement confirming that Taking Over of the relevant Trade Contract Works has taken place.		
Force Majeure	an event or cause listed below which is beyond the reasonable control of the Party (or its Personnel) claiming force majeure, not able to be overcome by the exercise of reasonable care and use of all		

	or medium of any kind concerning the business or the affairs of the Owner including:
	<ul style="list-style-type: none"> a) technical, commercial and business information relating to the Owner's facilities and other assets; b) financial information relating to the Owner's; and c) trade secrets, know-how, processes, technology belonging to or being used by the Owner which is confidential.
Intellectual Property Rights	the existing and future copyright, trademark or name, patents, design rights, intellectual property rights and/or any other rights of a similar nature in the Documents.
Legal and Regulatory Requirements	includes: (a) acts, ordinances, regulations, by-laws, awards and proclamations of the jurisdiction where the Project is being carried out; (b) certificates, licences, consents, permits, approvals and requirements of organisations having jurisdiction in connection with the carrying out of the Project and/or the Services; and (c) fees and charges payable in connection with (a) and (b) above.
Liabilities	damages, claims, actions, suits, proceedings, demands, losses, liabilities, costs and expenses of any kind.
Limitation Period	the period of 3 years following conclusion of the carrying out of the Services.
Mechanical Completion	means the condition achieved for the Project when it has been erected, installed and inspected in accordance with the approved design and activities such as hydro-testing, non-operating adjustments and cold alignment checks prior to commissioning have been completed.
Milestone Dates	a significant event or stage of the Project to be reached by a specified date during the performance of the Services as set out in Schedule 4.

Necessary Consents	any and all consents, permissions, permits, approvals, authorisation, lodgement, filing, Direction, authority, approval, requirement, licences and/or certificates or exception issued by a Government Agency or which is otherwise necessary to obtain in order to design, build, occupy and/or use the Project in the manner envisaged by the Owner.
Optional Services	any of the services listed in Schedule 7 of Schedule 1.
Owner	the person named as Owner and such person's successors in title and permitted assigns.
Owner's Engineer	the representative set out in Schedule 1 or such other owner's engineer who may be appointed from time to time in relation to the Project.
Party	either the Owner or the Consultant (as appropriate).
Personal Information	the "personal information", "health information" or similar as defined by an applicable Privacy Law.
Personnel	means: <ul style="list-style-type: none"> a) in relation to the Consultant, any of its employees, agents, subcontractors and representatives involved either directly or indirectly in the performance of the Services; and b) in relation to the Owner any of its present officers, employees, agents or representatives.
Privacy Law	any law relating to the privacy, confidentiality or use of any information about individuals under Thai law.
Programme	the target programme for the design and construction of the Project referred to in Schedule 4 as may be updated and notified to the Consultant from time to time by the Owner.
Project	the Project described in Schedule 1.

Project Cost Plan	the cost plan for the Project set out in Schedule 3 which states the total estimated cost for the project as may be updated following completion of FEED verification under Services Stage 1 and thereafter as may be notified to the Consultant from time to time by the Owner.
Services	the services to be performed by the Consultant set out in Schedule 5 and (and all services necessary and/or ancillary thereto) as may be varied pursuant to Clause 3.12 and any Optional Services instructed by the Owner in accordance with clause 3.14.
Services Stage 1	the Services in relation to the FEED verification and early design phase as set out in Schedule 5 Part 1.
Services Stage 2	the Services in relation to the EPC phase as set out in Schedule 5 Part 2.
Site	the land identified in Schedule 1.
Site Procedures and Policies	the policies and procedures relating to the Site as informed to the Consultant by the Owner from time to time.
Start Date	the date the Consultant first performed any services in connection with the Project.
Statement of Taking Over	means a statement to be issued by the Consultant to a Trade Contractor in the course of performing the Services pursuant to this Agreement confirming that Taking Over of the relevant Trade Contract Works has taken place.
Taking Over	means "Taking Over" of any of the Trade Contract Works as defined in the relevant Trade Contract occurring (if relevant) when Mechanical Completion has been achieved and all commissioning completed and all relevant tests passed and outstanding works completed.
Third Party Agreement	means the letter of Intent entered into between the Owner and PTT Public Company Limited dated 14 October 2015.
Trade Contract	means the contract entered into between the Owner and the Trade Contractor.

Trade Contract Amount	means, in relation to any Trade Contract under which the Owner has agreed to pay a specified lump sum in consideration of the carrying out of the relevant Trade Contract Works, that agreed lump sum (as may have been previously adjusted in accordance with the relevant Trade Contract at the relevant time).
Trade Contractor	means the persons contracted by the Owner to carry out parts of the Works.
Trade Contract Works	means parts of the Works to be performed by the Trade Contractors pursuant to the relevant Trade Contract.
VAT	value added tax or any tax of a similar nature which may be substituted for or levied in addition to it if and when applicable.
Willful Default	in respect of a Party: <ul style="list-style-type: none"> a) any fraud, fraudulent concealment or dishonesty; b) any wanton or reckless act or omission of the Party or any of its Personnel with reckless indifference to the possible harmful consequences arising from that act or omission; or c) any illegal or malicious act or omission of the Party or any of its Personnel.
Works	means the works in relation to the Project more particularly described in Schedule 1 as may be amended from time to time by the Owner.
1.2	References to Legal and Regulatory Requirements, laws, statutes, byelaws, regulations, orders and delegated legislation shall include any Legal and Regulatory Requirements, law, statute, byelaw, regulation, order or delegated legislation re-enacting, consolidating, amending, extending, consolidating or made pursuant to the same.
1.3	Headings are for ease of reference only and shall not affect the construction of this Agreement.

1.4 References to clauses, schedules and appendices shall be references respectively to the clauses of and the schedules and appendices to this Agreement.

1.5 The Consultant acknowledges and confirms that in entering into this Agreement it has placed no reliance upon any statement, representation or warranty made or given by the Owner which is not set out in this Agreement.

1.6 If any term, condition or provision of this Agreement is held to be invalid, unlawful or unenforceable to any extent, such term, condition or provision shall not affect the validity, legality or enforceability of the remaining parts of this Agreement.

1.7 This Agreement shall not be construed or interpreted against or to the disadvantage of the Owner on the grounds that this Agreement represents the Owner's standard terms and conditions of business and/or that this Agreement and/or any particular term or condition hereof may have originated from the Owner.

1.8 Except as otherwise provided in this Agreement, each party must pay its own costs and expenses of and incidental to, preparing, negotiating and executing this Agreement.

1.9 All stamp duty in connection with the Agreement will be paid by the Consultant.

1.10 At all times during the provision of the Services, the Consultant is not and will not act as, or be regarded as, an employee of the Owner and the Consultant and its Personnel will not be entitled to any benefits which would ordinarily accrue to any employee of the Owner by virtue of their status as an employee.

1.11 In the case of any conflict between the terms and conditions of this Agreement and the schedules to this Agreement the terms and conditions shall prevail and shall have precedence.

2 Agreement and Key Personnel

2.1 The Owner appoints the Consultant to provide the Services in relation to the Project subject to and in accordance with the terms of this Agreement. The Services are divided into two stages the FEED verification and early design stage and the EPC stage (the "Services Stages"). The Owner instructs the Consultant to perform Services up to and including Services Stage 1. The Consultant shall not perform (or commence the performance of) Services Stage 2 unless and until the Owner (at its sole option and discretion) issues a written notice to proceed. The Consultant expressly acknowledges that:

2.1.1 the Owner is under no obligation to issue a notice to proceed with Services Stage 2. If no notice to proceed is issued, the Consultant's sole entitlement shall be payment of those Services in respect of Services Stage 1 actually undertaken;

2.1.2 it shall be a condition precedent to any liability or obligation of the Owner arising out of or in connection with this Appointment for the performance and completion of any Services Stage that the Owner shall first have served upon the Consultant a notice to proceed;

2.1.3 the Consultant shall have no claim against the Owner for any loss of profit, loss of contract or any other cost or economic/consequential losses (whether direct or indirect) if the Owner elects not to issue a notice to proceed with Services Stage 2.

2.2 Regardless of the date of this Agreement this Agreement shall be effective from the Start Date. Any rights, obligations and liabilities accrued by the Owner against the Consultant prior to the date of this Agreement in relation to the Project shall be treated as having accrued under the terms of the Agreement.

2.3 The Consultant acknowledges that it has full knowledge of the scope of the Project. The Consultant has examined the Project Cost Plan and warrants to the Owner that the Project Cost Plan as may be updated and agreed by the Parties at the completion of Service Stage 1 (and for the avoidance of doubt prior to commencement of Services Stage 2 - EPC phase) represents a fair and reasonable estimate of the likely total cost to the Owner of executing and completing the various elements of the Works identified therein.

2.4 The Consultant shall supply all Personnel necessary for the proper and timely performance of the Services. The Consultant shall provide the key personnel identified in the Schedule 2. Without limiting the generality of clause 3.9, the Consultant will ensure that its Personnel hold the necessary licences, permits, endorsements or other certificates required by all applicable Legal and Regulatory Requirements for performing the Services.

2.5 No change (except if any member of the key personnel suffers long term illness or leaves the employment of the Consultant, provided that the Consultant shall provide the Owner with the written notice informing the details of the change resulting from such long term illness or such discontinuance of the employment) may be made to the identity of any of the key personnel without the prior written approval of the Owner. The Consultant agrees that it shall cause the key personnel who has been changed to remain complying with Clause 9 (Confidentiality) until the expiration or the termination of this Agreement.

2.6 The Owner may require (but not vexatiously) the removal of any of the Consultant's personnel (including any of the key personnel referred to in Schedule 2) who have not performed the Services properly or do not have the ability to perform the Services properly or who have refused to comply with the Owner's reasonable instructions as to their conduct from the Site or from any further participation in the Project. The Consultant shall promptly remove the person so specified and replace him (at the sole cost of the Consultant) with a person suitably qualified, competent, experienced and of no less seniority who shall have been previously approved by the Owner (such

approval not to be unreasonably withheld). The Owner shall have no liability to compensate the Consultant nor the personnel removed in terms of lost earnings or benefits, severance or any other statutory obligation that arises due to the removal.

- 2.7 The Consultant shall at all times comply with instructions and directions issued by the Owner and/or the Owner's Engineer in respect of any matter connected with the Project and the Services. The Consultant shall immediately advise the Owner and the Owner's Engineer in writing if he/she receives any instruction from the Owner and/or the Owner's Engineer compliance with which would, inevitably and unavoidably cause the Consultant to be in breach of any his other obligations or warranties to the Owner under this Agreement. The Consultant shall as part of his advice provide the Owner and the Owner's Engineer with a full and detailed account and explanation of the consequences of complying with the Owner's and/or the Owner's Engineer's instruction and why it is and in what precise respects the Consultant considers compliance with the Owner's and/or the Owner's Engineer's instruction will inevitably and unavoidably cause the Consultant to be in breach of any of his other obligations or warranties to the Owner under this Agreement. The Consultant shall not be obliged to proceed to comply with such instruction unless and/or until subsequently re-instructed so to do by the Owner and/or the Owner's Engineer in writing in which eventuality the Consultant shall not be held responsible for any inevitable and unavoidable adverse consequences properly warned of by the Consultant in his advice and acknowledged and/or accepted by the Owner and/or the Owner's Engineer as being the inevitable and unavoidable consequence of the Owner's and/or the Owner's Engineer's instruction and a proper and reasonable ground for concern and/or objection on the part of the Consultant.
- 2.8 The Consultant shall have regard to any and all budgetary constraints imposed upon the Project and/or the performance of the Services by the Owner from time to time and carry out the Services in an efficient and cost effective manner. The Consultant shall not do or permit to be done anything that would or might cause the Owner's budget to be exceeded without first obtaining the Owner's prior written consent thereto.
- 2.9 In addition to the provision of clause 2.4:
- 2.9.1 The Consultant will from time to time appoint an individual as the Consultant's Representative. Any change to the identity of the Consultant's Representative must not be made without the prior written approval of the Owner's Engineer (which approval must not be unreasonably withheld).
- 2.9.2 The Consultant's Representative is responsible for liaising with the Owner's Engineer on behalf of the Consultant.
- 2.9.3 Any direction given by the Owner's Engineer to the Consultant's Representative under the Agreement is deemed to have been given to the Consultant for and on behalf of the Owner, and the Consultant must fully comply with that direction.

2.9.4 Any communication given or document signed by the Consultant's Representative is deemed to have been given or signed by and will bind the Consultant.

2.9.5 Matters within the knowledge of the Consultant's Representative are deemed to be within the knowledge of the Consultant.

2.10 Within 1 month after the signature of this Agreement the Consultant shall procure the execution and delivery of a performance bond in the amount of 10% of the Fee in the form set out in Schedule 7. The performance bond shall be provided by a surety approved by the Owner. If the Consultant is in breach of this clause 2.10 then notwithstanding any other provision of this Agreement, the Owner may deduct the amount equivalent to ten percent of the Fee from sums that would otherwise be due to the Consultant until the Consultant has complied with this clause. The Consultant must keep such performance bond in full force and effect until the end of the Defects Liability Period.

3 Performance of Services

3.1 The Consultant warrants that it has and shall perform the Services in compliance with this Agreement and to the reasonable satisfaction of the Owner.

3.2 The Consultant warrants that it has and shall, subject to the provisions of this Agreement, proceed with the Services regularly and diligently in compliance with the Milestone Dates. The Consultant shall provide the Services in such manner so as to achieve completion of the Project in accordance with the Programme and the Project Cost Plan. If the Consultant is prevented or delayed in the performance of the Services then the Consultant shall use its best endeavours to mitigate the effects of that delay. The Milestone Dates may only be adjusted from time to time as agreed by the Consultant and the Owner or in the absence of any such agreement as determined by the Owner or Owner's Engineer acting reasonably (provided always that any such determination may be referred to the dispute resolution procedure under clause 20) due to (i) any Changes instructed pursuant to clause 5, and/or (ii) any breach by the Owner of this Agreement, and/or (iii) the occurrence of an event of Force Majeure.

3.3 In performing the Services the Consultant warrants and undertakes to the Owner that it has executed and shall continue to exercise all the reasonable skill, care and diligence to be expected of an appropriately qualified and competent engineer and designer and construction manager, in each case experienced in carrying out equivalent services for developments of a similar size, scope, complexity, value and purpose to the Project and in all respects with the industry Practice.

3.4 The Consultant shall visit the Site as often as is necessary and/or appropriate to ensure the proper performance of the Services and shall participate in project

meetings and/or any other meetings on or near the Site as and when reasonably required.

- 3.5 The Consultant warrants that it has and shall at all times keep the Owner fully and properly informed of all aspects of the progress and execution of the Project (including any slippage and/or anticipated slippage and the likely consequences thereof) and provide such information and advice to the Owner and such other persons as the Owner may reasonably require or as may be appropriate and in particular give the Owner notice of any requirement for instructions sufficiently in advance (in any event not less than 7 days' notice) to enable internal consultation to take place so that the Trade Contractors and the professional team are not prevented or delayed in their work. Without prejudice to the generality of this Clause 3.5 the Consultant shall provide the Owner with a weekly written report highlighting progress on key activities in the preceding week. The consultant shall also prepare a monthly progress report, reporting on progress of the Project and any and all pertinent developments concerning those matters which are the Consultant's responsibility under this Agreement which have occurred in the preceding month. The Consultant shall send to the Owner's Engineer on a day to day basis copies of all pertinent correspondence and documents (including minutes of meetings) sent or received by the Consultant in connection with the Project.
- 3.6 The Consultant undertakes and warrants that it has and will use suitably skilled, qualified and experienced personnel to execute and complete the Services and will ensure that its personnel hold the necessary licences, permits, endorsements or other certificates required by all applicable laws.
- 3.7 The Consultant shall liaise as necessary with the Trade Contractors and professional team members appointed by the Owner, any sub-contractors and/or suppliers to the intent that the overall design of the Project shall be fully integrated.
- 3.8 The Consultant shall immediately advise the Owner if the Consultant becomes aware for any reason that the budget or any element of it requires adjustment or does not represent a reasonably accurate forecast of the cost to the Owner of completing the Project or any part of it.
- 3.9 The Consultant is responsible for applying for and obtaining all Necessary Consents required for the Project (other than those specific Necessary Consents, if any, which the Owner confirms in writing that it will be obtaining) relating to the performance of the Services and otherwise for the Project (and shall provide copies of such to the Owner). The Consultant shall provide assistance and documentation reasonably required by the Owner to enable the Owner to apply for and obtain and maintain its Necessary Consents. The Consultant has and shall comply with (and ensure that the completed Project complies with) any Legal and Regulatory Requirements, the HSEC Policies and Standard and any Necessary Consents.
- 3.10 The Consultant warrants to the Owner that the Consultant shall ensure that the designs, drawings, plans, specifications, schedules, reports and data or other

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Documents supplied or prepared by the Consultant shall meet the requirements of the Owner in accordance with Schedule 5.

- 3.11 The Consultant warrants that it shall carry out the Services so as to comply with and so as not by any act or omission or breach cause or contribute towards a breach of the obligations under Third Party Agreements as may be updated and provided to the Consultant from time to time.
- 3.12 The Owner shall be entitled to instruct variations to the Services by way of addition or alteration in accordance with clause 5. A variation to the Services may also include the omission of work and such omitted work may be carried out by others, the Owner, or by others engaged by the Owner. Where the Owner instructs such an omission a fair and reasonable adjustment shall be made to the Fee but the Owner shall not be liable to the Consultant for any costs, expenses, disbursements or losses (including indirect losses, consequential losses, loss of profits (whether direct or indirect), loss of chance or other similar losses) arising out of that omission.
- 3.13 Notwithstanding anything to the contrary in this Agreement any services and/or works required arising out of the Consultant's failure to perform the Services in accordance with Schedule 5 or to otherwise comply with its duties or obligations in accordance with this Agreement and provided that the Owner shall have given written notice to the Consultant within the Limitation Period without cost to the Owner. The Consultant will not be entitled to adjust the Fee for re-performance of the Services due to a Defect.
- 3.14 The Owner may instruct (at its absolute discretion and without obligation) any of the Optional Services for the fixed fees specified in Schedule 2 Part 3.2.
- 3.15 The Owner shall be deemed to have relied solely upon the skill, care and diligence of the Consultant in respect of all matters within the scope of this Agreement. The liability of the Consultant under this Agreement shall not be released diminished or in any other way affected by any approval or inspection by the Owner of any of the Documents or the Project works or any part thereof or any materials comprised therein or the countersigning by the Owner of any certificates nor by any attendance by the Owner at site or project meetings nor by any approval by the Owner of any certificate issued by the Consultant nor by any payment made by the Owner in reliance thereon nor by any independent inspection, investigation or enquiry into any relevant matter which may be made or carried out by or for the Owner nor by the appointment by the Owner of any independent firm, company or party whatsoever to review the progress of or otherwise report to the Owner in respect of the Project nor by any action or omission of any such firm, company or party whether or not such action or omission might give rise to any independent liability of such firm, company or party to the Owner nor by the failure or omission of the Owner to do any of the aforesaid things.
- 3.16 The Consultant undertakes and warrants that it has fully studied all information which the Consultant has seen in relation to the Project and which could be

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reasonably inferred in relation to the contribution required from the Consultant and the Consultant further confirms that it has allowed in the agreed Fee for the carrying out of all other tasks and services as are necessary for the Services or to comply with the terms of this Agreement whether or not the same are expressed in this Agreement. Such tasks and services shall not be considered variation or additional services.

4 Excluded Materials

- 4.1 The Consultant undertakes and warrants to the Owner that it has not and shall not specify or approve for use in or in connection with the Project any substances, materials, building practices or techniques not in conformity with any relevant standards or codes of practice or which are generally known or which ought to have been known by the Consultant at the time of specification or approval for use to be deleterious to health and safety or to the durability of buildings and/or other structures and/or finishes and/or plant and machinery in the particular circumstances in which they are used and shall use the standard of care referred to in clause 3.3 to see that no such materials are used in or in connection with the Project.

5 Changes

- 5.1 The Owner's Engineer may give the Consultant written notice of a proposed variation to the Services (including any omission of the Services) ("Change Notice");
- 5.2 Following receipt of a Change Notice, the Consultant must as soon as practicable provide the Owner's Engineer (for the Owner's approval) the Consultant's estimate of the:
- (a) effect on the Milestones Dates; and
 - (b) likely cost to be incurred or reduced by the Consultant due to the proposed variation;
- 5.3 The Owner may direct the Consultant to give a detailed quotation for the proposed variation including a clear scope of work;
- 5.4 The Milestone Dates and the Fee will be adjusted for each proposed Change accepted in writing by the Owner's Engineer. The Owner shall have no liability in relation to any variation unless and until the Owner's Engineer has given a written confirmation in accordance with this clause 5.4;

- 5.5 The Consultant shall not make any alteration or addition to or omission from the Services nor the design or specification of the Project without the prior written consent of the Owner.

- 5.6 If a delay caused by or additional works results directly and solely from a default or breach of the Owner or Owner's Engineer that is not caused or contributed to by the breach, default or omission of the Consultant the Owner shall issue a Change Notice.

6 Fees and Payment

- 6.1 Subject to the proper performance by the Consultant of its obligations under this Agreement and to clause 14 (Termination and Suspension) the Owner shall pay or procure the payment to the Consultant of the Fee in respect of the Services provided always that:

6.1.1 the Consultant has complied with all of its obligations under this Agreement relevant to the stage in respect of which the payment is to be made, and

6.1.2 the Consultant has submitted an invoice in such form and with such details and supporting documents as may be reasonably required from time to time by the Owner, and

6.1.3 the Owner may withhold the whole or part of any instalment referred to in Schedule 2 if in its reasonable and bona fide opinion the Owner has a claim against the Consultant in respect of any neglect, default or non-performance under this Agreement.

- 6.2 The Fee is a fixed price and shall include all disbursements and out of pocket expenses incurred in connection with the provision of the Services.

- 6.3 The Owner shall pay to the Consultant an additional fee in respect of any further services instructed in writing by the Owner any such additional fee to be agreed between the Owner and the Consultant prior to compliance with the written instruction. If the Owner agrees in writing that services should be charged on an hourly basis the charge shall be calculated in accordance with the rates set out in Schedule 2. The Consultant shall keep such records as may be reasonably necessary to support any payment for additional fees.

- 6.4 The Consultant warrants that it has fully studied all information which the Consultant has seen in relation to the Project and which could reasonably be inferred in relation to the contribution required from the Consultant and the Consultant further confirms that it has allowed in the agreed Fee for the carrying out of all other tasks and services necessary for the Services or to comply with the terms of this Agreement whether or not the same are expressed in this Agreement. Such tasks and services shall not be considered variations or additional services for the purposes of this Clause 6.

- 6.5 If the Consultant is required to perform substantial additional work in relation to the Project by reason of any alteration or modification to the Project required by the Owner after the Owner has approved the Consultant's design then to the extent that the same shall not have been occasioned by any negligence, omission or default of the Consultant the Owner shall pay to the Consultant such fair and reasonable additional fees and expenses commensurate with the additional work performed by the Consultant (such fees and expenses to be agreed in writing in advance of such additional work being performed unless otherwise agreed by the Owner).
- 6.6 If any change in the nature or scope of the Project causes the Consultant to perform less work in relation to the Project, the Owner may issue a Change Notice omitting any part of the Services and reduce the Fee commensurate with the reduced work performed by the Consultant, but allowing for any work already carried out by the Consultant in relation to that part of the Project so changed prior to the Consultant receiving instructions regarding the change but not work carried out prematurely having regard to the programme for the actual progress of the Project.
- 6.7 Subject to clauses 6.3, 6.4, 6.5 and 6.6 the Fee shall constitute the Consultant's sole entitlement to remuneration in connection with this Agreement. Adjustments will only be made to the Fee in accordance with any express provision of this Agreement and for the avoidance of doubt the Fee shall not be increased for re-performance of services due to a defect, or otherwise resulting from any negligence, default or breach by the Consultant.
- 6.8 Where a supply or part supply of Services is to be provided from outside Thailand:
- 6.8.1 the Consultant must notify the Owner of the intention to import and the anticipated taxes payable; and
- 6.8.2 the notification by the Consultant must be in writing and must be received by the Owner not less than 90 Business Days prior to the importation.
- 6.9 Where the Owner is required by law to withhold or deduct from any payment due to the Consultant any amount with respect to or which relates to any tax, levy or duty, such withholding or deduction is hereby authorised by the Consultant. The Owner shall issue documents evidencing such withholding or deduction to the Consultant as required by law.
- 7 Procedure for Payment
- 7.1 The Fee plus applicable VAT (where applicable) shall be paid in the instalments set out in Schedule 2.
- 7.2 Unless otherwise provided in the Agreement, all payments required to be made to the Consultant by the Owner must be made in the currency specified in Schedule 2 by electronic funds transfer into the Consultant's nominated bank account.

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- 7.3 The Consultant will render an invoice to the Owner for the Services at the end of each month during the period in which the Services are provided for the value of each stage/milestone completed in that month (if any) in accordance with the amounts specified in Schedule 2 provided that the Consultant shall not issue more than one invoice in any given month.
- 7.4 Invoices will contain the following information:
- a) a sufficient description of the Services provided in the period covered by the invoice;
 - b) supporting documents and information as may be reasonably required from time to time by the Owner; and
 - c) any information stipulated by Law (including any information necessary to make the invoice a Tax invoice), or by the Owner, so that the Owner will receive the benefit of any Tax Credit in relation to the Services.
- 7.5 The Owner shall within 30 Business Days of receipt of the invoice (the "Final Date for Payment"), either pay to the Consultant:
- a) the amount shown on the invoice; or
 - b) the amount the Owner considers (acting reasonably) the Consultant is entitled to, with written particulars of any disputed amount.
- 7.6 Where there is a dispute in relation to the amount payable in respect of any invoice, that portion of the invoice which is not in dispute must be paid in accordance with Clause 7.5. That portion which is in dispute must be paid within 15 Business Days after the resolution of the dispute.
- 7.7 If the Owner fails to pay the Consultant any undisputed amounts pursuant to clause 7.5 by its Final Date for Payment, the Owner shall in addition pay the Consultant interest on the outstanding payment calculated at the rate equal to one month London Interbank Offered Rate (LIBOR) plus 1% per annum from the Final Date for Payment until the date the payment is actually made.
- 8 Intellectual Property and Documentation
- 8.1.1 The Consultant grants to the Owner an irrevocable, royalty free and non-exclusive licence, to the intellectual property rights of the Consultant used in the performance of the Services but which are in existence at the Start Date or come into existence after the Start Date and are created for a purpose other than the Services, for the purpose of design, construction, commissioning, maintenance, repair, enhancement and operation of the Project. The licence will be transferrable, for the sole purpose only of

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completing the Project, to the contractors and to any other parties engaged by the Owner in connection with the Project and to any other third parties having an interest in the Project or completed project without the consent of the Consultant. The Owner shall also be able to grant sub-licences of the licence granted pursuant to this clause.

- 8.1.2 The Owner shall have exclusive ownership of, right and title to and interest in all Intellectual Property Rights in the Documents arising in the course of the Services carried out under this Agreement including but not limited to all forms of intellectual property enforceable at law or in equity or under statute and, in particular, all rights whether past, present or future in relation to ideas, concepts, plans, designs, drawings, engineering information, data, specifications, reports, accounts, maintenance plans, models, scopes of services, conditions of contract, precedents, pro formas, spreadsheets, databases and other documents produced or first reduced to written or diagrammatic form by the Consultant or its Personnel in the performance of the Services. The Consultant hereby transfers all such Intellectual Property Rights in the Documents to the Owner and shall execute all documentation necessary to transfer the Intellectual Property Rights in the Documents to the Owner but the Consultant shall not be responsible for transferring third party rights in commercial software used by the Consultant to produce any part of the Services. If the Owner needs to make use of such third party software then (i) the Owner shall obtain its own licence(s) where such licence is generally available in the market to the Owner, or (ii) the Consultant shall obtain the licence for the Owner where it is not generally available in the market to the Owner.
- 8.2 The Consultant warrants and undertakes to the Owner that the Intellectual Property Rights in the Documents are vested and will vest in the Consultant so that the Consultant is able to grant the transfer contained in clause 8.1.2 without restriction or limitation (and to grant licence contained in clause 8.1.1 without restriction or limitation). The Consultant warrants and undertakes to the Owner that the Documents do not and will not infringe the Intellectual Property Rights of any third party.
- 8.3 The Consultant shall be liable for and shall indemnify the Owner against any and all expenses, liabilities, losses, claims or proceedings the Owner may incur in the event that the rights granted by the Consultant pursuant to this Clause 8 are found to be invalid, ineffective or impaired in any way; and/or in the event of any claim by any third party (whether upheld or not) that the exercise of the rights granted by the Consultant pursuant to this Clause 8 infringe the rights of such third party.
- 8.4 Not used.
- 8.5 The Consultant shall, if so requested by the Owner at any time (including upon the termination of the Consultant's engagement under this Agreement), give the Owner access to the negatives and/or native file formats and/or copies of all Documents.

8.6 The Consultant shall, if reasonably requested by the Owner at any time, execute such documents and perform such acts as may be required fully and effectively to assure to the Owner the rights referred to in this clause 8.

8.7 The Owner's rights and the Consultant's obligations under this clause 8 (whether or not accrued) shall survive any determination of this Agreement and/or conclusion of the Services under it.

8.8 The Consultant shall not use the Documents in such a way as to reproduce the design or produce a design the same as the design of the Project with any other party.

8.9 Format of Electronic Documentation

8.9.1 Electronic copies of all design documents and drawings generated by the Consultant shall be provided in both PDF print format and original native file format, including, but not limited to, Microsoft Word, Microsoft Excel and Autocad.

8.9.2 Electronic models used for hydraulic analysis, stress analysis, pipe work modelling etc. shall be provided in native format. Results output files from such modelling shall be exported in to an agreed format such as Excel spreadsheet to enable the Owner to analyse output data.

8.9.3 Electronic copies of communications and reports for final documentation shall be provided in PDF format only.

8.9.4 Documents provided by third parties in printed paper format only shall be scanned to PDF format at sufficient optical and colour resolution to enable clear and legible reproduction.

9 Confidentiality

9.1 Except as may be strictly necessary in the performance of its duties under this Agreement or as otherwise required by the applicable law, the Consultant shall, and shall cause the Consultant's Representative and the Consultant's key personnel, not at any time without the prior written consent of the Owner disclose to any person or otherwise make use of any of the Documents or any photographs or this Agreement or any information or any other confidential information relating to the Project, the completed Project, the Site or the Owner (including, without limitation, financial information, the terms or existence of agreements for lease or leases or agreements for sale concerning the Project). This clause 9 shall cease to apply to any matter which is or comes into the public domain through no default on the part of the Consultant or any person for whom it is responsible.

9.2 The Consultant shall not, without the prior written consent of the Owner, publish alone or in conjunction with any other person any articles, illustrations, photographs or videos relating to the Project.

9.3 Each Party agrees to comply with obligations under the Privacy Law in respect of Personal Information obtained by or disclosed under this Agreement to the extent that then any such Privacy Law may apply.

9.4 This clause 9 will survive termination of the Agreement.

10 Assignment and Novation

10.1 The Owner may upon written notice to the Consultant (and with the Consultant's consent which consent may not be unreasonably withheld or delayed) assign or otherwise charge the benefit of all or any of the Consultant's obligations under this Agreement and/or any benefit arising under or out of this Agreement (whether or not accrued). Notwithstanding the preceding provisions of this clause 10.1, the Owner may upon written notice to the Consultant (and without the Consultant's consent) assign or otherwise charge the benefit of the Consultant's obligations under this Agreement and/or benefit arising under or out of this Agreement (whether or not accrued) to an Affiliate.

10.2 The Consultant shall not assign, novate or otherwise transfer this Agreement (whether in whole or in part) or any right or obligation under it (whether or not accrued) without the prior written consent of the Owner.

11 Sub-letting

11.1 The Consultant shall not sub-contract or delegate the performance of any of the Services without the Owner's prior written consent. The Consultant shall be responsible for any services it sub-contracts to a third party as if it had performed those services itself and the fees and expenses payable in accordance with Clause 6 shall not be increased by any amount payable by the Consultant to its sub-consultant.

12 Insurance and Indemnities

12.1 The Consultant:

- (a) warrants to the Owner that it has in force and shall maintain a policy of professional indemnity insurance covering the performance of the Consultant's duties under this Agreement for an indemnity limit of no less than \$1,000,000 (one million US Dollars) in respect of each and every claim and in annual aggregate from the date of this Agreement until the date which is three years after the date of conclusion of the carrying out of the Services.

(b) warrants to the Owner that it has a public or general liability policy covering all liabilities to third parties arising out of any act, breach or omission of the Consultant in respect of:

(i) any injury to, or death of, any person (other than liability which is required by law to be insured under a workers' compensation policy of insurance), not being a person who at the time of the contract is engaged in or upon the service of the Consultant under a contract of employment or services; or

(ii) any loss, damage, destruction to property not belonging to nor in the care, custody or control of the Consultant,

with a limit of liability of US\$5,000,000 for each and every claim; and in the aggregate.

(c) warrants to the Owner that it shall maintain any other insurance which is required by law for the time being in force in the Country, state or territory where the Services are performed.

(d) shall on request produce to the Owner from time to time evidence in the form of a certificate of insurances.

12.2 The Consultant's obligations to maintain insurance shall in no way negate or limit any or all of its obligations or duties under or in connection with this Agreement nor its liability in respect of any breach or non-performance of this Agreement.

12.3 The Consultant will be liable for, and will indemnify and keep indemnified the Owner and the Owner's Personnel against any liability, cost or expense incurred by the Owner in respect of:

12.3.1 claims by any person against the Owner, the Owner's Engineer or the Owner's Personnel in respect of loss of or damage to any property (real or personal);

12.3.2 claims by any person against the Owner, the Owner's Engineer or the Owner's Personnel in respect of personal injury, disease, illness or death;

12.3.3 the cost of re-performance of any part of the Services where the cost of such re-performance is to be paid by the Consultant under the Agreement;

12.3.4 loss or damage to any of the Owner's property (subject always to clause 12.6) provided that a limit of liability shall not exceed USD5,000,000 (five million US dollars) for each and every claim and in the aggregate. The Owner shall be liable for, and will indemnify and keep indemnified the Consultant and the Consultant's Personnel against any liability, cost or expense incurred by the Consultant in respect of loss or damage to the

Owner's property under this clause in excess of such specific amount except where such loss or damage is caused by the deliberate act or Willful Default of the Consultant and/or the Consultant's Personnel; and

- 12.3.5 any third party Liabilities and claims against the Owner attributable to any negligent act or omission or breach by the Consultant;

In the course of or by reason of the execution of the Works or the performance of the Services to the extent incurred as a result of the acts or omissions, breach of contract, and breach of any relevant Legal and Regulatory Requirement in relation to the performance of the Services by the Consultant.

- 12.4 The Consultant's Liabilities under clause 12.3 will be reduced proportionally to the extent that the Liabilities were caused, or contributed to, by the Owner's, the Owner's Engineer's or the Owner's Personnel's negligent acts, omissions or Willful Default.

- 12.5 Each indemnity under clause 12.3 and 12.4 in the Agreement is a continuing obligation separate and independent from the Consultant's other obligations and survives termination of the Agreement.

- 12.6 From the date of commencement of the Works at the Site until the issue of the Statement of Taking Over under the last Trade Contract to reach Taking Over, the Owner shall procure the taking out and maintenance of Construction All Risks Insurance ("CAR Insurance Policy") policy for the full reinstatement value of the Works which shall include the Owner and the Consultant as joint insured thereunder in accordance with requirements set in the insurance schedule annexed at Schedule 8 (CAR Insurance Schedule). The Owner shall not be liable to insure against any personal injury to or the death of any person or any damage, loss or injury to property caused by the effect of an Excepted Risk or any other exclusion expressly set out in the insurance schedule annexed at Schedule 8 (CAR Insurance Schedule).

- 12.7 The Consultant shall indemnify and hold harmless the Owner against any excess and/or deductible applicable to any claim made under or in connection with the CAR Insurance Policy which results from an act or omission or breach by the Consultant.

- 12.8 If there is any part of the Services that need to be performed at Owner's plant, Owner and/or Owner's Engineer shall notify Consultant in writing on, or before, the commencement of the Services of the location of all known locations of asbestos or asbestos-containing materials (together, "Asbestos") at the plant and thereafter immediately upon any other Asbestos being located, whether it is likely to affect the performance of the Services or not.

In the event that any Asbestos is located during the performance of the Services, Owner and/or Owner's Engineer shall arrange for an approved specialist consultant to inspect and remove the Asbestos and shall notify Consultant in writing when all such Asbestos has been mitigated and where such Asbestos has not been removed full

details of how such Asbestos has been contained so as not to present any ongoing risk or hazard, Consultant shall have no obligation or liability under the Agreement to perform any Services in connection with the discovery, treatment, removal, transportation or any activity in relation to any Asbestos found to be present.

In the event that Asbestos is discovered at the plant, Consultant shall be entitled, upon reasonable written notice to the Owner and/or Owner's Engineer (but forthwith to the extent necessary), to suspend the Services at the plant to the extent reasonably necessary to prevent the exposure of Consultant's personnel to such Asbestos (and as impacting upon the Services elsewhere). Such suspension shall be limited to the time required to remove, treat or contain such Asbestos.

- 12.9 Subject to clause 12.8, Consultant shall not be liable for costs arising from the failure to correctly identify or for costs arising to correctly handle, transport, or treat hazardous materials, except those materials brought to the site by Consultant or those materials brought to site by others for which Consultant is responsible.

- 12.10 Consultant shall not be responsible for any costs or liability related to the discovery of any underground conditions or obstructions that were not identified to Consultant before the execution of this Agreement or which could not have been reasonably foreseen by Consultant.

- 12.11 Third Party liability shall be determined at law.

13 Cooperation with Third Parties

The Consultant will:

- 13.1 not impede or interfere with the work of any third party or their personnel on Site (whether employed or engaged by the Owner or not);
- 13.2 coordinate the performance of the Services with the work of any third party and reasonably cooperate with such third parties and their personnel at the Site.
- 13.3 be liable for and indemnify the Owner against any liabilities of the Owner and any claims by third parties as a result of any act, breach or omission due to the Consultant's failure to comply with this clause 13. The Owner shall use reasonable endeavours to mitigate such liabilities.

"13A Trade Contracts - Consultant's Authority

- 13A.1 Subject to clause 13A.2 the Consultant is authorised to exercise all rights and undertake all obligations conferred upon him by the Trade Contracts. The Consultant shall ensure that the Works are carried out in accordance with the design approved by the Owner.

- 13A.2 The Consultant shall not:

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- 13A.2.1 Instruct any Trade Contractor to make any variation to the terms of a Trade Contract without the prior written approval of the Owner;
- 13A.2.2 without the prior written approval of the Owner issue any tender documentation in relation to any Trade Contract Works, nor select or notify any Trade Contractor of their selection to carry out any Trade Contract Works;
- 13A.2.3 except with the prior written consent of the Owner take an action (including settling or agreeing any claim and/or issuing any instruction) in relation to any Trade Contract which will or is reasonably likely to cause an increase in the Trade Contract Amount;
- 13A.2.4 where the parties have agreed a date for completion of the relevant Trade Contract Works pursuant to the relevant Trade Contract, grant any extension of time pursuant to any Trade Contract or issue any instruction or otherwise which will or is reasonably likely to entitle a Trade Contractor to an extension of time pursuant to the relevant Trade Contract without the prior written approval of the Owner;
- 13A.2.5 for any Trade Contract other than those referred to in clause 13A.2.4 except with the prior written consent of the Owner, issue any instruction reasonably likely to extend the time taken to complete the relevant Trade Contract Works under that Trade Contract;
- 13A.2.6 enter into any contractual or other commitment on behalf of the Owner whether pursuant to a letter of intent or otherwise (including appointing any Trade Contractor) without the prior written approval of the Owner;
- 13A.2.7 give notice of the intention to terminate or terminate any Trade Contractor's employment without the prior written approval of the Owner; or
- 13A.2.8 include any Holding Company, Subsidiary or other associated companies of the Consultant on any bid list for any potential Trade Contract without the prior written consent of the Owner.
- 13A.3 If the Consultant needs or will need any instructions, information or approval from the Owner in order for him to perform the Services in accordance with this Agreement, he shall apply to the Owner for such instructions, information or approval as soon as the need is apparent, having regard always to the Programme.

13B Certificates

- 13B.1 Whenever the Consultant is notified by a Trade Contractor that in his opinion the relevant Trade Contract Works have reached Taking Over entitling him to receive a Statement of Taking Over, the Consultant shall notify the Owner.
- 13B.2 The Owner and representatives of the Owner shall be entitled to accompany the Consultant on the inspection of the relevant Trade Contract Works referred to in clause 13B.1 and to make reasonable representations to the Consultant in relation to the issue of the Statement of Taking Over in respect of the same and the Consultant shall have due regard to any such representation.
- 13B.3 The Consultant shall provide the Owner with a copy of the Statement of Taking Over Issued to any Trade Contractor as soon as reasonably practicable after the date that such Statement of Taking Over is issued to the relevant Trade Contractor,
- 13B.4 The Consultant shall provide the Owner with a copy of the Final Statement of Taking Over and for all purposes this final Taking Over of the Project shall be deemed to have taken place on the date stated in that Final Certificate of Taking Over.

14 Termination and Suspension

14.1 If the Consultant:

- a) fails to comply with any of the provisions of this Agreement or breaches any obligations under this Agreement (whether fundamental, material or not) and fails to rectify such non-compliance or breach within 14 days of a written notice from the Owner requiring rectification or remedy then the Owner may give the Consultant a further written notice terminating the Consultant's employment under this Agreement forthwith or at such other time as may be specified in that notice.
- b) at any time shall become bankrupt or make a composition or arrangement with its creditors or have a provisional liquidator, receiver or manager of its business or undertaking duly appointed or have an administrator or receiver as defined in the Bankruptcy Act B.E. 2483 (1940), as amended from time to time, appointed or have possession taken by, then the Owner may terminate this Agreement with immediate effect.

- 14.2 Without prejudice to any rights and remedies which the Owner may possess whether by virtue of the Agreement or otherwise at law, the Owner shall be entitled (for its convenience) at any time in its absolute discretion to terminate the employment of the Consultant under this Agreement by giving no less than 7 days' notice in writing.

14.3 The Owner (in its absolute discretion) may by notice in writing suspend the performance of all or part of the Services. The Owner shall issue a notice in writing suspending the performance of all or part of the Services if there is an imminent health and safety concern.

14.4 In the event of termination under clauses 14.1 or 14.2 or suspension under clause 14.3 the Consultant shall take all steps necessary to ensure a safe termination or suspension of the Services.

14.5 In the event of a suspension of the Services under clause 14.3, the Owner may by a written notice require the Consultant to resume the performance of the Services and the Consultant shall as soon as reasonably practicable then resume the performance of the Services.

14.6 In the event of a suspension of the Services under clause 14.3 continues for longer than 90 Business Days, the Consultant may request in writing that the Services be resumed. Unless written instructions to resume are given by the Owner within 28 days after the Consultant's request, either party may forthwith determine the employment of the Consultant upon the expiry of that 28 day period.

14.7 Subject to clause 15.8 in the event of termination under clause 14.1, 14.2 or 14.6 or upon suspension of the Services under clause 14.3, the Consultant shall be entitled to:

- a) any instalment of the Fee due and owing at the time of termination or suspension and a fair and reasonable proportion of the next instalment of the Fee to become due following the date of termination or suspension having regard to the Services which have been provided by the Consultant prior to termination or suspension (less any set-off which the Owner is entitled to make whether by virtue of this Agreement or otherwise at law);
- b) such reasonable costs and expenses as are reasonably incurred by the Consultant in relation to such termination or suspension provided that the Consultant has taken all reasonable steps to minimise and prevent such costs and expenses and provided further that this clause 14.7(b) shall not apply in the event of termination pursuant to clause 14.1.

14.8 In the event of termination pursuant to clause 14.1 no monies shall be payable to the Consultant until the Owner has ascertained (subject always to the limitation on liability under clause 22.2) the amount of any loss and/or damage caused to the Owner by the termination or breach by the Consultant of the terms of this Agreement and the Owner shall be entitled to deduct the same from any monies otherwise due in accordance with clause 14.7 or to recover the same from the Consultant as a debt.

14.9 Notwithstanding any other provision of this Agreement neither suspension of the performance of the Services nor termination of the Consultant's engagement under this Agreement howsoever arising shall render the Owner liable to the Consultant for

any claim for any additional compensation such as loss of profit, loss of fees, loss of expectation, loss of opportunity, indirect losses, consequential losses, loss or chance or any other such similar losses arising out of the suspension of the Services or the termination of the Consultant's employment under this Agreement.

14.10 The Consultant shall be entitled to submit an invoice to the Owner for any sums which it is entitled to be paid pursuant to Clause 14.7 at the end of the calendar month in which the suspension or termination occurred.

14.11 For the avoidance of doubt, the provisions of clause 7 shall apply in relation to any invoice submitted to the Owner pursuant to Clause 14.10 and to any sum due in respect of such invoice.

14.12 Upon any termination or suspension of the Agreement the Consultant shall if required by the Owner (as a pre-condition to receiving any payment under this clause 14) forthwith deliver to the Owner the Documents (whether in the course of preparation or completed) in both a PDF print format and original native file format.

14.13 Termination of the Consultant's employment under this Agreement shall not affect the accrued rights and remedies of either party in relation to any negligence omission or default or breach of contract of the other party prior to such termination and the provisions of this Agreement shall continue to bind the parties for as long as necessary to give effect to their respective rights and obligations under this Agreement.

14.14 If (i) the Owner fails to pay any undisputed amounts within 90 days of its Final Date for Payment or (ii) the Owner becomes insolvent and the Owner fails to rectify such non-compliance or breach within 14 days of a written notice from the Consultant requiring rectification or remedy then the Consultant may give the Owner a further written notice terminating the Consultant's employment under this Agreement forthwith. Following such termination the provisions of Clauses 14.7 to 14.13 inclusive shall apply.

15 Health and Safety

15.1 The Consultant shall have full regard to the safety of all persons entitled to be on the Site, shall comply with all applicable health and safety and environmental regulations and laws in force from time to time and shall comply with the Owner's HSE Policies and Standards.

15.2 The Consultant must ensure that all of its Personnel, whilst on Site, comply with any site safety regulations and conditions for access to the Site (including, but not limited to, the Site Procedures and Policies) and with all reasonable directions given by the Owner or the Owner's Engineer.

15.3

15.3.1 The Consultant's Personnel required to work on Site must attend all appropriate and relevant induction courses required by the Owner ("Owner Induction Courses").

15.3.2 Where the Consultant's Personnel are required to have specific skills for the performance of the Services, the induction and training requirements relevant to them must:

(a) be confirmed by the Owner's Engineer; and

(b) be undertaken by the relevant Consultant's Personnel prior to the commencement of any work on, or near the vicinity of the Site.

15.3.3 The Owner will pay for the cost of providing the Owner Induction Courses but the Consultant shall arrange and be responsible for the costs of the Consultant's Personnel attending the Owner Induction Courses.

15.3.4 Any person visiting the Consultant on Site to meet Personnel working on the Site, and who is not performing any type of manual work, will also be required to attend the relevant Owner Induction Course. This requirement will not apply if the visitor is accompanied at all times whilst on Site by a person who has attended all relevant Owner Induction Courses.

16 Notices

16.1 Any notice, approval, consent, direction, demand or other communication ("Notice") given or made under the Agreement:

16.1.1 must be in writing;

16.1.2 to be effectively served on the other Party, must be:

(i) left at or sent by prepaid ordinary post to the address of the Party set out in Schedule 1 (or such other address as may be notified to the other Party from time to time);

(ii) subject to clause 16.1.8, sent by email to the email address of the Party as set out in Schedule 1 (or such other e-mail address as shall be notified to the other Party from time to time).

16.1.3 subject to clause 16.1.8, a Notice takes effect from the time it is received unless a later time is specified in it;

16.1.4 if posted in Thailand, a letter is taken to be received on the fifth Business Day after posting;

16.1.5 if posted outside of Thailand, a letter is taken to be received on the seventh Business Day after posting;

16.1.6 a facsimile is taken to be received at the time shown in a transmission report by the machine which indicates that the whole facsimile was sent;

16.1.7 subject to clause 16.1.8, email is taken to be received at the time when the sender receives confirmation on its email system that the email has been transmitted;

16.1.8 notices under clause 20 must only be given in writing in accordance with clauses 16.1.2(i) and may not be given by email. Although any giving of such communications by email will not be effective communication for the purposes of the Agreement, a Party may elect to send a copy of such communication by email; and

16.1.9 for the purpose of this clause 16, email includes email whether sent using a network or using a common information system, or third party document control system.

17 Entire Agreement

17.1 This Agreement sets out the entire agreement between the Consultant and the Owner in relation to the Project and replaces all prior agreements and understandings. All additions, amendments and variations shall be binding only if in writing; and signed by duly authorised representatives of the Owner and the Consultant.

18 The Role of Consultant's Project Manager

18.1 The Consultant warrants and undertakes to the Owner that the Project Manager (as defined in Schedule 1) shall:

18.1.1 assume and maintain personal control, management and supervision of the Services to be performed by the Consultant;

18.1.2 establish and maintain direct and regular personal contact and communication with the Owner and the Owner's Engineer on all matters pertaining to the Consultant's responsibilities under this Agreement;

18.1.3 prepare for and make himself available to attend all key meetings with and presentations to (inter alia) public organisations and/or authorities, funders, purchasers, tenants, managing agents and/or contractors with whom the Owner is or may be in negotiation; and

18.1.4 abstain from any and all other professional appointments and/or responsibilities which might impede or impair the ability of the Lead

Partner / Director to fulfil the aforementioned functions and ensure that the Services are at all times performed in accordance with the requirements of this Agreement;

18.2 The Consultant shall allocate to the Project sufficient and appropriate numbers of appropriately qualified and experienced personnel and shall ensure (where appropriate) such continuity of personnel as is or may be necessary to ensure at all times the proper, effective and efficient performance of the Services in accordance with the requirements of this Agreement.

19 Waiver

19.1 Failure by either Party at any time to enforce any provision of this Agreement against the other shall not be construed as a waiver of such entitlement and shall not affect the validity of this Agreement or any part or parts hereof or the right of the relevant Party to enforce any provision in accordance with its terms. The rights and/or remedies of either Party may only be waived by formal written waiver which is signed by a duly authorised representative of the Party waiving its rights and which makes express and unequivocal reference to the waiver being made pursuant to this Clause 19.

20 Dispute Resolution

20.1 In the event of any dispute, question or difference of opinion between the Owner and the Consultant arising out of or under the Agreement ("Dispute"), a Party may give to the other Party a notice ("Notice of Dispute") specifying the Dispute and requiring its resolution under this clause 20.1.

20.2 If a Notice of Dispute is given under clause 20.1 and the Parties are not otherwise able to resolve the Dispute, the Parties must nominate a senior representative to meet within a period of twenty (20) Business Days from the date on which the Notice of Dispute is received, or within such longer period as the Parties agree, the chief executive officers (or their respective nominees) of each Party may meet and attempt to resolve the Dispute by discussions in good faith. Unless the dispute can be resolved at that meeting or the chief executive officers agree otherwise, the chief executive officers must also discuss whether the Parties should attempt to resolve the dispute or difference by one of the methods referred to in clause 20.3 below.

20.3 The Parties may at any time, by agreement, attempt to resolve any Dispute by conciliation, mediation or expert determination before submitting that Dispute to arbitration.

20.4 If the Parties are unable to resolve the Dispute within a period of forty-five (45) Business Days from the date of the Notice of Dispute or within such longer period as the Parties may agree, either Party may submit the Dispute to arbitration as follows:

(a) Any Dispute arising out of or in connection with this Agreement, including any question regarding its existence, validity or termination, shall be referred to and finally resolved by arbitration administered by the Singapore International Arbitration Centre ("SIAC") in accordance with the Arbitration Rules of the Singapore International Arbitration Centre ("SIAC Rules") for the time being in force, which rules are deemed to be incorporated by reference in this clause.

(b) The seat of the arbitration shall be Singapore.

(c) The Tribunal shall consist of one (1) arbitrator.

(d) The language of the arbitration shall be English.

20.5 Neither the commencement nor conduct of any dispute settlement procedure will excuse any interruption to the Services or to the performance by the Parties of their respective obligations under the Agreement.

21 Law

21.1 This Agreement shall be governed by and construed in accordance with the laws of Thailand. Subject to clause 20, each Party irrevocably submits to the non-exclusive jurisdiction of the courts of Thailand, with respect to any proceedings which may be brought at any time relating to this Agreement.

22 Limitation

22.1 The exclusions and limitations of rights, remedies, warranties, guarantees, obligations and liabilities set out in this Agreement shall be exclusively those set forth in the Agreement and those stated exclusions and limitations are in lieu of any others available at law or in equity. Where no specific right or remedy is specifically articulated in the Agreement in respect of any limitations or exclusions of rights, remedies, warranties, guarantees, obligations or liabilities, any right to remedy as may be available at law or in equity shall be available to the relevant party.

22.2 The exclusions and limitations of liability set out in this Agreement shall apply irrespective of whether liability arises by statute, contract, tort (including but not limited to negligence) or otherwise at law.

22.3 Notwithstanding when the cause of action may have accrued, the Consultant will remain liable to the Owner under this Agreement until the expiry of the Limitation Period and any shorter statutory Limitation Period shall not apply.

22.4 The Consultant's total aggregate liability to the Owner whether arising out of or in connection with the Agreement (including for any consequential losses) is limited to the greater of one hundred percent (100%) of the Fee under this Agreement or one

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million US Dollars (US\$1,000,000), except that the Consultant's liability shall not be reduced by, and liability shall be unlimited in respect of:

- (i) the Consultant's liability in any case of fraud, deliberate default, gross negligence, reckless misconduct, willful Default and/or abandonment of the Agreement.
- (ii) the Consultant's liability for death or personal injury caused by the Consultant's negligence.
- (iii) the Consultant's liability for indemnities under this Agreement in relation to claims by third parties.
- (iv) cost of reperformance of the Services under clause 3.13.
- (v) recoveries under any Project insurance policies taken out by the Owner.
- (vi) loss or damage to the Owner's property (other than the Works) for which the separate cap on liability set out in clause 12.3.4 shall apply.

23 Partnership

- 23.1 If the Consultant is a partnership then each partner of the Consultant shall be jointly and severally liable.


EXECUTED as a DEED by the Parties and delivered on the date at the beginning of the Agreement

EXECUTED by)
Kuwait Petroleum Aviation)
(Thailand) Limited)
acting by two Authorised
Signatories

Authorised Signatory Signature: 

Authorised Signatory

Print Name: Fadel Al-Faraj, Managing
Director Global Businesses

Authorised Signatory Signature: 

Authorised Signatory

Print Name: Talat Bousheetan, Projects
Director

EXECUTED by)
Foster Wheeler (Thailand) Ltd)
acting by one authorised
signatory)

Authorised Signatory Signature: 

Authorised Signatory

Print Name: Graham Pope,
Director and General Manager



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foster
wheeler



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AMBER (JP8 OPERATIONS CONVERSION) PROJECT

AT

KPAT TERMINAL, THAILAND

FW PROJECT NO. 23212

CONTRACT NO.: 001/23212

PILING, CIVIL AND STRUCTURAL STEEL

CONTRACT DOCUMENT

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AMBER PROJECT
CONTRACT NO.: 001/23212
PILING, CIVIL AND STRUCTURAL STEEL WORKS
Kuwait Petroleum Aviation (Thailand) Ltd.


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AGREEMENT & GENERAL CONDITIONS OF CONTRACT

Part A & B-Cover.doc

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**KUWAIT PETROLEUM AVIATION
(THAILAND) LTD.**

- and -

SWOT CONSTRUCTION CO., LTD.

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This Contract is made on 24th August, 2017

Between

Kuwait Petroleum Aviation (Thailand) Ltd., whose registered office is Floor 10, Lake Rachada Office Complex, 193/38 Rachadapisek Road, Klongtoey, Bangkok 10110, Thailand (the "Owner"); and

Svat Construction Co., Ltd., whose registered office is 209 Moo 2, Tungsukla, Sriracha, Chonburi 20230, Thailand (the "Contractor").

WHEREAS the Owner operates a fuel storage facility in Chonburi, Thailand (the "Site") that contains amongst others, eight above ground storage tanks.

WHEREAS the Owner wishes to employ the Contractor and the Contractor wishes to accept the employment, as an independent contractor, to furnish materials, equipment, plant machinery, consumables, labor skills, expertise and services necessary to the Works at the Owner's KPAT terminal.

The Parties agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them:

"ASME B31.3" means the American Society of Mechanical Engineers requirements for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals.

"ASME Section V" means means the American Society of Mechanical Engineers

"Bank Guarantee" has the meaning given to it in Clause 3.2.

"Baht" means the lawful currency of Thailand.

"Business Day" means any day (excluding Saturday, Sunday and public holiday) which is a normal bank working day in Thailand.

"Commencement Date" means the date on which the Contractor is to commence the performance of the Works pursuant to Clause 2.3.

"Completion" means the date on which an acceptance certificate is issued by Owner to Contractor for satisfaction of Payment Milestone as set out in Appendix 2.

"Completion Date" means Before Part D, section 1. 2018, or such date that may be amended or extended in accordance with Clause 7 hereof.

"Contract" means the contract made between Owner and Contractor and comprises the documents stated in the terms and conditions to form the Contract including all appendices.

"Contract Price" means the meaning given to it under Clause 11.1.

"Contractor's Default" has the meaning given in Clause 12.2.

"Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works.

"Defects Liability Period" means the period of one year following completion of the Works, during which the Contractor is responsible for making good defects and damage in accordance with Clause 9.

"Delay Liquidated Damages" has the meaning given in Clause 7.3.

"Force Majeure" has the meaning given in Clause 15.1.

"Invitation to Tender" means the invitation to tender including its addendums and clarifications provided to the Contractor and as is set out in [Appendix 3].

"Lump Sum Payment" means the meaning given to it under Clause 11.1 exclusive of value added tax to be paid in accordance with the Payment Milestones.

"Notice to Proceed" means the written notice to be issued by the Owner to the Contractor pursuant to Clause 2.2 specifying the Commencement Date.

"Owner's Technical" means KPAC Technical Department.

"Parties" means the Owner and the Contractor and "Party" means any of them.

"Payment Milestones" means the schedule of payments, applicable milestones and conditions to be satisfied as set out in Appendix 2 that need to be met before Owner has an obligation to make such relevant payment of the Lump Sum Price.

"Project" means the AMBER (JP8 Operations Conversion) Project where located at KPAT Terminal, Leamchabang, Chonburi, Thailand.

"Project Scope" means without limitation of the execution of all Works and all services to be performed by the Contractor under this Contract.

"Safety Regulations" has the meaning given to it in Clause 3.5(a)

"Schedule of Payments" has the details given to it under Part E.

"Specification and Technical Documents" means each of the specification and technical documents set out in Contract Requisition listed in Part C of this Contract.

"Variation Order" has the meaning given to it in Clause 10.1.

"Works" means the scope of works set out in Contracts Requisition listed in Part C of this Contract.

"Works Schedule" means the schedule to complete the Works as set out in Appendix 1.

1.2 Headings and Title

The headings and titles in this Contract shall not be deemed part thereof or be taken into consideration in the interpretation or construction of the Contract.

1.3 Interpretation

1.3.1 Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

1.3.2 Words importing the singular only also include the plural and vice-versa where the context requires.

1.3.3 References herein to Clauses and Appendices shall be deemed references to Clauses and Appendices to this Contract (unless it appears otherwise from the context).

1.3.4 References to the words "include" or "including" shall be deemed to be followed by "without limitation" or "but not limited to," whether or not they are followed by such phrases or words of similar import.

2. THE OWNER

2.1 Access to and Possession of the Site

The Owner shall, as to be mutually agreed between the Parties, grant the Contractor access to the Site. A temporary work area will be allocated within the Site for temporary laydown, storage and/or fabrication (as the case may be) with an entrance independent of the main Site entrance ("Work Area").

2.2 Owner's Right of Access

Owner and its authorized representatives reserve the right to access and inspect the Works being performed whenever and wherever they are being performed, including but not limited to the premises of the Contractor or Contractor's sub-contractor's premises. Contractor shall procure that that Owner has access to Contractor's sub-contractor's premises.

2.3 Notice to Proceed

The Owner shall issue a Notice to Proceed to the Contractor, which authorises the commencement of all Works under the Contract. The Contractor shall commence performance of the Works on the date which the Owner specifies (the "Commencement Date") in the Notice to Proceed.

2.4 Conditions Precedent

The obligations of the Parties to perform their obligations hereunder shall be subject to the satisfaction by the Owner of the following conditions:

- (a) Conditions of Contract Clauses 1. to 20. inclusive.
- (b) Minutes of meetings of commercial and technical clarifications
- (c) Contract Requisition listed in Part C of this Contract

If there is any inconsistency between the Conditions of Contract and the Appendix, the text of the Conditions of Contract shall take precedence over the Appendix unless the text expressly indicates otherwise. Contractor shall immediately refer to Owner for clarification of any such inconsistency. Any matter set forth in one portion of the Contract but omitted from another portion shall be treated as though set forth in both the portions.

2.5 Provision of Electricity

(a) Subject to Clause 2.5(b), Contractor shall provide its own electricity supply for carrying out the Works at the Site and/or Work Area.

(b) Owner will provide, free of charge, electricity for use of the office facility at the Site.

2.6 Delegation to Owner's Engineer

Notwithstanding anything to the contrary in this Contract, the Owner shall have the right to delegate responsibility for matters related to the Works to the Owner's Engineer provided that Owner continues to be liable to honor its obligations in accordance with the Contract.

3. OBLIGATIONS AND REPRESENTATIONS AND WARRANTIES OF THE CONTRACTOR

3.1 General Obligations and Representations and Warranties

The Contractor represents and warrants that it shall carry out the Works:

- (a) using skill, care and diligence to be expected of appropriately qualified and experienced professional designers, engineers and constructors with experience in works of a type, nature and complexity similar to the Works in accordance with generally accepted standards and professional engineering practice incorporating satisfactory quality assurance procedures which conforms with the Invitation to Tender and shall provide all necessary Contractor's Equipment and labour;
- (b) in a workmanlike and professional manner in accordance with prudent industry practices, modern engineering design, project management and supervisory principles and practices and in accordance with the standards to be expected from leading international contractors with experience in similar projects using similar technology and of a similar size, scope and complexity to the Project;
- (c) manufacture and fabricate consistent with prudent industry practices and in accordance with the standards and codes of practice specified or referred to in the Contract, and where no such standards and codes are specified, to the standards consistently employed in projects of a similar size, scope and complexity to the Project by leading international contractors;
- (d) so that upon completion and in accordance with the Contract, satisfy the performance criteria set out in the Contract unless otherwise agreed in writing by the Owner;
- (e) so as to comply at all times with all laws and licenses, permits, approvals of any governmental authority having jurisdiction over the matter in question.

The Contractor represents that it has the required skill and capacity as a professional in the business to perform the Works in the manner described in the Contract. The Contractor further represents and warrants that all the Works will be free from all defects in design, workmanship and material in accordance with the Invitation to Tender during the Defects Liability Period. This warranty does not cover improper use or maintenance.

3.2 Bank Guarantee

The Contractor shall provide a bank guarantee in favour on the Owner not later than 14 days from the date of this Contract in substantially the same form as set out in the Invitation to Tender ("Bank Guarantee"). The Bank Guarantee shall be in an amount equal to 10% of the awarded Contract Price and must remain valid for the duration of the Contract until finish of Defects Liability Period

3.3 Contractor's Representative

- (a) The Contractor shall employ one or more competent representatives acceptable to the Owner to superintend the carrying out of the Works. They shall be fluent in the English language for day to day communications. Their names and qualifications shall be communicated in writing to the Owner.
- (b) Any instruction or notice which the Owner gives to the Contractor's representatives mentioned in Clause 3.3 (a) above shall be deemed to have been given to the Contractor.
- (c) Any decision, advice or instruction given by the Contractor's representative mentioned in Clause 3.3 (a) above to the Owner shall have the same effect as though it had been given by the Contractor.
- (d) Any appointment or removal of the Contractor's representatives shall be in writing and shall not take effect until a copy thereof has been delivered by the Contractor to the Owner.

3.4 Contractor's Equipment

- (a) The Contractor shall provide all Contractor's Equipment necessary to complete the Works.
- (b) All Contractor's Equipment shall, when brought on to the Site and/or Work Area, be deemed to be exclusively intended for the execution of the Works. At its sole discretion, the Contractor shall be allowed to remove from, or bring back to, the Site and/or Work Area any such equipment, as appropriate and necessary, for the completion of the Works.
- (c) The Contractor shall provide suitable and safe storage and protection for Owner's Equipment under the care and control of the Contractor and at no additional costs to the Owner. Any unaccounted variations in inventory quantities of Owner's equipment under the care and control Contractor shall be remedied by the Contractor at no cost to Owner.

3.5 Safety Precautions

- (a) The Contractor at all times shall fully comply and observe the Owner's safety, health and environmental regulations including those that may be amended from time to time by the Owner ("Safety Regulations") and Thai laws and regulations regarding safety on the Site as they relate to the construction, installation, testing and commissioning of the Works to be delivered by the Contractor. For the avoidance of doubt, the initial Safety Regulations are provided in the Invitation to Tender.
- (b) The Contractor acknowledges that it has been provided with a copy of the Safety Regulations and it has read and understands the Safety Regulations.
- (c) The Contractor shall take all reasonable measures in consultation with the Owner to protect the safety of all persons (including, without limitation, vendors' and subcontractors' employees, servants, agents, suppliers and invitees) who at the Contractor's or Owner's request come into the Site and/or Work Area.

3.6 Owner's Equipment

Except for the free issue materials set out in the Invitation to Tender ("Owner's Equipment"), there is no Owner's equipment available for use by the Contractor.

3.7 Clearance of Site

The Contractor shall from time to time during the progress of the Works clear away and remove all surplus materials and rubbish provided that it was brought onto Site and/or Work Area or generated by the Contractor. On completion of the Works, the Contractor shall remove all Contractor's Equipment, all surplus materials, rubbish, and waste from the Site and/or Work Area.

3.8 Compliance with Laws and Regulations

The Contractor shall, at all times and in all matters arising in the performance of the Contract, observe and fully comply in all respects with, and give all notices required by the provisions of any law or regulation, of any duly constituted authority. The Contractor shall protect and indemnify the Owner and the Owner's directors, officers and agents against any claim or liability arising from or based on violation of any law or regulations imposed on the Contractor in relation to the Works.

3.9 Licenses and Permits

The Contractor shall, on behalf of the Owner, obtain any licenses or permits required to perform the Works at the Site and/or Work Area.

3.10 Coordination Meetings

Contractor shall attend, as required by the Owner, coordination meetings with Owner from time to time.

4. DESIGN

4.1 Specification and Technical Documents

The Parties agree that the Specification and Technical Documents are agreed by the Parties and the Works shall be in accordance with the Specification and Technical Documents unless otherwise agreed in writing by both Parties.

5. LABOR

5.1 Engagement of Labour

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all labour including payment of remuneration and any amounts required under law.

5.2 Sub-contractors

The Contractor may appoint sub-contractors to provide services to Contractor however before such appointments are made, Contractor must obtain the prior written consent of the Owner. The Contractor agrees that in the event of sub-contract, the Contractor shall not be released from any and all obligations, responsibilities, and liabilities under this Contract.

5.3 Labour Law

The Contractor shall at all times observe and fully comply with all applicable Thai labor law and all rules and regulations issued pursuant thereto and government rules.

6. WORKMANSHIP AND MATERIALS

6.1 Manner of Execution

All Works to be done by or on behalf of the Contractor and the Contractor's sub-contractors shall be executed in the manner and in accordance with the Contract. Where the manner of fabrication and execution is not set out in the Contract, the work shall be executed in a proper and workmanlike manner in accordance with recognised international industry practice.

6.2 Independent Inspection

The Owner shall have the right to inspect all aspects of the Works at any reasonable time. The Owner shall have the right to delegate any inspection of the Works to the Owner's Engineer.

7. PROGRAMME

7.1 Time for Completion

The Contractor shall complete the Works in accordance with the Works Schedule and in any case no later than the Completion Date.

7.2 Claims for Extension of Time for Completion

The Contractor may claim an extension to the Completion Date if:

- (a) Not applicable;
- (b) the Owner's Default under Clause 13.1; or
- (c) Force Majeure.

Not applicable.

The Owner shall, after due consultation with the Contractor and in the Owner's own discretion which shall not be unreasonably withheld or delayed, grant the Contractor from time to time, either prospectively or retrospectively, such extension to the Completion Date as may be justified. The Owner shall notify the Contractor accordingly.

7.3 Delay in Completion

If the Contractor fails to complete the Works by the Completion Date, the Contractor shall pay delay liquidated damages of point one percent (0.1%) per day of the Contract Price with a maximum Delay Liquidated Damages of ten percent (10%) of the Contract Price ("Delay Liquidated Damages").

7.4 Order to Suspend

Provided there is a reasonable ground, including the movement of fuel in to or out of tanks or any time there is a hazardous atmosphere at the Site and/or the Work Area, the Owner may at any time instruct the Contractor to suspend progress of the Works. The Contractor agrees it shall have no right to make any claim for additional compensation or otherwise for such suspension of the Works.

7.5 Resumption of Work

Permission or instruction to proceed after Works have been suspended shall be given, in writing, by Owner to Contractor.

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8. TESTS ON WORKS

8.1 Tests

Testing of the Works shall be done in accordance with Contracts Requisition listed in Part C of the Contract.

9. DEFECTS AFTER TAKING OVER

9.1 Making Good Defects

The Contractor shall be responsible for making good any defect in or damage to any part of the Works which may appear or occur during the Defects Liability Period and which arises from, either:

- (a) any defective materials, workmanship or design, or
- (b) any act or omission of the Contractor during the Defects Liability Period.

The Contractor shall make good the defect or damage without reasonable delay and at the Contractor's own cost and expenses.

9.2 Notice of Defects

If any such defect appears or damage occurs, the Owner shall deliver a notice in writing to the Contractor and the Owner may fix a reasonable time for remedying the defect or damage.

9.3 Failure to Remedy Defects

If the Contractor fails to remedy the defect or damage within the time fixed by Owner, the Owner may carry out the work himself or by others at the Contractor's risk, costs and expenses, provided that he does so in his reasonable manner. The costs properly incurred by the Owner in remedying the defect or damage shall be deducted from the Contract Price, but the Contractor shall have no responsibility for such work or (ii) if the Owner has paid to the Contractor the Contract Price in full, claim against the Contractor for such costs and the Contractor shall reimburse such costs within 7 days.

9.4 Removal of Defective Work

If the defect or damage is such that repairs cannot be expeditiously carried out on the Site and/or Work Area, the Contractor may with the consent of the Owner remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

10. VARIATIONS

10.1 Owner's Right to Vary

The Owner may by variation order to the Contractor at any time before the Works are taken over and Completion occurs, instruct the Contractor to alter, amend, omit, add to or otherwise vary any of the Works ("Variation Order").

The Contractor shall not vary or alter any of the Works or any part of the Works, except in accordance with a Variation Order from the Owner. The Contractor may, however, at any time propose variations of the Works to the Owner.

10.2 Variation Order Procedure

Prior to any Variation Order under Clause 10 the Owner shall notify the Contractor of the nature and form of such variation.

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As soon as possible after having received such notice, the Contractor shall submit to the Owner:

- (a) a description of work, if any, to be performed in respect to the envisaged variation and a programme for its execution; and
- (b) the Contractor's proposals for any necessary modifications to the Programme according to Clause 7.1 or to any of the Contractor's obligations under the Contract; and
- (c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission the Owner shall, after due consultation with the Contractor, decide as soon as possible whether or not the variation shall be carried out.

If the Owner decides that the variation shall be carried out, he shall issue a Variation Order clearly identified as such in accordance with the Owner's submission or as modified by agreement.

10.3 Disagreement on the Adjustment of the Contract Price

If the Contractor and the Owner are unable to agree on the adjustment of the Contract Price, the dispute shall be resolved in accordance with Clause 16. Due account shall be taken of any over- or under-recovery of overheads by the Contractor in consequence of the variation. Furthermore, the following shall be taken into consideration in the adjustment of the Contract Price:

- (a) the reasonable cost of any partial execution of the Works rendered useless by any such variation; and
- (b) the reasonable cost of making necessary alterations to Works already manufactured or in the course of manufacture or of any Works done that have to be altered in consequence of such a variation; and
- (c) any additional reasonable costs incurred by the Contractor by the disruption of the progress of the Works as detailed in the Programme.

10.4 Contractor to Proceed

On receipt of a Variation Order, the Contractor shall forthwith proceed to carry out the variation and be bound to these Conditions in so doing as if such variation was stated in the Contract.

The Works shall not be delayed pending the granting of an extension of the Time for Completion.

10.5 Records of Cost

In any case where the Contractor is instructed to proceed with a Variation Order prior to the determination of the adjustment to the Contract Price in respect thereof, the Contractor shall keep records of the cost of undertaking the Variation Order and of time expended thereon. Such records shall be open to inspection and verification by the Owner at all reasonable times.

11. CONTRACT PRICE AND PAYMENT

11.1 Lump Sum Price (Contract Price)

The descriptions of items given in the Schedule of Rates and Prices are for guidance only. It is the Contractor's sole responsibility to determine the exact nature and extent of the Works to be performed under the Contract. No claim or the Contract Price adjustment arising as the result of the Contractor's failure in this respect will be considered.

The quantities of the performed works set out in the Schedule of Rates and Prices are the estimated quantities of the work and are not intended to be taken as the actual and correct quantities of the Works to be executed by the Contractor under the Contract. The Contractor shall calculate the value of the work for which it considers that it is entitled to submit an application for progress payment and the final account by measure or re-measure in accordance with the Contract for the Owner review and approval.

11.2 Terms of Payment

Payment shall be made according to Payment Milestones of this Contract as set out in Appendix 2

Owner shall have the right to withhold from any payment due to the Contractor, including the final payment of the Lump Sum Price, such amounts as the Owner deems necessary or appropriate to protect it from liability because of any one or more of the following reasons:

- (i) defects and deficiencies in any Work, whether or not payment has been made therefor;
- (ii) either the filing of third-party claims or liens for which the Contractor is liable or reasonable evidence indicating probable filing of such claims;
- (iii) a dispute as to the accuracy or completeness of any request for payment;
- (iv) the Contractor's failure in any material respect to carry out the Works or perform any of its obligations under this Contract; and
- (v) any withholding tax required by law.

11.3 Method of Application

The Contractor shall submit applications for interim payments for the Owner approval at intervals of not less than a calendar month. The applications shall be in the form of statements showing:

- (a) Any entitlement for payment of part of the Contract Price relating to any designated Milestone achieved during the period for which the statement is issued, together with the amount of any lump sum or other scheduled payment as may be due under Milestones achieved during said period;
- (b) The amount to which the Contractor, by way of Variation Order, considers itself entitled to in connection with all other matters (including, but not limited to, any items to be the subject of fixed unit rates or cost reimbursement) for which provision is made under the Contract.

When the Owner has verified the amount of an application and statement submitted, but in no event later than thirty (30) days after he received the application and progress statement, the Owner shall certify and notify the Contractor of the amount certified and the basis upon which the amount has been calculated by way of a payment certificate issued by the Owner.

11.4 Payment

The Owner shall pay the amount certified within thirty (30) days from the date of receipt of correct invoice and confirmation from both Parties that the relevant Milestone was achieved.

Payment shall be made by wire transfer or by account payee cheque to:

Bank: : Krungthai Bank
Branch : Tha Rua Laemchabang
Account Name : Swot construction Co., Ltd.
Account Number : 277-1-00860-2

12. TERMINATION BY OWNER

12.1 Notice of Default

In respect of the Project, if the Contractor is not executing the Works in accordance with the Contract or is neglecting to perform his obligations, the Owner may give notice to the Contractor requiring him to make good such failure or neglect within a specified period which shall not be unreasonable taking into account the circumstances.

12.2 Contractor's Default

Subject to any other provision of the Contract allowing termination by the Contractor, in the event that the Contractor:

- (a) has failed to comply within the time specified in a notice under Clause 12.1; or
- (b) assigns the Works without the Owner's written consent; or
- (c) commits any breach of or fails to comply with or observe the provisions of this Contract or any of them; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him or compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors (including, if a so-called "provisional administrator" is appointed over the assets of the Contractor) or goes into liquidation;

the Owner may, at its absolute discretion choose to:

- (i) upon fourteen (14) days written notice (save for (d) above which shall not require notice) to the Contractor at its absolute discretion choose to:
 - (A) postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory assurances have been provided by the Contractor;
 - (B) take the whole or part of the Works out of the Contractor's hands and take such measures as are reasonably required by the Owner to facilitate the taking out, including making such deductions from payments otherwise due to the Contractor as reflects the works taken out; or
- (ii) give the Contractor written notice that:

- (A) the Contractor has committed an act or omission constituting a Contractor's default;
- (B) the Owner intends to terminate the Contract at the end of the period given by the Owner in the notice;
- (C) the Contractor is to remedy such default within the period given pursuant to (B) above; and
- (D) if the Contractor does not remedy the default within the period given, the Owner will terminate the Contract without having to require any consent from any Court of authority.

The period allowed for remedial action under Clause 12.2(ii) above shall be no less than seven (7) days, except in case of Clause 12.2 (d) where no such remedy period is required.

Any such expulsion and termination shall be without prejudice to any other rights or powers of the Owner or the Contractor under the Contract.

The Owner may upon such termination complete the Works himself or engage any other contractor to complete the Works.

Notwithstanding anything to the contrary herein, unless otherwise agreed between the parties hereto, this Contract shall be deemed automatically terminated if and when the Contract is terminated for any reason, in which event the Owner's liability towards the Contractor shall only be the payment to the Contractor of the value of the work done by the Contractor up to the time of the said termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

The Contractor shall be liable to the Owner for all damages under the terms of this Contract and otherwise, including increased construction costs and increased administrative costs, suffered by the Owner as a result of the Contractor's default. All such damages may be recovered by the Owner from the Contractor in accordance with Clause (20.2) of this Contract or, without prejudice to that right, the Owner shall have the right to suspend payment under this Contract until the default has been rectified and have the right to deduct from any money due or becoming due to the Contractor under this Contract. The Owner may exercise any or all of the foregoing rights to the extent necessary to satisfy the full amount of any obligations of the Contractor, and if any balance remains owing to the Owner, it may be collected against the Contractor.

12.3 Payment after Termination

After termination under Clause 12.2 has taken effect, the Owner shall have the rights conferred by this Clause namely, without prejudice to other rights or entitlements granted to it in the Contract:

- (a) the Owner shall not be liable to make any further payments to the Contractor until the Works have been completed, except any payments obligations arising prior to the date of termination under Clause 12.2, which shall be made in accordance with Clause 11.4.
- (b) When the Works are so complete, the Owner shall be entitled to recover from the Contractor the extra costs, if any, of completing the Works.

12.4 Cessation of Work and Removal of Contractor's Equipment

Upon termination of the Contract (whether by the Owner or the Contractor), the Contractor shall promptly:

- (a) cease all further work, except for such work as may have been instructed by the Owner or is necessary for the protection of life or property or for the safety of the Works;
- (b) procure the assignment of any subcontract as requested by the Owner;
- (c) hand over the Works to the extent that they have been executed at the date of termination to the Owner and/ or any person designated by the Owner; and
- (d) remove all other goods from the Site and/or Work Area, except as necessary for safety, and leave the Work Area and Site.

13. SUSPENSION AND TERMINATION BY CONTRACTOR

13.1 Owner's Default

In case the Owner:

- (a) subject to Clause 11.4, fails to pay the Contractor the amount due under any payment certificate within 30 days after the amount became payable; or
- (b) fails to cause to issue any certificate of the Owner as required hereunder; or
- (c) fails to give permission to proceed in the event of a suspension that affects the whole of the Works under Clause 7.5; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes in to liquidation; or
- (e) consistently fails to meet his material obligations hereunder,

("Owner Default").

The Contractor may, at its absolute discretion choose to:

- (i) give thirty (30) days written notice to the Owner that the Contractor will postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory payment security is established covering the outstanding part of the Lump Sum Price, and/or
- (ii) give the Owner written notice that:
 - (A) the Owner has committed an act or omission constituting an Owners default;
 - (B) the Contractor intends to terminate the Contract at the end of the period given by the Contractor in the notice;
 - (C) the Owner is to remedy such default within the period given pursuant to (B) above; and
 - (D) if the Owner does not remedy the default within the period given, the Contractor will terminate the Contract without having to require any consent from any Court of authority.

The period allowed for remedial action shall be no less than 21 days.

Any such termination shall be without prejudice to any other rights of the Contractor or the Owner under the Contract.

13.2 Removal of Contractor's Equipment

On such termination, the Contractor shall be entitled to remove immediately all Contractor's Equipment which is on the Site and/or Work Area.

13.3 Payment on Termination for Owner's Default

In the event of such termination the Owner shall pay the Contractor for the value of the Works completed at the time of termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

14. RISK AND RESPONSIBILITY

14.1 General Indemnity

The Contractor hereby warrants and represents that it holds and/or has received all the necessary licences and consents which are required from any licensor and any other person in connection with the design, construction, operation and maintenance of the Works, and the Contractor shall hold harmless and indemnify the Owner, its directors and employees from and against all claims losses, liabilities, expenses, charges, liens and other obligations whatsoever in connection with this Contract and from and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto provided that the claim or proceedings arise out of the design, construction, manufacture or use of the Works.

14.2 Claims

The Contractor shall be promptly notified of any claim under this Clause made against the Owner. The Contractor together with the Owner may at his own cost conduct negotiations for the settlement of such claim, and any litigation that may arise therefrom.

The Owner shall not make any admission, which might be prejudicial to the Contractor unless the Contractor has failed to take over the conduct of the negotiations or litigation within a reasonable time after having been so requested.

The Contractor may conduct such negotiations or litigation referred to above on the condition that he shall provide the Owner such reasonable security as the Owner may require as quickly as reasonably possible. The security shall be for an amount which is an assessment of the compensation, damages, expenses and costs for which the Owner and/or the Owner may become liable and which are the subject of the indemnity under Clause 14.1.

The Owner shall, at the request of the Contractor, provide all available assistance for the purpose of contesting any such claim or action, and shall be repaid all reasonable costs incurred in so doing.

14.3 Contractor's Liability

The Contractor shall, until the end of the Defects Liability Period or any extended period of Defects Liability Period, defend, indemnify, be liable for and hold harmless to the Owner against all losses, expenses (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) and claims, including (without limitation) any claims in respect of any loss of or damage to physical property (other than the Works), death or personal injury, arising out of or resulting from or occurring to the extent caused by:

- (a) defective design, material or workmanship of the Contractor;

- (b) negligence or breach of statutory or contractual duty of the Contractor, or its respective employees, advisors, consultants and agents; or
- (c) the performance by the Contractor under the Contract, any subcontractor, any person or organization directly or indirectly employed by any of them regardless of the negligence of any such party,

save for loss or damage arising through the Owner's gross negligence or wilful default.

14.4 Accidents

The Contractor shall be liable for and shall indemnify the Owner against all losses, expenses or claims arising in connection with the death of or injury to any person employed by the Contractor for the purposes of the Works, unless caused by the gross negligence or wilful default of the Owner or other contractors engaged by the Owner or by their respective employees or agents.

14.5 Liability for Indirect Damages

Neither party shall be liable to the other for any loss of profit, loss of use, loss of production, loss of data, loss of financing costs, loss of contracts or for any other indirect damage that may be suffered by the other, except as expressly provided in this Contract.

14.6 Liability after Expiration of Defects Liability Period

Except as otherwise set forth herein, the Contractor shall have no liability to the Owner for any loss of or damage to the Works or the Project which occurs after the expiration of the Defects Liability Period, unless caused by gross negligence or wilful default of the Contractor.

14.7 Mitigation of Loss or Damage

In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage which has occurred or may occur.

14.8 Insurances

Without limiting or reducing Contractor's liability and responsibility hereunder, Contractor shall procure and maintain, at its own cost and expense and through first class insurers, during performance of the Works and shall ensure that any subcontractors do likewise, the following insurance applicable to its activities with respect to and for the duration of the Contract:

- (a) Comprehensive General Third Party Liability Insurance in the amount of one million US Dollars (1,000,000 USD.) for any one claim and without limit to the number of claims in respect of any bodily and/or personal injury including death and property damage or destruction of any person or property which shall arise out of or in consequence of Consultant's performance of the Services. Such policy shall include Contractual Liability cover and a cross liability provision.
- (b) Such Employer's Liability, Workmen's Compensation Insurance or similar cover which the Consultant is statutorily required to effect with respect to its personnel
- (c) Any other insurance which may be relevant and/or necessary and/or may be required by law.

All insurance policies shall be endorsed to provide the Employer with not less than thirty (30) days notice of any cancellation or material amendment thereof.

The Consultant shall provide Owner with such evidence of its insurance coverage as the Owner may reasonably require.

Should Contractor at any time neglect or refuse to provide or renew any insurance required herein, or should any insurance be cancelled, Owner shall have the right to procure such insurance at the Contractor's cost. Owner shall be entitled to deduct such sums from any monies due or which may become due to Contractor in addition to any other remedies Owner may have under the Contract

15. FORCE MAJEURE

15.1 Definition of Force Majeure

Force Majeure means any circumstances which are unforeseeable and beyond the control of the Contractor or of the Owner upon due care and diligent performance, including but not limited to:

- (a) war and other hostilities (whether war be declared or not), invasion, act of foreign enemies, mobilisation, requisition or embargo;
- (c) rebellion, terrorism, revolution, insurrection, military or usurped power, civil war, and civil unrest;
- (d) closure of ports, suspension of government services, breakdown of communications, riot, commotion, disorder, strike, lockout and other industrial action, except where this involves any personnel and other employees of the Contractor, other than as a part of a nationwide industrial action; and/or
- (f) natural catastrophes including, without limitation, flood, fire and earthquakes.

The burden of proof as to whether a Force Majeure event has occurred and whether the Force Majeure event excuses the party from performance shall be upon the party claiming such Force Majeure event.

15.2 Effect of Force Majeure

Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligations is prevented by any circumstances of Force Majeure which arise after the Commencement Date.

15.3 Notice of Occurrence

If either party considers that any circumstances of Force Majeure have occurred which may affect performance of his obligations he shall promptly notify the other party of the event or circumstances constituting the Force Majeure and shall to the extent possible specify the obligations, the performance of which is or will be prevented.

15.4 Performance to Continue

Upon the occurrence of any circumstances of Force Majeure, the Contractor shall use his best endeavour to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify the Owner of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure.

However, the Contractor shall not take any such steps unless the Owner has approved the Contractor's proposed steps and reasonable remedy or remedies (if necessary); provided, that the Owner shall respond to the proposed steps and reasonable remedy or remedies within 72 hours. Such 72 hours may be extended by the Owner if the Owner requires additional time to consider the proposal of the Contractor. If the Owner has not responded within 72 hours, Owner shall be deemed to have approved and directed such steps.

15.5 Damage caused by Force Majeure

If in consequence of Force Majeure the Works shall suffer loss or damage the Contractor shall be entitled to be paid for the value of the work done at that time, without regard to the loss or damage that has occurred but only to the extent such loss or damage has not been compensated by insurance proceeds.

15.6 Termination in Consequence of Force Majeure

If circumstances of Force Majeure have occurred and shall continue for a cumulative period of 90 days then, notwithstanding that the Contractor may by reason thereof have been granted an extension to complete the Works, either party shall be entitled to serve upon the other 21 days' notice to terminate the Contract. If at the expiry of the period of 21 days Force Majeure shall still continue the Contract shall terminate, otherwise the Contract shall continue to be in force and effect.

15.7 Payment on Termination for Force Majeure

If the Contract is terminated under Clause 15.6 the Contractor shall be paid the value of the Work done at that time. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

15.8 Release from Performance

If circumstances of Force Majeure occur and in consequence thereof under the law governing the Contract the parties are released from further performance of the Contract, the sum payable by the Owner to the Contractor shall be the same as that which would have been payable under Clause 15.7 if the Contract had been terminated under Clause 15.6.

15.9 Force Majeure Affecting Owner's Duties

The provisions of Clause 19 shall also apply in circumstances where the Owner is prevented from performing any of his duties under the Contract including (without limitation) the duty to make payment to the Contractor under the Contract by reason of Force Majeure; provided, however, subject to the foregoing, any payments due to the Contractor in accordance with Clause 15.7 shall be paid by the Owner in accordance with the provisions set forth in Clause 11.

16. DISPUTES AND ARBITRATION

16.1 Arbitration

Any dispute arising out of or in connection with this Contract, including any question regarding its existence, validity or termination, shall be referred to and finally resolved by arbitration in Thailand in accordance with the Arbitration rules of the Thai Arbitration Institute, the Ministry of Justice ("TAI Rules") for the time being in force, which rules are deemed to be incorporated by reference in this clause.

The Tribunal shall consist of three arbitrators to be appointed in accordance to the TAI Rules. The place of arbitration shall be Thailand.

The language of the arbitration shall be English.

16.2 Work to Continue

Performance of the Contract shall continue during arbitration proceedings unless the Owner shall order suspension. If any such suspension is ordered the reasonable costs incurred by the Contractor and occasioned thereby shall be approved by the Owner (acting reasonably) and added to the Contract Price.

Except as otherwise set forth herein, no payments due or payable by the Owner shall be withheld on account of pending reference to arbitration.

17. CHANGE OF CONTROL

Notwithstanding any provisions to the contrary in this Agreement, Owner has the right to terminate this Contract, effective immediately, at any time and without prior notice or compensation in lieu thereof nor any goodwill indemnity by sending a fax and a letter to Contractor in the event there is a change in control of Contractor.

Change of control means the sale of all or substantially all the assets of Contractor, any merger, consolidation or acquisition of Contractor with, by or into another corporation, entity or person; or any change in the ownership of more than fifty percent (50%) of the voting capital stock of Contractor in one or more related transactions.

18. NOTICES

Any notice, request or other communication required hereunder shall be deemed to have been duly given or made when it shall be in writing and delivered by hand or facsimile or by registered mail, addressed as follows:

If to Contractor,

Svot Construction Co., Ltd.
209 Moo 2, Tungskula, Sriracha
Chonburi 20230 THAILAND
Tel: +66 38 352 593 to 4
Fax: +66 38 352 593
Attention: Mr. Suebsak Sukkham

If to Owner,

Floor 29, Exchange Tower,
388 Rachadapisek Road, Klongtoey, Sukhumvit Road
Bangkok 10110 THAILAND
Tel: +66 2 1049244
Fax: +66 2 1049101

19. CONTACT LIST

Any correspondence not required to be given under Clause 18 shall be given by email and sent to the contact list set out in Appendix 5.

20. GENERAL

20.1 Assignment

Neither Party may assign its rights or obligations under this Contract without the prior written consent of the other Party.

20.2 Documents Mutually Explanatory

The Contract shall be taken as mutually explanatory. Any ambiguities or discrepancies shall be resolved amicably by both Parties.

20.3 Inconsistency

In case of any inconsistency between the terms of the Contract, the Invitation to Tender and Specification and Technical Documents, the terms of the Invitation to Tender and Specification and Technical Documents shall prevail.

20.4 Applicable Law

The interpretation and the construction of this Contract, and all matters relating hereto, shall be governed by the laws of Thailand.

20.5 Third Parties

Notwithstanding any other provision of this Contract, nothing in this Contract is intended to confer and nothing purports to confer any right to enforce any of its terms on any person who is not a party to it.

20.6 Waivers

No failure or delay by any party to exercise any right, power or remedy will operate as a waiver of it nor will any partial exercise preclude any further exercise of the same, or of some other right, power or remedy, other than expressly stated in this Contract.

20.7 Amendment

No amendment or waiver of any provision of this Contract, or consent to any departure therefrom, shall be effective unless in writing and signed or consented to (in writing) by the Parties, and then such waiver or consent shall be effective only in the specific instance and for the specific purpose for which given.

20.8 Unenforceability

Any provision of this Contract that is prohibited, unenforceable or not authorized in any one jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition, unenforceability or non-authorization without invalidating the remaining provisions of this Contract or affecting the validity, enforceability or authorization of such provision in any other jurisdiction.

20.9 Entire Agreement

This Contract, together with any other agreements, documents, or certificates to be executed by the Parties pursuant to this Agreement constitutes the entire agreement between the Parties with respect to the transactions contemplated hereby. All previous documents, undertakings, and agreements, whether oral, written or otherwise, between the Parties concerning the subject matter of this Contract are hereby cancelled and shall not affect or modify any of the terms or obligations set forth in this Contract.

20.10 Confidentiality

The Parties agree that this Contract shall be kept confidential and shall not be disclosed to any third party, except as such disclosure is required by an applicable law or regulation or by any governmental authority having jurisdiction over any of the Parties or such disclosure is made by any Party to their financial, legal or other professional advisors on a "need to know" basis. In the event that a proper request is made for this Contract by any governmental authority, the Owner shall notify the Contractor of such request and the Owner and Contractor shall promptly meet to discuss an appropriate course of action provided, however, that nothing contained in this sub-clause shall obligate the Owner to violate any applicable law or refuse any properly presented request made by any governmental authority. If any Party discloses this Contract in violation of this sub-clause, it shall indemnify and hold the other Parties harmless from any present or future claim, liability, fine or penalty, including any claim for payment of additional taxes, in each case as a result of disclosure of this Contract. The restrictions contained in this Clause 20.10 shall survive the termination or expiry of this Contract.

20.11 Governing Law

This Contract shall be governed by and construed in accordance with the laws of Thailand.

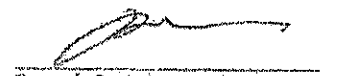
IN WITNESS WHEREOF, the parties hereto, having read and understood the contents of this Contract, have caused this Contract to be signed in their respective names as well as affixed with the company's seal of (if any) as of the date first above written.

SIGNED for and on behalf of
Kuwait Petroleum Aviation (Thailand) Ltd.


By: _____

Title:

SIGNED for and on behalf of
Swet Construction Co., Ltd.


By: PRAYUE NISSAVANANT

Title: Managing Director

**AMBER (JP8 OPERATIONS CONVERSION)
PROJECT**

AT

KPAT TERMINAL, THAILAND

FW PROJECT NO. 23212

CONTRACT NO.: 002/23212

MECHANICAL AND PIPING

CONTRACT DOCUMENT

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KUWAIT PETROLEUM AVIATION (THAILAND) LTD.

- and -

CHART KARNCHANG LAEMCHABANG CO., LTD.

Referee 4.

WAV.

Referee 4.

WAV.

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This Contract is made on 24th August 2017

Between

Kuwait Petroleum Aviation (Thailand) Ltd., whose registered office is Floor 10, Lake Rachada Office Complex, 193/38 Rachadapisek Road, Klongtoey, Bangkok 10110, Thailand (the "Owner"); and

Chart Karnchang Laemchabang Co., Ltd., whose registered office is 101/1 Moo9, Tuengsukhla, Sriracha, Chonburi 20230, Thailand (the "Contractor").

WHEREAS the Owner operates a fuel storage facility in Chonburi, Thailand (the "Site") that contains amongst others, eight above ground storage tanks,

WHEREAS the Owner wishes to employ the Contractor and the Contractor wishes to accept the employment, as an independent contractor, to furnish materials, equipment, plant machinery, consumables, labor skills, expertise and services necessary to the Works at the Owner's KPAT terminal.

The Parties agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them:

"ASME B31.3" means the American Society of Mechanical Engineers requirements for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals.

"ASME Section V" means means the American Society of Mechanical Engineers

"Bank Guarantee" has the meaning given to it in Clause 3.2.

"Baht" means the lawful currency of Thailand.

"Business Day" means any day (excluding Saturday, Sunday and public holiday) which is a normal bank working day in Thailand.

"Commencement Date" means the date on which the Contractor is to commence the performance of the Works pursuant to Clause 2.3.

"Completion" means the date on which an acceptance certificate is issued by Owner to Contractor for satisfaction of Payment Milestone as set out in Appendix 2.

"Completion Date" means refer to Part D, section 2018, or such date that may be amended or extended in accordance with Clause 7 hereof.

"Contract" means the contract made between Owner and Contractor and comprises the documents stated in the terms and conditions to form the Contract including all appendices.

"Contract Price" means the meaning given to it under Clause 11.1.

"Contractor's Default" has the meaning given in Clause 12.2.

"Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works.

"Defects Liability Period" means the period of one year following completion of the Works, during which the Contractor is responsible for making good defects and damage in accordance with Clause 9.

"Delay Liquidated Damages" has the meaning given in Clause 7.3.

"Force Majeure" has the meaning given in Clause 15.1.

"Invitation to Tender" means the invitation to tender including its addendums and clarifications provided to the Contractor and as is set out in [Appendix 3].

"Lump Sum Payment" means the meaning given to it under Clause 11.1 exclusive of value added tax to be paid in accordance with the Payment Milestones.

"Notice to Proceed" means the written notice to be issued by the Owner to the Contractor pursuant to Clause 2.2 specifying the Commencement Date.

"Owner's Technical" means KPIAC Technical Department.

"Parties" means the Owner and the Contractor and "Party" means any of them.

"Payment Milestones" means the schedule of payments, applicable milestones and conditions to be satisfied as set out in Appendix 2 that need to be met before Owner has an obligation to make such relevant payment of the Lump Sum Price.

"Project" means the AMBER (JFS Operations Conversion) Project where located at KPAT Terminal, Leamchaebang, Chonburi, Thailand.

"Project Scope" means without limitation of the execution of all Works and all services to be performed by the Contractor under this Contract.

"Safety Regulations" has the meaning given to it in Clause 3.5(a).

"Schedule of Payments" has the details given to it under Part E.

"Specification and Technical Documents" means each of the specification and technical documents set out in Contract Requisition listed in Part C of this Contract.

"Variation Order" has the meaning given to it in Clause 10.1.

"Works" means the scope of works set out in Contracts Requisition listed in Part C of this Contract.

"Works Schedule" means the schedule to complete the Works as set out in Appendix 1.

1.2 Headings and Title

The headings and titles in this Contract shall not be deemed part thereof or be taken into consideration in the interpretation or construction of the Contract.

1.3 Interpretation

1.3.1 Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

1.3.2 Words importing the singular only also include the plural and vice versa where the context requires.

1.3.3 References herein to Clauses and Appendices shall be deemed references to Clauses and Appendices to this Contract (unless it appears otherwise from the context).

1.3.4 References to the words "include" or "including" shall be deemed to be followed by "without limitation" or "but not limited to," whether or not they are followed by such phrases or words of similar import.

2. THE OWNER

2.1 Access to and Possession of the Site

The Owner shall, as to be mutually agreed between the Parties, grant the Contractor access to the Site. A temporary work area will be allocated within the Site for temporary laydown, storage and/or fabrication (as the case may be) with an entrance independent of the main Site entrance ("Work Area").

2.2 Owner's Right of Access

Owner and its authorized representatives reserve the right to access and inspect the Works being performed whenever and wherever they are being performed, including but not limited to the premises of the Contractor or Contractor's sub-contractor's premises. Contractor shall procure that that Owner has access to Contractor's sub-contractor's premises.

2.3 Notice to Proceed

The Owner shall issue a Notice to Proceed to the Contractor, which authorises the commencement of all Works under the Contract. The Contractor shall commence performance of the Works on the date which the Owner specifies (the "Commencement Date") in the Notice to Proceed.

2.4 Conditions Precedent

The obligations of the Parties to perform their obligations hereunder shall be subject to the satisfaction by the Owner of the following conditions:

- (a) Conditions of Contract Clauses 1. to 20. inclusive.
- (b) Minutes of meetings of commercial and technical clarifications
- (c) Contract Requisition listed in Part C of this Contract

If there is any inconsistency between the Conditions of Contract and the Appendix, the text of the Conditions of Contract shall take precedence over the Appendix unless the text expressly indicates otherwise. Contractor shall immediately refer to Owner for clarification of any such inconsistency. Any matter set forth in one portion of the Contract but omitted from another portion shall be treated as though set forth in both the portions.

2.5 Provision of Electricity

- (a) Subject to Clause 2.5(b), Contractor shall provide its own electricity supply for carrying out the Works at the Site and/or Work Area.
- (b) Owner will provide, free of charge, electricity for use of the office facility at the Site.

2.6 Delegation to Owner's Engineer

Notwithstanding anything to the contrary in this Contract, the Owner shall have the right to delegate responsibility for matters related to the Works to the Owner's Engineer provided that Owner continues to be liable to honor its obligations in accordance with the Contract.

3. OBLIGATIONS AND REPRESENTATIONS AND WARRANTIES OF THE CONTRACTOR

3.1 General Obligations and Representations and Warranties

The Contractor represents and warrants that it shall carry out the Works:

- (a) using skill, care and diligence to be expected of appropriately qualified and experienced professional designers, engineers and constructors with experience in works of a type, nature and complexity similar to the Works in accordance with generally accepted standards and professional engineering practice incorporating satisfactory quality assurance procedures which conforms with the Invitation to Tender and shall provide all necessary Contractor's Equipment and labour;
- (b) in a workmanlike and professional manner in accordance with prudent industry practices, modern engineering design, project management and supervisory principles and practices and in accordance with the standards to be expected from leading international contractors with experience in similar projects using similar technology and of a similar size, scope and complexity to the Project;
- (c) manufacture and fabricate consistent with prudent industry practices and in accordance with the standards and codes of practice specified or referred to in the Contract, and where no such standards and codes are specified, to the standards consistently employed in projects of a similar size, scope and complexity to the Project by leading international contractors;
- (d) so that upon completion and in accordance with the Contract, satisfy the performance criteria set out in the Contract unless otherwise agreed in writing by the Owner;
- (e) so as to comply at all times with all laws and licenses, permits, approvals of any governmental authority having jurisdiction over the matter in question.

The Contractor represents that it has the required skill and capacity as a professional in the business to perform the Works in the manner described in the Contract. The Contractor further represents and warrants that all the Works will be free from all defects in design, workmanship and material in accordance with the Invitation to Tender during the Defects Liability Period. This warranty does not cover improper use or maintenance.

3.2 Bank Guarantee

The Contractor shall provide a bank guarantee in favour on the Owner not later than 14 days from the date of this Contract in substantially the same form as set out in the Invitation to Tender ("Bank Guarantee"). The Bank Guarantee shall be in an amount equal to 10% of the awarded Contract Price and must remain valid for the duration of the Contract until finish of Defects Liability Period.

3.3 Contractor's Representative

- (a) The Contractor shall employ one or more competent representatives acceptable to the Owner to superintend the carrying out of the Works. They shall be fluent in the English

language for day to day communications. Their names and qualifications shall be communicated in writing to the Owner.

- (b) Any instruction or notice which the Owner gives to the Contractor's representatives mentioned in Clause 3.3 (a) above shall be deemed to have been given to the Contractor.
- (c) Any decision, advice or instruction given by the Contractor's representative mentioned in Clause 3.3 (a) above to the Owner shall have the same effect as though it had been given by the Contractor.
- (d) Any appointment or removal of the Contractor's representatives shall be in writing and shall not take effect until a copy thereof has been delivered by the Contractor to the Owner.

3.4 Contractor's Equipment

- (a) The Contractor shall provide all Contractor's Equipment necessary to complete the Works.
- (b) All Contractor's Equipment shall, when brought on to the Site and/or Work Area, be deemed to be exclusively intended for the execution of the Works. At its sole discretion, the Contractor shall be allowed to remove from, or bring back to, the Site and/or work Area any such equipment, as appropriate and necessary, for the completion of the Works.
- (c) The Contractor shall provide suitable and safe storage and protection for Owner's Equipment under the care and control of the Contractor and at no additional costs to the Owner. Any unaccounted variations in inventory quantities of Owner's equipment under the care and control Contractor shall be remedied by the Contractor at no cost to Owner.

3.5 Safety Precautions

- (a) The Contractor at all times shall fully comply and observe the Owner's safety, health and environmental regulations including those that may be amended from time to time by the Owner ("Safety Regulations") and Thai laws and regulations regarding safety on the Site as they relate to the construction, installation, testing and commissioning of the Works to be delivered by the Contractor. For the avoidance of doubt, the initial Safety Regulations are provided in the Invitation to Tender.
- (b) The Contractor acknowledges that it has been provided with a copy of the Safety Regulations and it has read and understands the Safety Regulations.
- (c) The Contractor shall take all reasonable measures in consultation with the Owner to protect the safety of all persons (including, without limitation, vendors' and subcontractors' employees, servants, agents, suppliers and invitees) who at the Contractor's or Owner's request come into the Site and/or Work Area.

3.6 Owner's Equipment

Except for the free issue materials set out in the Invitation to Tender ("Owner's Equipment"), there is no Owner's equipment available for use by the Contractor.

3.7 Clearance of Site

The Contractor shall from time to time during the progress of the Works clear away and remove all surplus materials and rubbish provided that it was brought onto Site and/or Work Area or

generated by the Contractor. On completion of the Works, the Contractor shall remove all Contractor's Equipment, all surplus materials, rubbish, and waste from the Site and/or Work Area.

3.8 Compliance with Laws and Regulations

The Contractor shall, at all times and in all matters arising in the performance of the Contract, observe and fully comply in all respects with, and give all notices required by the provisions of any law or regulation, of any duly constituted authority. The Contractor shall protect and indemnify the Owner and the Owner's directors, officers and agents against any claim or liability arising from or based on violation of any law or regulations imposed on the Contractor in relation to the Works.

3.9 Licenses and Permits

The Contractor shall, on behalf of the Owner, obtain any licenses or permits required to perform the Works at the Site and/or Work Area.

3.10 Coordination Meetings

Contractor shall attend, as required by the Owner, coordination meetings with Owner from time to time.

4. DESIGN

4.1 Specification and Technical Documents

The Parties agree that the Specification and Technical Documents are agreed by the Parties and the Works shall be in accordance with the Specification and Technical Documents unless otherwise agreed in writing by both Parties.

5. LABOR

5.1 Engagement of Labour

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all labour including payment of remuneration and any amounts required under law.

5.2 Sub-contractors

The Contractor may appoint sub-contractors to provide services to Contractor however before such appointments are made; Contractor must obtain the prior written consent of the Owner. The Contractor agrees that in the event of sub-contract, the Contractor shall not be released from any and all obligations, responsibilities, and liabilities under this Contract.

5.3 Labour Law

The Contractor shall at all times observe and fully comply with all applicable Thai labor law and all rules and regulations issued pursuant thereto and government rules.

6. WORKMANSHIP AND MATERIALS

6.1 Manner of Execution

All Works to be done by or on behalf of the Contractor and the Contractor's sub-contractors shall be executed in the manner and in accordance with the Contract. Where the manner of

fabrication and execution is not set out in the Contract, the work shall be executed in a proper and workmanlike manner in accordance with recognised international industry practice.

6.2 Independent Inspection

The Owner shall have the right to inspect all aspects of the Works at any reasonable time. The Owner shall have the right to delegate any inspection of the Works to the Owner's Engineer.

7. PROGRAMME

7.1 Time for Completion

The Contractor shall complete the Works in accordance with the Works Schedule and in any case no later than the Completion Date.

7.2 Claims for Extension of Time for Completion

The Contractor may claim an extension to the Completion Date if:

- (a) Owner fails to provide the Owner's Equipment;
- (b) the Owner's Default under Clause 13.1; or
- (c) Force Majeure.

The Contractor shall give to the Owner notice of his intention to make a claim for an extension of time within 10 days from the date such circumstances becoming known to the Contractor. The notice shall be followed as soon as possible by the claim with full supporting details.

The Owner shall, after due consultation with the Contractor and in the Owner's own discretion which shall not be unreasonably withheld or delayed, grant the Contractor from time to time, either prospectively or retrospectively, such extension to the Completion Date as may be justified. The Owner shall notify the Contractor accordingly.

7.3 Delay in Completion

If the Contractor fails to complete the Works by the Completion Date, the Contractor shall pay delay liquidated damages of point one percent (0.1%) per day of the Contract Price with a maximum Delay Liquidated Damages of ten percent (10%) of the Contract Price ("Delay Liquidated Damages").

7.4 Order to Suspend

Provided there is a reasonable ground, including the movement of fuel in to or out of tanks or any time there is a hazardous atmosphere at the Site and/or the Work Area, the Owner may at any time instruct the Contractor to suspend progress of the Works. The Contractor agrees it shall have no right to make any claim for additional compensation or otherwise for such suspension of the Works.

7.5 Resumption of Work

Permission or instruction to proceed after Works have been suspended shall be given, in writing, by Owner to Contractor.

8. TESTS ON WORKS

8.1 Tests

Testing of the Works shall be done in accordance with Contracts Requisition listed in Part C of the Contract.

9. DEFECTS AFTER TAKING OVER

9.1 Making Good Defects

The Contractor shall be responsible for making good any defect in or damage to any part of the Works which may appear or occur during the Defects Liability Period and which arises from, either:

- (a) any defective materials, workmanship or design, or
- (b) any act or omission of the Contractor during the Defects Liability Period.

The Contractor shall make good the defect or damage without reasonable delay and at the Contractor's own cost and expenses.

9.2 Notice of Defects

If any such defect appears or damage occurs, the Owner shall deliver a notice in writing to the Contractor and the Owner may fix a reasonable time for remedying the defect or damage.

9.3 Failure to Remedy Defects

If the Contractor fails to remedy the defect or damage within the time fixed by Owner, the Owner may carry out the work himself or by others at the Contractor's risk, costs and expenses, provided that he does so in his reasonable manner. The costs properly incurred by the Owner in remedying the defect or damage shall be deducted from the Contract Price, but the Contractor shall have no responsibility for such work or (ii) if the Owner has paid to the Contractor the Contract Price in full, claim against the Contractor for such costs and the Contractor shall reimburse such costs within 7 days.

9.4 Removal of Defective Work

If the defect or damage is such that repairs cannot be expeditiously carried out on the Site and/or Work Area, the Contractor may with the consent of the Owner remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

10. VARIATIONS

10.1 Owner's Right to Vary

The Owner may by variation order to the Contractor at any time before the Works are taken over and Completion occurs, instruct the Contractor to alter, amend, omit, add to or otherwise vary any of the Works ("Variation Order").

The Contractor shall not vary or alter any of the Works or any part of the Works, except in accordance with a Variation Order from the Owner. The Contractor may, however, at any time propose variations of the Works to the Owner.

10.2 Variation Order Procedure

Prior to any Variation Order under Clause 10 the Owner shall notify the Contractor of the nature and form of such variation.

As soon as possible after having received such notice, the Contractor shall submit to the Owner:

- (a) a description of work, if any, to be performed in respect to the envisaged variation and a programme for its execution; and
- (b) the Contractor's proposals for any necessary modifications to the Programme according to Clause 7.1 or to any of the Contractor's obligations under the Contract; and
- (c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission the Owner shall, after due consultation with the Contractor, decide as soon as possible whether or not the variation shall be carried out.

If the Owner decides that the variation shall be carried out, he shall issue a Variation Order clearly identified as such in accordance with the Owner's submission or as modified by agreement.

10.3 Disagreement on the Adjustment of the Contract Price

If the Contractor and the Owner are unable to agree on the adjustment of the Contract Price, the dispute shall be resolved in accordance with Clause 16. Due account shall be taken of any over- or under-recovery of overheads by the Contractor in consequence of the variation. Furthermore, the following shall be taken into consideration in the adjustment of the Contract Price:

- (a) the reasonable cost of any partial execution of the Works rendered useless by any such variation, and
- (b) the reasonable cost of making necessary alterations to Works already manufactured or in the course of manufacture or of any Works done that have to be altered in consequence of such a variation; and
- (c) any additional reasonable costs incurred by the Contractor by the disruption of the progress of the Works as detailed in the Programme.

10.4 Contractor to Proceed

On receipt of a Variation Order, the Contractor shall forthwith proceed to carry out the variation and be bound to these Conditions in so doing as if such variation was stated in the Contract.

The Works shall not be delayed pending the granting of an extension of the Time for Completion.

10.5 Records of Cost

In any case where the Contractor is instructed to proceed with a Variation Order prior to the determination of the adjustment to the Contract Price in respect thereof, the Contractor shall keep records of the cost of undertaking the Variation Order and of time expended thereon. Such records shall be open to inspection and verification by the Owner at all reasonable times.

11. CONTRACT PRICE AND PAYMENT

11.1 Lump Sum Price (Contract Price)

The descriptions of items given in the Schedule of Rates and Prices are for guidance only. It is the Contractor's sole responsibility to determine the exact nature and extent of the Works to be

performed under the Contract. No claim or the Contract Price adjustment arising as the result of the Contractor's failure in this respect will be considered.

The quantities of the performed works set out in the Schedule of Rates and Prices are the estimated quantities of the work and are not intended to be taken as the actual and correct quantities of the Works to be executed by the Contractor under the Contract. The Contractor shall calculate the value of the work for which it considers that it is entitled to submit an application for progress payment and the final account by measure or re-measure in accordance with the Contract for the Owner review and approval.

11.2 Terms of Payment

Payment shall be made according to Payment Milestones of this Contract as set out in Appendix 2

Owner shall have the right to withhold from any payment due to the Contractor, including the final payment of the Lump Sum Price, such amounts as the Owner deems necessary or appropriate to protect it from liability because of any one or more of the following reasons:

- (i) defects and deficiencies in any Work, whether or not payment has been made therefor;
- (ii) either the filing of third-party claims or liens for which the Contractor is liable, or reasonable evidence indicating probable filing of such claims;
- (iii) a dispute as to the accuracy or completeness of any request for payment;
- (iv) the Contractor's failure in any material respect to carry out the Works or perform any of its obligations under this Contract; and
- (v) any withholding tax required by law.

11.3 Method of Application

The Contractor shall submit applications for interim payments for the Owner approval at intervals of not less than a calendar month. The applications shall be in the form of statements showing:

- (a) Any entitlement for payment of part of the Contract Price relating to any designated Milestone achieved during the period for which the statement is issued, together with the amount of any lump sum or other scheduled payment as may be due under Milestones achieved during said period;
- (b) The amount to which the Contractor, by way of Variation Order, considers itself entitled to in connection with all other matters (including, but not limited to, any items to be the subject of fixed unit rates or cost reimbursement) for which provision is made under the Contract.

When the Owner has verified the amount of an application and statement submitted, but in no event later than thirty (30) days after he received the application and progress statement, the Owner shall certify and notify the Contractor of the amount certified and the basis upon which the amount has been calculated by way of a payment certificate issued by the Owner.

11.4 Payment

The Owner shall pay the amount certified within thirty (30) days from the date of receipt of correct invoice and confirmation from both Parties that the relevant Milestone was achieved.

Payment shall be made by wire transfer or by account payee cheque to:

Bank: : To be confirmed
Branch : To be confirmed
Account Name : Chart Kanchang Lachchabaug Co., Ltd.
Account Number : To be confirmed

12. TERMINATION BY OWNER

12.1 Notice of Default

In respect of the Project, if the Contractor is not executing the Works in accordance with the Contract or is neglecting to perform his obligations, the Owner may give notice to the Contractor requiring him to make good such failure or neglect within a specified period which shall not be unreasonable taking into account the circumstances.

12.2 Contractor's Default

Subject to any other provision of the Contract allowing termination by the Contractor, in the event that the Contractor:

- (a) has failed to comply within the time specified in a notice under Clause 12.1; or
- (b) assigns the Works without the Owner's written consent; or
- (c) commits any breach of or fails to comply with or observe the provisions of this Contract or any of them; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him or compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors (including, if a so-called "provisional administrator" is appointed over the assets of the Contractor) or goes into liquidation;

the Owner may, at its absolute discretion choose to:

- (i) upon fourteen (14) days written notice (save for (d) above which shall not require notice) to the Contractor at its absolute discretion choose to:
 - (A) postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory assurances have been provided by the Contractor;
 - (B) take the whole or part of the Works out of the Contractor's hands and take such measures as are reasonably required by the Owner to facilitate the taking out, including making such deductions from payments otherwise due to the Contractor as reflects the works taken out; or
- (ii) give the Contractor written notice that:
 - (A) the Contractor has committed an act or omission constituting a Contractor's default;
 - (B) the Owner intends to terminate the Contract at the end of the period given by the Owner in the notice;
 - (C) the Contractor is to remedy such default within the period given pursuant to (B) above; and

- (D) If the Contractor does not remedy the default within the period given, the Owner will terminate the Contract without having to require any consent from any Court of authority.

The period allowed for remedial action under Clause 12.2(ii) above shall be no less than seven (7) days, except in case of Clause 12.2 (d) where no such remedy period is required.

Any such expulsion and termination shall be without prejudice to any other rights or powers of the Owner or the Contractor under the Contract.

The Owner may upon such termination complete the Works himself or engage any other contractor to complete the Works.

Notwithstanding anything to the contrary herein, unless otherwise agreed between the parties hereto, this Contract shall be deemed automatically terminated if and when the Contract is terminated for any reason, in which event the Owner's liability towards the Contractor shall only be the payment to the Contractor of the value of the work done by the Contractor up to the time of the said termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

The Contractor shall be liable to the Owner for all damages under the terms of this Contract and otherwise, including increased construction costs and increased administrative costs, suffered by the Owner as a result of the Contractor's default. All such damages may be recovered by the Owner from the Contractor in accordance with Clause (20.2) of this Contract or, without prejudice to that right, the Owner shall have the right to suspend payment under this Contract until the default has been rectified and have the right to deduct from any money due or becoming due to the Contractor under this Contract. The Owner may exercise any or all of the foregoing rights to the extent necessary to satisfy the full amount of any obligations of the Contractor, and if any balance remains owing to the Owner, it may be collected against the Contractor.

12.3 Payment after Termination

After termination under Clause 12.2 has taken effect, the Owner shall have the rights conferred by this Clause, namely, without prejudice to other rights or entitlements granted to it in the Contract:

- (a) the Owner shall not be liable to make any further payments to the Contractor until the Works have been completed, except any payments obligations arising prior to the date of termination under Clause 12.2, which shall be made in accordance with Clause 11.4.
- (b) When the Works are so complete, the Owner shall be entitled to recover from the Contractor the extra costs, if any, of completing the Works.

12.4 Cessation of Work and Removal of Contractor's Equipment

Upon termination of the Contract (whether by the Owner or the Contractor), the Contractor shall promptly:

- (a) cease all further work, except for such work as may have been instructed by the Owner or is necessary for the protection of life or property or for the safety of the Works;
- (b) procure the assignment of any subcontract as requested by the Owner;
- (c) hand over the Works to the extent that they have been executed at the date of termination to the Owner and/or any person designated by the Owner; and

- (d) remove all other goods from the Site and/or Work Area, except as necessary for safety, and leave the Work Area and Site.

13. SUSPENSION AND TERMINATION BY CONTRACTOR

13.1 Owner's Default

In case the Owner:

- (a) subject to Clause 11.4, fails to pay the Contractor the amount due under any payment certificate within 30 days after the amount became payable; or
- (b) fails to cause to issue any certificate of the Owner as required hereunder; or
- (c) fails to give permission to proceed in the event of a suspension that affects the whole of the Works under Clause 7.5; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes in to liquidation; or
- (e) consistently fails to meet his material obligations hereunder,

("Owner Default"),

the Contractor may, at its absolute discretion choose to:

- (i) give thirty (30) days written notice to the Owner that the Contractor will postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory payment security is established covering the outstanding part of the Lump Sum Price, and/or
- (ii) give the Owner written notice that:
 - (A) the Owner has committed an act or omission constituting an Owners default;
 - (B) the Contractor intends to terminate the Contract at the end of the period given by the Contractor in the notice;
 - (C) the Owner is to remedy such default within the period given pursuant to (B) above; and
 - (D) if the Owner does not remedy the default within the period given, the Contractor will terminate the Contract without having to require any consent from any Court of authority.

The period allowed for remedial action shall be no less than 21 days.

Any such termination shall be without prejudice to any other rights of the Contractor or the Owner under the Contract.

13.2 Removal of Contractor's Equipment

Upon the termination, the Contractor shall be entitled to remove immediately all Contractor's Equipment which is on the Site and/or Work Area.

13.3 Payment on Termination for Owner's Default

In the event of termination the Owner shall pay the Contractor for the value of the Works completed at the time of termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

14. RISK AND RESPONSIBILITY

14.1 General Indemnity

The Contractor hereby warrants and represents that it holds and/or has received all the necessary licences and consents which are required from any licensor and any other person in connection with the design, construction, operation and maintenance of the Works, and the Contractor shall hold harmless and indemnify the Owner, its directors and employees from and against all claims losses, liabilities, expenses, charges, liens and other obligations whatsoever in connection with this Contract and from and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto provided that the claim or proceedings arise out of the design, construction, manufacture or use of the Works.

14.2 Claims

The Contractor shall be promptly notified of any claim under this Clause made against the Owner. The Contractor together with the Owner may at his own cost conduct negotiations for the settlement of such claim, and any litigation that may arise there from.

The Owner shall not make any admission, which might be prejudicial to the Contractor unless the Contractor has failed to take over the conduct of the negotiations or litigation within a reasonable time after having been so requested.

The Contractor may conduct such negotiations or litigation referred to above on the condition that he shall provide the Owner such reasonable security as the Owner may require as quickly as reasonably possible. The security shall be for an amount which is an assessment of the compensation, damages, expenses and costs for which the Owner and/or the Owner may become liable and which are the subject of the indemnity under Clause 14.1.

The Owner shall, at the request of the Contractor, provide all available assistance for the purpose of contesting any such claim or action, and shall be repaid all reasonable costs incurred in so doing.

14.3 Contractor's Liability

The Contractor shall, until the end of the Defects Liability Period or any extended period of Defects Liability Period, defend, indemnify, be liable for and hold harmless to the Owner against all losses, expenses (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) and claims, including (without limitation) any claims in respect of any loss of or damage to physical property (other than the Works), death or personal injury, arising out of or resulting from or occurring to the extent caused by:

- defective design, material or workmanship of the Contractor;
- negligence or breach of statutory or contractual duty of the Contractor, or its respective employees, advisors, consultants and agents; or
- the performance by the Contractor under the Contract, any subcontractor, any person or organization directly or indirectly employed by any of them regardless of the negligence of any such party,

save for loss or damage arising through the Owner's gross negligence or wilful default.

14.4 Accidents

The Contractor shall be liable for and shall indemnify the Owner against all losses, expenses or claims arising in connection with the death of or injury to any person employed by the Contractor for the purposes of the Works, unless caused by the gross negligence or wilful default of the Owner or other contractors engaged by the Owner or by their respective employees or agents.

14.5 Liability for Indirect Damages

Neither party shall be liable to the other for any loss of profit, loss of use, loss of production, loss of data, loss of financing costs, loss of contracts or for any other indirect damage that may be suffered by the other, except as expressly provided in this Contract.

14.6 Liability after Expiration of Defects Liability Period

Except as otherwise set forth herein, the Contractor shall have no liability to the Owner for any loss of or damage to the Works or the Project which occurs after the expiration of the Defects Liability Period, unless caused by gross negligence or wilful default of the Contractor.

14.7 Mitigation of Loss or Damage

In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage which has occurred or may occur.

14.8 Insurances

Without limiting or reducing Contractor's liability and responsibility hereunder, Contractor shall procure and maintain, at its own cost and expense and through first class insurers acceptable to the Owner, during performance of the Works and shall ensure that any subcontractors do likewise, the following insurance applicable to its activities with respect to and for the duration of the Contract:

- Comprehensive General Third Party Liability Insurance in the amount of one million US Dollars (1,000,000 USD.) for any one claim and without limit to the number of claims in respect of any bodily and/or personal injury including death and property damage or destruction of any person or property which shall arise out of or in consequence of Consultant's performance of the Services. Such policy shall include Contractual Liability cover and a cross liability provision.
- Such Employer's Liability, Workmen's Compensation Insurance or similar cover which the Consultant is statutorily required to effect with respect to its personnel
- Any other insurance which may be relevant and/or necessary and/or may be required by law.

All insurance policies shall be endorsed to provide the Employer with not less than thirty (30) days notice of any cancellation or material amendment thereof.

The Consultant shall provide Owner with such evidence of its insurance coverage as the Owner may reasonably require.

Should Contractor at any time neglect or refuse to provide or renew any insurance required herein, or should any insurance be cancelled, Owner shall have the right to procure such

insurance at the Contractor's cost. Owner shall be entitled to deduct such sums from any monies due or which may become due to Contractor in addition to any other remedies Owner may have under the Contract

15. FORCE MAJEURE

15.1 Definition of Force Majeure

Force Majeure means any circumstances which are unforeseeable and beyond the control of the Contractor or of the Owner upon due care and diligent performance, including but not limited to:

- (a) war and other hostilities (whether war be declared or not), invasion, act of foreign enemies, mobilisation, requisition or embargo;
- (c) rebellion, terrorism, revolution, insurrection, military or usurped power, civil war, and civil unrest;
- (d) closure of ports, suspension of government services, breakdown of communications, riot, commotion, disorder, strike, lockout and other industrial action, except where this involves any personnel and other employees of the Contractor, other than as a part of a nationwide industrial action; and/or
- (f) natural catastrophes including, without limitation, flood, fire and earthquakes.

The burden of proof as to whether a Force Majeure event has occurred and whether the Force Majeure event excuses the party from performance shall be upon the party claiming such Force Majeure event.

15.2 Effect of Force Majeure

Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligations is prevented by any circumstances of Force Majeure which arise after the Commencement Date.

15.3 Notice of Occurrence

If either party considers that any circumstances of Force Majeure have occurred which may affect performance of his obligations he shall promptly notify the other party of the event or circumstances constituting the Force Majeure and shall to the extent possible specify the obligations, the performance of which is or will be prevented.

15.4 Performance to Continue

Upon the occurrence of any circumstances of Force Majeure, the Contractor shall use his best endeavour to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify the Owner of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure. However, the Contractor shall not take any such steps unless the Owner has approved the Contractor's proposed steps and reasonable remedy or remedies (if necessary); provided, that the Owner shall respond to the proposed steps and reasonable remedy or remedies within 72 hours. Such 72 hours may be extended by the Owner if the Owner requires additional time to consider the proposal of the Contractor. If the Owner has not responded within 72 hours, Owner shall be deemed to have approved and directed such steps

15.5 Damage caused by Force Majeure

If in consequence of Force Majeure the Works shall suffer loss or damage the Contractor shall be entitled to be paid for the value of the work done at that time, without regard to the loss or damage that has occurred but only to the extent such loss or damage has not been compensated by insurance proceeds.

15.6 Termination in Consequence of Force Majeure

If circumstances of Force Majeure have occurred and shall continue for a cumulative period of 90 days then, notwithstanding that the Contractor may by reason thereof have been granted an extension to complete the Works, either party shall be entitled to serve upon the other 21 days' notice to terminate the Contract. If at the expiry of the period of 21 days Force Majeure shall still continue the Contract shall terminate, otherwise the Contract shall continue to be in force and effect.

15.7 Payment on Termination for Force Majeure

If the Contract is terminated under Clause 15.6 the Contractor shall be paid the value of the Work done at that time. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

15.8 Release from Performance

If circumstances of Force Majeure occur and in consequence thereof under the law governing the Contract the parties are released from further performance of the Contract, the sum payable by the Owner to the Contractor shall be the same as that which would have been payable under Clause 15.7 if the Contract had been terminated under Clause 15.6.

15.9 Force Majeure Affecting Owner's Duties

The provisions of Clause 19 shall also apply in circumstances where the Owner is prevented from performing any of his duties under the Contract including (without limitation) the duty to make payment to the Contractor under the Contract by reason of Force Majeure; provided, however, subject to the foregoing, any payments due to the Contractor in accordance with Clause 15.7 shall be paid by the Owner in accordance with the provisions set forth in Clause 11.

16. DISPUTES AND ARBITRATION

16.1 Arbitration

Any dispute arising out of or in connection with this Contract, including any question regarding its existence, validity or termination, shall be referred to and finally resolved by arbitration in Thailand in accordance with the Arbitration rules of the Thai Arbitration Institute, the Ministry of Justice ("TAI Rules") for the time being in force, which rules are deemed to be incorporated by reference in this clause.

The Tribunal shall consist of three arbitrators to be appointed in accordance to the TAI Rules. The place of arbitration shall be Thailand.

The language of the arbitration shall be English.

16.2 Work to Continue

Performance of the Contract shall continue during arbitration proceedings unless the Owner shall order suspension. If any such suspension is ordered the reasonable costs incurred by the

Contractor and occasioned thereby shall be approved by the Owner (acting reasonably) and added to the Contract Price.

Except as otherwise set forth herein, no payments due or payable by the Owner shall be withheld on account of pending reference to arbitration.

17. CHANGE OF CONTROL

Notwithstanding any provisions to the contrary in this Agreement, Owner has the right to terminate this Contract, effective immediately, at any time and without prior notice or compensation in lieu thereof nor any goodwill indemnity by sending a fax and a letter to Contractor in the event there is a change in control of Contractor.

Change of control means the sale of all or substantially all the assets of Contractor; any merger, consolidation or acquisition of Contractor with, by or into another corporation, entity or person; or any change in the ownership of more than fifty percent (50%) of the voting capital stock of Contractor in one or more related transactions.

18. NOTICES

Any notice, request or other communication required hereunder shall be deemed to have been duly given or made when it shall be in writing and delivered by hand or facsimile or by registered mail, addressed as follows:

If to Contractor,

Chart Kanchang Laemchabang Co., Ltd.
101/1 Moo 9, Tungaukhla, Sriracha
Chonburi 20230 THAILAND
Tel: +66 (0) 3849 0777 - 9.
Fax: +66 (0) 3849 4340
Attention: Weerapon O-Charot, General Manager

If to Owner,

Floor 29, Exchange Tower,
388 Rachadapisek Road, Klongtoey, Sukhumvit Road
Bangkok 10110 THAILAND
Tel: +66 2 1049244
Fax: +66 2 1049101

19. CONTACT LIST

Any correspondence not required to be given under Clause 18 shall be given by email and sent to the contact list set out in Appendix 5.

20. GENERAL

20.1 Assignment

Neither Party may assign its rights or obligations under this Contract without the prior written consent of the other Party.

20.2 Documents Mutually Explanatory

The Contract shall be taken as mutually explanatory. Any ambiguities or discrepancies shall be resolved amicably by both Parties.

20.3 Inconsistency

In case of any inconsistency between the terms of the Contract, the Invitation to Tender and Specification and Technical Documents, the terms of the Invitation to Tender and Specification and Technical Documents shall prevail.

20.4 Applicable Law

The interpretation and the construction of this Contract, and all matters relating hereto, shall be governed by the laws of Thailand.

20.5 Third Parties

Notwithstanding any other provision of this Contract, nothing in this Contract is intended to confer and nothing purports to confer any right to enforce any of its terms on any person who is not a party to it.

20.6 Waivers

No failure or delay by any party to exercise any right, power or remedy will operate as a waiver of it nor will any partial exercise preclude any further exercise of the same, or of some other right, power or remedy, other than expressly stated in this Contract.

20.7 Amendment

No amendment or waiver of any provision of this Contract, or consent to any departure therefrom, shall be effective unless in writing and signed or consented to (in writing) by the Parties, and then such waiver or consent shall be effective only in the specific instance and for the specific purpose for which given.

20.8 Unenforceability

Any provision of this Contract that is prohibited, unenforceable or not authorized in any one jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition, unenforceability or non-authorization without invalidating the remaining provisions of this Contract or affecting the validity, enforceability or authorization of such provision in any other jurisdiction.

20.9 Entire Agreement

This Contract, together with any other agreements, documents, or certificates to be executed by the Parties pursuant to this Agreement constitutes the entire agreement between the Parties with respect to the transactions contemplated hereby. All previous documents, undertakings, and agreements, whether oral, written or otherwise, between the Parties concerning the subject matter of this Contract are hereby cancelled and shall not affect or modify any of the terms or obligations set forth in this Contract.

20.10 Confidentiality

The Parties agree that this Contract shall be kept confidential and shall not be disclosed to any third party, except as such disclosure is required by an applicable law or regulation or by any governmental authority having jurisdiction over any of the Parties or such disclosure is made by any Party to their financial, legal or other professional advisors on a "need to know" basis.

In the event that a proper request is made for this Contract by any governmental authority, the Owner shall notify the Contractor of such request and the Owner and Contractor shall promptly meet to discuss an appropriate course of action provided, however, that nothing contained in this sub-clause shall obligate the Owner to violate any applicable law or refuse any properly presented request made by any governmental authority. If any Party discloses this Contract in violation of this sub-clause, it shall indemnify and hold the other Parties harmless from any present or future claim, liability, fine or penalty, including any claim for payment of additional taxes, in each case as a result of disclosure of this Contract. The restrictions contained in this Clause 20.10 shall survive the termination or expiry of this Contract.

20.11 Governing Law

This Contract shall be governed by and construed in accordance with the laws of Thailand.

IN WITNESS WHEREOF, the parties hereto, having read and understood the contents of this Contract, have caused this Contract to be signed in their respective names as well as affixed with the company's seal of (if any) as of the date first above written.

SIGNED for and on behalf of
Kawit Petroleum Aviation (Thailand) Ltd.

C. P. A. Jalelb.
By:

Title:

SIGNED for and on behalf of
Chart Karachang Laemchabang Co., Ltd.

W. O. Charat

By: Weerapong O-Charat,

Title: General Manager





AMBER (JP8 OPERATIONS CONVERSION) PROJECT

AT

KPAT TERMINAL, THAILAND

FW PROJECT NO. 23212

CONTRACT NO.: 003/23212

ELECTRICAL AND INSTRUMENT

CONTRACT DOCUMENT

HW

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AMBER PROJECT
CONTRACT NO.: 003/23212
ELECTRICAL AND INSTRUMENT WORKS
Kuwait Petroleum Aviation (Thailand) Ltd.

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Kuwait Petroleum Aviation (Thailand) Ltd.

- and -

T.S.Group Management Co., Ltd.

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This Contract is made on 24th August, 2017

Between

Kuwait Petroleum Aviation (Thailand) Ltd., whose registered office is Floor 10, Lake Rachada Office Complex, 19338 Rachadapisek Road, Klongtoey, Bangkok 10110, Thailand (the "Owner"); and

T.S. GROUP MANAGEMENT CO., LTD., a company duly registered and existing under the laws of Thailand, having its office located at 134/60 Soi Khubon 27 Subsoi 15 Khubon Road, Khwang Tharang, Khet Bangkhen Bangkok 10220, Thailand (hereinafter referred to as the "Contractor").

WHEREAS the Owner operates a fuel storage facility in Chonburi, Thailand (the "Site") that contains amongst others, eight above ground storage tanks.

WHEREAS the Owner wishes to employ the Contractor and the Contractor wishes to accept the employment, as an independent contractor, to furnish materials, equipment, plant machinery, consumables, labor skills, expertise and services necessary to the Works at the Owner's KRAT terminal.

The Parties agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them:

"ASME B31.3" means the American Society of Mechanical Engineers requirements for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals.

"ASME Section V" means the American Society of Mechanical Engineers

"Bank Guarantee" has the meaning given to it in Clause 3.2.

"Baht" means the lawful currency of Thailand.

"Business Day" means any day (excluding Saturday, Sunday and public holiday) which is a normal bank working day in Thailand.

"Commencement Date" means the date on which the Contractor is to commence the performance of the Works pursuant to Clause 2.3.

"Completion" means the date on which an acceptance certificate is issued by Owner to Contractor for satisfaction of Payment Milestones as set out in Appendix 2.

"Completion Date" means Refer to Part D, Section 4.2016 or such date that may be amended or extended in accordance with Clause 7 hereof.

"Contract" means the contract made between Owner and Contractor and comprises the documents stated in the terms and conditions to form the Contract including all appendices.

"Contract Price" means the meaning given to it under Clause 11.1.

"Contractor's Default" has the meaning given in Clause 12.2.

"Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works.

"Defects Liability Period" means the period of one (1) year following completion of the Works, during which the Contractor is responsible for making good defects and damage in accordance with Clause 9.

"Delay Liquidated Damages" has the meaning given in Clause 7.3.

"Force Majeure" has the meaning given in Clause 15.1.

"Invitation to Tender" means the invitation to tender including its addendums and clarifications provided to the Contractor and as is set out in (Appendix 3).

"Lump Sum Payment" means the meaning given to it under Clause 11, exclusive of value added tax to be paid in accordance with the Payment Milestones.

"Notice to Proceed" means the written notice to be issued by the Owner to the Contractor pursuant to Clause 2.2 specifying the Commencement Date.

"Owner's Technical" means KPIAC Technical Department.

"Parties" means the Owner and the Contractor and "Party" means any of them.

"Payment Milestones" means the schedule of payments, applicable milestones and conditions to be satisfied as set out in Appendix 2 that need to be met before Owner has an obligation to make such relevant payment of the Lump Sum Price.

"Project" means the AMBER (The KPAT JFS Operations Conversion) Project where located at Leamchabang, Chonburi, Thailand.

"Project Scope" means without limitation of the execution of all Works and all services to be performed by the Contractor under this Contract.

"Safety Regulations" has the meaning given to it in Clause 3.5(a).

"Schedule of Payments" has the details given to it under Part E.

"Specification and Technical Documents" means each of the specification and technical documents set out in Contract Requisition listed in Part C of this Contract.

"Variation Order" has the meaning given to it in Clause 10.1.

"Works" means the scope of works set out in Contracts Requisition listed in Part C of this Contract.

"Works Schedule" means the schedule to complete the Works as set out in Appendix 1.

1.2 Headings and Title

The headings and titles in this Contract shall not be deemed part thereof or be taken into consideration in the interpretation or construction of the Contract.

1.3 Interpretation

- 1.3.1 Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.
- 1.3.2 Words importing the singular only also include the plural and vice versa where the context requires.
- 1.3.3 References herein to Clauses and Appendices shall be deemed references to Clauses and Appendices to this Contract unless it appears otherwise from the context.
- 1.3.4 References to the words "include" or "including" shall be deemed to be followed by "without limitation" or "but not limited to," whether or not they are followed by such phrases or words of similar import.

2. THE OWNER

2.1 Access to and Possession of the Site

The Owner shall, as to be mutually agreed between the Parties, grant the Contractor access to the Site. A temporary work area will be allocated within the Site for temporary laydown, storage and/or fabrication (as the case may be) with an entrance independent of the main Site entrance (Work Area).

2.2 Owner's Right of Access

Owner and its authorized representatives reserve the right to access and inspect the Works being performed whenever and wherever they are being performed, including but not limited to the premises of the Contractor or Contractor's sub-contractors premises. Contractor shall procure that that Owner has access to Contractor's sub-contractors premises.

2.3 Notice to Proceed

The Owner shall issue a Notice to Proceed to the Contractor, which authorises the commencement of all Works under the Contract. The Contractor shall commence performance of the Works on the date which the Owner specifies (the "Commencement Date") in the Notice to Proceed.

2.4 Conditions Precedent

The obligations of the Parties to perform their obligations hereunder shall be subject to the satisfaction by the Owner of the following conditions:

- (a) Conditions of Contract Clauses 1 to 20, inclusive.
- (b) Minutes of meetings of commercial and technical clarifications
- (c) Contract Requisition listed in Part C of this Contract

If there is any inconsistency between the Conditions of Contract and the Appendix, the text of the Conditions of Contract shall take precedence over the Appendix unless the text expressly indicates otherwise. Contractor shall immediately refer to Owner for clarification of any such inconsistency. Any matter set forth in one portion of the Contract but omitted from another portion shall be treated as though set forth in both the portions.

2.5 Provision of Electricity

- (a) Contractor shall provide its own electricity supply for carrying out the Works at the Site and/or Work Area.
- (b) Not applicable

2.6 Delegation to Owner's Engineer

Notwithstanding anything to the contrary in this Contract, the Owner shall have the right to delegate responsibility for matters related to the Works to the Owner's Engineer provided that Owner continues to be liable to honor its obligations in accordance with the Contract.

3. OBLIGATIONS AND REPRESENTATIONS AND WARRANTIES OF THE CONTRACTOR

3.1 General Obligations and Representations and Warranties

The Contractor represents and warrants that it shall carry out the Works:

- (a) using skill, care and diligence to be expected of appropriately qualified and experienced professional designers, engineers and constructors with experience in works of a type, nature and complexity similar to the Works in accordance with generally accepted standards and professional engineering practice incorporating satisfactory quality assurance procedures which conforms with the Invitation to Tender and shall provide all necessary Contractor's Equipment and Labour;
- (b) in a workmanlike and professional manner in accordance with prudent industry practices, modern engineering design, project management and supervisory principles and practices and in accordance with the standards to be expected from leading international contractors with experience in similar projects using similar technology and of a similar size, scope and complexity to the Project;
- (c) manufacture and fabricate consistent with prudent industry practices and in accordance with the standards and codes of practice specified or referred to in the Contract, and where no such standards and codes are specified, to the standards consistently employed in projects of a similar size, scope and complexity to the Project by leading international contractors;
- (d) so that upon completion and in accordance with the Contract, satisfy the performance criteria set out in the Contract unless otherwise agreed in writing by the Owner;
- (e) so as to comply at all times with all laws and licenses, permits, approvals of any governmental authority having jurisdiction over the matter in question.

The Contractor represents that it has the required skill and capacity as a professional in the business to perform the Works in the manner described in the Contract. The Contractor further represents and warrants that all the Works will be free from all defects in design, workmanship and material in accordance with the Invitation to Tender during the Defects Liability Period. This warranty does not cover improper use or maintenance.

3.2 Bank Guarantee

The Contractor shall provide a bank guarantee in favour on the Owner not later than 14 days from the date of this Contract in substantially the same form as set out in the Invitation to Tender (Bank Guarantee). The Bank Guarantee shall be in an amount equal to 10% of the awarded Contract Price and must remain valid for the duration of the Contract until finish of Defects Liability Period

3.3 Contractor's Representative

- (a) The Contractor shall employ one or more competent representatives acceptable to the Owner to superintend the carrying out of the Works. They shall be fluent in the English language for day to day communications. Their names and qualifications shall be communicated in writing to the Owner.
- (b) Any instruction or notice which the Owner gives to the Contractor's representatives mentioned in Clause 3.3 (a) above shall be deemed to have been given to the Contractor.
- (c) Any decision, advice or instruction given by the Contractor's representative mentioned in Clause 3.3 (a) above to the Owner shall have the same effect as though it had been given by the Contractor.
- (d) Any appointment or removal of the Contractor's representatives shall be in writing and shall not take effect until a copy thereof has been delivered by the Contractor to the Owner.

3.4 Contractor's Equipment

- (a) The Contractor shall provide all Contractor's Equipment necessary to complete the Works.
- (b) All Contractor's Equipment shall, when brought on to the Site and/or Work Area, be deemed to be exclusively intended for the execution of the Works. At its sole discretion, the Contractor shall be allowed to remove from, or bring back to, the Site and/or Work Area any such equipment, as appropriate and necessary, for the completion of the Works.
- (c) The Contractor shall provide suitable and safe storage and protection for Owner's Equipment under the care and control of the Contractor and at no additional costs to the Owner. Any unaccounted variations in inventory quantities of Owner's equipment under the care and control Contractor shall be remedied by the Contractor at no cost to Owner.

3.5 Safety Precautions

- (a) The Contractor at all times shall fully comply and observe the Owner's safety, health and environmental regulations including those that may be amended from time to time

by the Owner (Safety Regulations) and Thai laws and regulations regarding safety on the Site as they relate to the construction, installation, testing and commissioning of the Works to be delivered by the Contractor. For the avoidance of doubt, the initial Safety Regulations are provided in the Invitation to Tender.

- (b) The Contractor acknowledges that it has been provided with a copy of the Safety Regulations and it has read and understands the Safety Regulations.
- (c) The Contractor shall take all reasonable measures in consultation with the Owner to protect the safety of all persons (including, without limitation, vendors' and subcontractors' employees, servants, agents, suppliers and invitees) who at the Contractor's or Owner's request come into the Site and/or Work Area.

3.6 Owner's Equipment

Except for the free issue materials set out in the Invitation to Tender (Owner's Equipment), there is no Owner's equipment available for use by the Contractor.

3.7 Clearance of Site

The Contractor shall from time to time during the progress of the Works clear away and remove all surplus materials and rubbish provided that it was brought onto Site and/or Work Area or generated by the Contractor. On completion of the Works, the Contractor shall remove all Contractor's Equipment, all surplus materials, rubbish, and waste from the Site and/or Work Area.

3.8 Compliance with Laws and Regulations

The Contractor shall, at all times and in all matters arising in the performance of the Contract, observe and fully comply in all respects with, and give all notices required by the provisions of any law or regulation, of any duly constituted authority. The Contractor shall protect and indemnify the Owner and the Owner's directors, officers and agents against any claim or liability arising from or based on violation of any law or regulations imposed on the Contractor in relation to the Works.

3.9 Licenses and Permits

The Contractor shall, on behalf of the Owner, obtain any licenses or permits required to perform the Works at the Site and/or Work Area.

3.10 Coordination Meetings

Contractor shall attend, as required by the Owner, coordination meetings with Owner from time to time.

4. DESIGN

4.1 Specification and Technical Documents

The Parties agree that the Specification and Technical Documents are agreed by the Parties and the Works shall be in accordance with the Specification and Technical Documents unless otherwise agreed in writing by both Parties.



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5. LABOR

5.1 Engagement of Labour

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all labour including payment of remuneration and any amounts required under law.

5.2 Sub-contractors

The Contractor may appoint sub-contractors to provide services to Contractor however before such appointments are made; Contractor must obtain the prior written consent of the Owner. The Contractor agrees that in the event of sub-contract, the Contractor shall not be released from any and all obligations, responsibilities, and liabilities under this Contract.

5.3 Labour Law

The Contractor shall at all times observe and fully comply with all applicable Thai labor law and all rules and regulations issued pursuant thereto and government rules.

6. WORKMANSHIP AND MATERIALS

6.1 Manner of Execution

All Works to be done by or on behalf of the Contractor and the Contractor's sub-contractors shall be executed in the manner and in accordance with the Contract. Where the manner of fabrication and execution is not set out in the Contract, the work shall be executed in a proper and workmanlike manner in accordance with recognised international industry practice.

6.2 Independent Inspection

The Owner shall have the right to inspect all aspects of the Works at any reasonable time. The Owner shall have the right to delegate any inspection of the Works to the Owner's Engineer.

7. PROGRAMME

7.1 Time for Completion

The Contractor shall complete the Works in accordance with the Works Schedule and in any case no later than the Completion Date.

7.2 Claims for Extension of Time for Completion

The Contractor may claim an extension to the Completion Date if:

- (a) Owner fails to provide the Owner's Equipment;
- (b) the Owner's Default under Clause 13.1; or
- (c) Force Majeure.

The Contractor shall give to the Owner notice of his intention to make a claim for an extension of time within 10 days from the date such circumstances becoming known to the Contractor. The notice shall be followed as soon as possible by the claim with full supporting details.

The Owner shall, after due consultation with the Contractor and in the Owner's own discretion which shall not be unreasonably withheld or delayed, grant the Contractor from time to time, either prospectively or retrospectively, such extension to the Completion Date as may be justified. The Owner shall notify the Contractor accordingly.

7.3 Delay in Completion

If the Contractor fails to complete the Works by the Completion Date, the Contractor shall pay delay liquidated damages of point one percent (0.1%) per day of the Contract Price with a maximum Delay Liquidated Damages of ten percent (10%) of the Contract Price. (Delay Liquidated Damages).

7.4 Order to Suspend

Provided there is a reasonable ground, including the movement of fuel in to or out of tanks or any time there is a hazardous atmosphere at the Site and/or the Work Area, the Owner may at any time instruct the Contractor to suspend progress of the Works. The Contractor agrees it shall have no right to make any claim for additional compensation or otherwise for such suspension of the Works.

7.5 Resumption of Work

Permission or instruction to proceed after Works have been suspended shall be given, in writing, by Owner to Contractor.

8. TESTS ON WORKS

8.1 Tests

Testing of the Works shall be done in accordance with Contracts Requisition listed in Part C of the Contract.

9. DEFECTS AFTER TAKING OVER

9.1 Making Good Defects

The Contractor shall be responsible for making good any defect in or damage to any part of the Works which may appear or occur during the Defects Liability Period and which arises from, either:

- (a) any defective materials, workmanship or design, or
- (b) any act or omission of the Contractor during the Defects Liability Period.

The Contractor shall make good the defect or damage without reasonable delay and at the Contractor's own cost and expenses.

9.2 Notice of Defects

If any such defect appears or damage occurs, the Owner shall deliver a notice in writing to the Contractor and the Owner may fix a reasonable time for remedying the defect or damage.

9.3 Failure to Remedy Defects

If the Contractor fails to remedy the defect or damage within the time fixed by Owner, the Owner may carry out the work himself or by others at the Contractor's risk, costs and expenses.

provided that he does so in his reasonable manner. The costs properly incurred by the Owner in remedying the defect or damage shall be deducted from the Contract Price, but the Contractor shall have no responsibility for such work or (ii) if the Owner has paid to the Contractor the Contract Price in full, claim against the Contractor for such costs and the Contractor shall reimburse such costs within 7 days.

9.4 Removal of Defective Work

If the defect or damage is such that repairs cannot be expeditiously carried out on the Site and/or Work Area, the Contractor may with the consent of the Owner remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

10. VARIATIONS

10.1 Owner's Right to Vary

The Owner may by variation order to the Contractor at any time before the Works are taken over and Completion occurs, instruct the Contractor to alter, amend, omit, add to or otherwise vary any of the Works (Variation Order).

The Contractor shall not vary or alter any of the Works or any part of the Works, except in accordance with a Variation Order from the Owner. The Contractor may, however, at any time propose variations of the Works to the Owner.

10.2 Variation Order Procedure

Prior to any Variation Order under Clause 10 the Owner shall notify the Contractor of the nature and form of such variation.

As soon as possible after having received such notice, the Contractor shall submit to the Owner:

- (a) a description of work, if any, to be performed in respect to the envisaged variation and a programme for its execution; and
- (b) the Contractor's proposals for any necessary modifications to the Programme according to Clause 7.1 or to any of the Contractor's obligations under the Contract; and
- (c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission the Owner shall, after due consultation with the Contractor, decide as soon as possible whether or not the variation shall be carried out.

If the Owner decides that the variation shall be carried out, he shall issue a Variation Order clearly identified as such in accordance with the Owner's submission or as modified by agreement.

10.5 Disagreement on the Adjustment of the Contract Price

If the Contractor and the Owner are unable to agree on the adjustment of the Contract Price, the dispute shall be resolved in accordance with Clause 16. Due account shall be taken of any over- or under-recovery of overheads by the Contractor in consequence of the variation. Furthermore, the following shall be taken into consideration in the adjustment of the Contract Price:

- (a) the reasonable cost of any partial execution of the Works rendered useless by any such variation; and
- (b) the reasonable cost of making necessary alterations to Works already manufactured or in the course of manufacture or of any Works done that have to be altered in consequence of such a variation; and
- (c) any additional reasonable costs incurred by the Contractor by the disruption of the progress of the Works as detailed in the Programme.

10.4 Contractor to Proceed

On receipt of a Variation Order, the Contractor shall forthwith proceed to carry out the variation and be bound to these Conditions in so doing as if such variation was stated in the Contract.

The Works shall not be delayed pending the granting of an extension of the Time for Completion.

10.5 Records of Cost

In any case where the Contractor is instructed to proceed with a Variation Order prior to the determination of the adjustment to the Contract Price in respect thereof, the Contractor shall keep records of the cost of undertaking the Variation Order and of time expended thereon. Such records shall be open to inspection and verification by the Owner at all reasonable times.

11. CONTRACT PRICE AND PAYMENT

11.1 Lump Sum Price (Contract Price)

The descriptions of items given in the Schedule of Rates and Prices are for guidance only. It is the Contractor's sole responsibility to determine the exact nature and extent of the Works to be performed under the Contract. No claim or the Contract Price adjustment arising as the result of the Contractor's failure in this respect will be considered.

The quantities of the performed works set out in the Schedule of Rates and Prices are the estimated quantities of the work and are not intended to be taken as the actual and correct quantities of the Works to be executed by the Contractor under the Contract. The Contractor shall calculate the value of the work for which it considers that it is entitled to submit an application for progress payment and the final account by measure or re-measure in accordance with the Contract for the Owner review and approval.

11.2 Terms of Payment

Payment shall be made according to Payment Milestones of this Contract as set out in Appendix 2

Owner shall have the right to withhold from any payment due to the Contractor, including the final payment of the Lump Sum Price, such amounts as the Owner deems necessary or appropriate to protect it from liability because of any one or more of the following reasons:

- (i) defects and deficiencies in any Work, whether or not payment has been made therefor;
- (ii) either the filing of third-party claims or liens for which the Contractor is liable or reasonable evidence indicating probable filing of such claims;

- (iii) a dispute as to the accuracy or completeness of any request for payment; and
- (iv) the Contractor's failure in any material respect to carry out the Works or perform any of its obligations under this Contract; and
- (v) any withholding tax required by law.

11.3 Method of Application

The Contractor shall submit applications for interim payments for the Owner approval at intervals of not less than a calendar month. The applications shall be in the form of statements showing:

- (a) Any entitlement for payment of part of the Contract Price relating to any designated Milestone achieved during the period for which the statement is issued, together with the amount of any lump sum or other scheduled payment as may be due under Milestones achieved during said period;
- (b) The amount to which the Contractor, by way of Variation Order, considers itself entitled to in connection with all other matters (including, but not limited to, any items to be the subject of fixed unit rates or cost reimbursement) for which provision is made under the Contract.

When the Owner has verified the amount of an application and statement submitted, but in no event later than thirty (30) days after he received the application and progress statement, the Owner shall certify and notify the Contractor of the amount certified and the basis upon which the amount has been calculated by way of a payment certificate issued by the Owner.

11.4 Payment

The Owner shall pay the amount certified within thirty (30) days from the date of receipt of correct invoice and confirmation from both Parties that the relevant Milestone was achieved.

Payment shall be made by wire transfer or by account payee cheque to:

Bank: : Bank of Ayudhya Public Company Limited,
 Branch : Ramintra K.M.8 Road, (025/0276)
 Account Name : T.S.Group Management Co., Ltd.
 Account Number : 276-1-16969-3, Saving

12. TERMINATION BY OWNER

12.1 Notice of Default

In respect of the Project, if the Contractor is not executing the Works in accordance with the Contract or is neglecting to perform his obligations, the Owner may give notice to the Contractor requiring him to make good such failure or neglect within a specified period which shall not be unreasonable taking into account the circumstances.

12.2 Contractor's Default

Subject to any other provision of the Contract allowing termination by the Contractor, in the event that the Contractor:

- (a) has failed to comply within the time specified in a notice under Clause 12.1; or
- (b) assigns the Works without the Owner's written consent; or
- (c) commits any breach of or fails to comply with or observe the provisions of this Contract or any of them; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him or compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors (including, if a so-called provisional administrator is appointed over the assets of the Contractor or goes into liquidation;

the Owner may, at its absolute discretion choose to:

- (i) upon fourteen (14) days written notice (save for (d) above which shall not require notice) to the Contractor at its absolute discretion choose to:
 - (A) postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory assurances have been provided by the Contractor;
 - (B) take the whole or part of the Works out of the Contractor's hands and take such measures as are reasonably required by the Owner to facilitate the taking out, including making such deductions from payments otherwise due to the Contractor as reflects the works taken out; or
- (ii) give the Contractor written notice that:
 - (A) the Contractor has committed an act or omission constituting a Contractor's default;
 - (B) the Owner intends to terminate the Contract at the end of the period given by the Owner in the notice;
 - (C) the Contractor is to remedy such default within the period given pursuant to (B) above; and
 - (D) if the Contractor does not remedy the default within the period given, the Owner will terminate the Contract without having to require any consent from any Court of Authority.

The period allowed for remedial action under Clause 12.2(ii) above shall be no less than seven (7) days, except in case of Clause 12.2 (d) where no such remedy period is required.

Any such expulsion and termination shall be without prejudice to any other rights or powers of the Owner or the Contractor under the Contract.

The Owner may upon such termination complete the Works himself or engage any other contractor to complete the Works.

Notwithstanding anything to the contrary herein, unless otherwise agreed between the parties hereto, this Contract shall be deemed automatically terminated if and when the Contract is terminated for any reason, in which event the Owner's liability towards the Contractor shall only be the payment to the Contractor of the value of the work done by the Contractor up to the time of the said termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

The Contractor shall be liable to the Owner for all damages under the terms of this Contract and otherwise, including increased construction costs and increased administrative costs, suffered by the Owner as a result of the Contractor's default. All such damages may be recovered by the Owner from the Contractor in accordance with Clause (20.2) of this Contract or, without prejudice to that right, the Owner shall have the right to suspend payment under this Contract until the default has been rectified and have the right to deduct from any money due or becoming due to the Contractor under this Contract. The Owner may exercise any or all of the foregoing rights to the extent necessary to satisfy the full amount of any obligations of the Contractor, and if any balance remains owing to the Owner, it may be collected against the Contractor.

12.3 Payment after Termination

After termination under Clause 12.2 has taken effect, the Owner shall have the rights conferred by this Clause namely, without prejudice to other rights or entitlements granted to it in the Contract:

- (a) the Owner shall not be liable to make any further payments to the Contractor until the Works have been completed, except any payments obligations arising prior to the date of termination under Clause 12.2, which shall be made in accordance with Clause 11.4.
- (b) When the Works are so complete, the Owner shall be entitled to recover from the Contractor the extra costs, if any, of completing the Works.

12.4 Cessation of Work and Removal of Contractor's Equipment

Upon termination of the Contract (whether by the Owner or the Contractor), the Contractor shall promptly:

- (a) cease all further work, except for such work as may have been instructed by the Owner or is necessary for the protection of life or property or for the safety of the Works;
- (b) procure the assignment of any subcontract as requested by the Owner;
- (c) hand over the Works to the extent that they have been executed at the date of termination to the Owner and/or any person designated by the Owner; and
- (d) remove all other goods from the Site and/or Work Area, except as necessary for safety, and leave the Work Area and Site.

13. SUSPENSION AND TERMINATION BY CONTRACTOR

13.1 Owner's Default

In case the Owner:

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- (a) subject to Clause 11.4, fails to pay the Contractor the amount due under any payment certificate within 30 days after the amount became payable; or
- (b) fails to cause to issue any certificate of the Owner as required hereunder; or
- (c) fails to give permission to proceed in the event of a suspension that affects the whole of the Works under Clause 7.5; or
- (d) becomes bankrupt or insolvent, has a receiving order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes in to liquidation; or
- (e) consistently fails to meet his material obligations hereunder,

(Owner Default),

the Contractor may, at its absolute discretion choose to:

- (i) give thirty (30) days written notice to the Owner that the Contractor will postpone the fulfilment of its obligations under the Contract until such default has been remedied and satisfactory payment security is established covering the outstanding part of the Lump Sum Price, and/or
- (ii) give the Owner written notice that:
 - (A) the Owner has committed an act or omission constituting an Owner's default;
 - (B) the Contractor intends to terminate the Contract at the end of the period given by the Contractor in the notice;
 - (C) the Owner is to remedy such default within the period given pursuant to (B) above; and
 - (D) if the Owner does not remedy the default within the period given, the Contractor will terminate the Contract without having to require any consent from any Court of authority.

The period allowed for remedial action shall be no less than 21 days.

Any such termination shall be without prejudice to any other rights of the Contractor or the Owner under the Contract.

13.2 Removal of Contractor's Equipment

Upon the termination, the Contractor shall be entitled to remove immediately all Contractor's Equipment which is on the Site and/or Work Area.

13.3 Payment on Termination for Owner's Default

In the event of termination the Owner shall pay the Contractor for the value of the Works completed at the time of termination. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

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14. RISK AND RESPONSIBILITY

14.1 General Indemnity

The Contractor hereby warrants and represents that it holds and/or has received all the necessary licences and consents which are required from any licensor and any other person in connection with the design, construction, operation and maintenance of the Works, and the Contractor shall hold harmless and indemnify the Owner, its directors and employees from and against all claims losses, liabilities, expenses, charges, liens and other obligations whatsoever in connection with this Contract and from and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto provided that the claim or proceedings arise out of the design, construction, manufacture or use of the Works.

14.2 Claims

The Contractor shall be promptly notified of any claim under this Clause made against the Owner. The Contractor together with the Owner may at his own cost conduct negotiations for the settlement of such claim, and any litigation that may arise therefrom.

The Owner shall not make any admission, which might be prejudicial to the Contractor unless the Contractor has failed to take over the conduct of the negotiations or litigation within a reasonable time after having been so requested.

The Contractor may conduct such negotiations or litigation referred to above on the condition that he shall provide the Owner such reasonable security as the Owner may require as quickly as reasonably possible. The security shall be for an amount which is an assessment of the compensation, damages, expenses and costs for which the Owner and/or the Contractor may become liable and which are the subject of the indemnity under Clause 14.1.

The Owner shall, at the request of the Contractor, provide all available assistance for the purpose of contesting any such claim or action, and shall be repaid all reasonable costs incurred in so doing.

14.3 Contractor's Liability

The Contractor shall, until the end of the Defects Liability Period or any extended period of Defects Liability Period, defend, indemnify, be liable for and hold harmless to the Owner against all losses, expenses (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) and claims, including (without limitation) any claims in respect of any loss of or damage to physical property (other than the Works), death or personal injury, arising out of or resulting from or occurring to the extent caused by:

- (a) defective design, material or workmanship of the Contractor;
- (b) negligence or breach of statutory or contractual duty of the Contractor, or its respective employees, advisors, consultants and agents; or
- (c) the performance by the Contractor under the Contract, any subcontractor, any person or organization directly or indirectly employed by any of them regardless of the negligence of any such party,

save for loss or damage arising through the Owner's gross negligence or wilful default.

14.4 Accidents

The Contractor shall be liable for and shall indemnify the Owner against all losses, expenses or claims arising in connection with the death of or injury to any person employed by the Contractor for the purposes of the Works, unless caused by the gross negligence or wilful default of the Owner or other contractors engaged by the Owner or by their respective employees or agents.

14.5 Liability for Indirect Damages

Neither party shall be liable to the other for any loss of profit, loss of use, loss of production, loss of data, loss of financing costs, loss of contracts or for any other indirect damage that may be suffered by the other, except as expressly provided in this Contract.

14.6 Liability after Expiration of Defects Liability Period

Except as otherwise set forth herein, the Contractor shall have no liability to the Owner for any loss of or damage to the Works or the Project which occurs after the expiration of the Defects Liability Period, unless caused by gross negligence or wilful default of the Contractor.

14.7 Mitigation of Loss or Damage

In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage which has occurred or may occur.

14.8 Insurance

Without limiting or reducing Contractor's liability and responsibility hereunder, Contractor shall procure and maintain, at its own cost and expense and through first-class insurers acceptable to the Owner, during performance of the Works and shall ensure that any subcontractors do likewise, the following insurance applicable to its activities with respect to and for the duration of the Contract:

- (a) Comprehensive General Third Party Liability Insurance in the amount of one million US Dollars (1,000,000 USD) for any one claim and without limit to the number of claims in respect of any bodily and/or personal injury including death and property damage or destruction of any person or property which shall arise out of or in consequence of Consultant's performance of the Services. Such policy shall include Contractual Liability cover and a cross-liability provision.
- (b) Such Employer's Liability, Workmen's Compensation Insurance or similar cover which the Consultant is statutorily required to effect with respect to its personnel.
- (c) Any other insurance which may be relevant and/or necessary and/or may be required by law.

All insurance policies shall be endorsed to provide the Employer with not less than thirty (30) days notice of any cancellation or material amendment thereof.

The Consultant shall provide Owner with such evidence of its insurance coverage as the Owner may reasonably require.

Should Contractor at any time neglect or refuse to provide or renew any insurance required herein, or should any insurance be cancelled, Owner shall have the right to procure such insurance at the Contractor's cost. Owner shall be entitled to deduct such sums from any monies due or which may become due to Contractor in addition to any other remedies Owner may have under the Contract

15. FORCE MAJEURE

15.1 Definition of Force Majeure

Force Majeure means any circumstances which are unforeseeable and beyond the control of the Contractor or of the Owner upon due care and diligent performance, including but not limited to:

- (a) war and other hostilities (whether war be declared or not), invasion, act of foreign enemies, mobilisation, requisition or embargo;
- (c) rebellion, terrorism, revolution, insurrection, military or usurped power, civil war, and civil unrest;
- (d) closure of ports, suspension of government services, breakdown of communications, riot, commotion, disorder, strike, lockout and other industrial action, except where this involves any personnel and other employees of the Contractor, other than as a part of a nationwide industrial action; and/or
- (f) natural catastrophes including, without limitation, flood, fire and earthquakes.

The burden of proof as to whether a Force Majeure event has occurred and whether the Force Majeure event excuses the party from performance shall be upon the party claiming such Force Majeure event.

15.2 Effect of Force Majeure

Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligations is prevented by any circumstances of Force Majeure which arise after the Commencement Date.

15.3 Notice of Occurrence

If either party considers that any circumstances of Force Majeure have occurred which may affect performance of his obligations he shall promptly notify the other party of the event or circumstances constituting the Force Majeure and shall to the extent possible specify the obligations, the performance of which is or will be prevented.

15.4 Performance to Continue

Upon the occurrence of any circumstances of Force Majeure, the Contractor shall use his best endeavour to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify the Owner of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure. However, the Contractor shall not take any such steps unless the Owner has approved the Contractor's proposed steps and reasonable remedy or remedies (if necessary); provided, that the Owner shall respond to the proposed steps and reasonable remedy or remedies within 72

hours. Such 72 hours may be extended by the Owner if the Owner requires additional time to consider the proposal of the Contractor. If the Owner has not responded within 72 hours, Owner shall be deemed to have approved and directed such steps.

15.5 Damage caused by Force Majeure

If in consequence of Force Majeure the Works shall suffer loss or damage the Contractor shall be entitled to be paid for the value of the work done at that time, without regard to the loss or damage that has occurred but only to the extent such loss or damage has not been compensated by insurance proceeds.

15.6 Termination in Consequence of Force Majeure

If circumstances of Force Majeure have occurred and shall continue for a cumulative period of 90 days then, notwithstanding that the Contractor may by reason thereof have been granted an extension to complete the Works, either party shall be entitled to serve upon the other 21 days' notice to terminate the Contract. If at the expiry of the period of 21 days Force Majeure shall still continue the Contract shall terminate, otherwise the Contract shall continue to be in force and effect.

15.7 Payment on Termination for Force Majeure

If the Contract is terminated under Clause 15.6 the Contractor shall be paid the value of the Work done at that time. Owner and Contractor agree to discuss and agree in good faith an agreed upon amount for the value of the Works completed at the time of termination.

15.8 Release from Performance

If circumstances of Force Majeure occur and in consequence thereof under the law governing the Contract the parties are released from further performance of the Contract, the sum payable by the Owner to the Contractor shall be the same as that which would have been payable under Clause 15.7 if the Contract had been terminated under Clause 15.6.

15.9 Force Majeure Affecting Owner's Duties

The provisions of Clause 19 shall also apply in circumstances where the Owner is prevented from performing any of his duties under the Contract including without limitation the duty to make payment to the Contractor under the Contract by reason of Force Majeure; provided, however, subject to the foregoing, any payments due to the Contractor in accordance with Clause 15.7 shall be paid by the Owner in accordance with the provisions set forth in Clause 11.

16. DISPUTES AND ARBITRATION

16.1 Arbitration

Any dispute arising out of or in connection with this Contract, including any question regarding its existence, validity or termination, shall be referred to and finally resolved by arbitration in Thailand in accordance with the Arbitration rules of the Thai Arbitration Institute, the Ministry of Justice (TAI Rules) for the time being in force, which rules are deemed to be incorporated by reference in this clause.

The Tribunal shall consist of three arbitrators to be appointed in accordance to the TAI Rules. The place of arbitration shall be Thailand.

The language of the arbitration shall be English).

16.2 Work to Continue

Performance of the Contract shall continue during arbitration proceedings unless the Owner shall order suspension. If any such suspension is ordered the reasonable costs incurred by the Contractor and occasioned thereby shall be approved by the Owner (acting reasonably) and added to the Contract Price.

Except as otherwise set forth herein, no payments due or payable by the Owner shall be withheld on account of pending reference to arbitration.

17. CHANGE OF CONTROL

Notwithstanding any provisions to the contrary in this Agreement, Owner has the right to terminate this Contract, effective immediately, at any time and without prior notice or compensation in lieu thereof nor any goodwill indemnity by sending a fax and a letter to Contractor in the event there is a change in control of Contractor.

Change of control means the sale of all or substantially all the assets of Contractor; any merger, consolidation or acquisition of Contractor with, by or into another corporation, entity or person; or any change in the ownership of more than fifty percent (50%) of the voting capital stock of Contractor in one or more related transactions.

18. NOTICES

Any notice, request or other communication required hereunder shall be deemed to have been duly given or made when it shall be in writing and delivered by hand or facsimile or by registered mail, addressed as follows:

If to Contractor,


T.S.Group Management Co.,Ltd.
134/60 Soi Khubon 27 Subsoi 15 Khubon Road,
Khwang Tharang , Khet Bangkhen Bangkok 10220,Thailand.
Tel: +66 3301 2415-6
Fax: +66 3301 2417
Attention: Mr. Somyoth Nonthaphet /Project Manager

If to Owner,

Floor 29, Exchange Tower,
388 Rachadapisek Road, Klongtoey, Sukhumvit Road
Bangkok 10110 THAILAND
Tel: +66 2 1049244)
Fax: +66 2 1049101;

19. CONTACT LIST

Any correspondence not required to be given under Clause 18 shall be given by email and sent to the contact list set out in Appendix 5.



20. GENERAL

20.1 Assignment

Neither Party may assign its rights or obligations under this Contract without the prior written consent of the other Party.

20.2 Documents Mutually Explanatory

The Contract shall be taken as mutually explanatory. Any ambiguities or discrepancies shall be resolved amicably by both Parties.

20.3 Inconsistency

In case of any inconsistency between the terms of the Contract, the Invitation to Tender and Specification and Technical Documents, the terms of the Invitation to Tender and Specification and Technical Documents shall prevail.

20.4 Applicable Law

The interpretation and the construction of this Contract, and all matters relating hereto, shall be governed by the laws of Thailand.

20.5 Third Parties

Notwithstanding any other provision of this Contract, nothing in this Contract is intended to confer and nothing purports to confer any right to enforce any of its terms on any person who is not a party to it.

20.6 Waivers

No failure or delay by any party to exercise any right, power or remedy will operate as a waiver of it nor will any partial exercise preclude any further exercise of the same, or of some other right, power or remedy, other than expressly stated in this Contract.

20.7 Amendment


No amendment or waiver of any provision of this Contract, or consent to any departure therefrom, shall be effective unless in writing and signed or consented to (in writing) by the Parties, and then such waiver or consent shall be effective only in the specific instance and for the specific purpose for which given.

20.8 Unenforceability

Any provision of this Contract that is prohibited, unenforceable or not authorized in any one jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition, unenforceability or non-authorization without invalidating the remaining provisions of this Contract or affecting the validity, enforceability or authorization of such provision in any other jurisdiction.

20.9 Entire Agreement

This Contract, together with any other agreements, documents, or certificates to be executed by the Parties pursuant to this Agreement constitutes the entire agreement between the Parties with respect to the transactions contemplated hereby. All previous documents, undertakings, and agreements, whether oral, written or otherwise, between the Parties concerning the subject



matter of this Contract are hereby cancelled and shall not affect or modify any of the terms or obligations set forth in this Contract.

20.10 Confidentiality

The Parties agree that this Contract shall be kept confidential and shall not be disclosed to any third party, except as such disclosure is required by an applicable law or regulation or by any governmental authority having jurisdiction over any of the Parties or such disclosure is made by any Party to their financial, legal or other professional advisors on a "need to know" basis. In the event that a proper request is made for this Contract by any governmental authority, the Owner shall notify the Contractor of such request and the Owner and Contractor shall promptly meet to discuss an appropriate course of action provided, however, that nothing contained in this sub-clause shall obligate the Owner to violate any applicable law or refuse any properly presented request made by any governmental authority. If any Party discloses this Contract in violation of this sub-clause, it shall indemnify and hold the other Parties harmless from any present or future claim, liability, fine or penalty, including any claim for payment of additional taxes, in each case as a result of disclosure of this Contract. The restrictions contained in this Clause 20.10 shall survive the termination or expiry of this Contract.

20.11 Governing Law

This Contract shall be governed by and construed in accordance with the laws of Thailand.

IN WITNESS WHEREOF, the parties hereto, having read and understood the contents of this Contract, have caused this Contract to be signed in their respective names as well as affixed with the company's seal of it any as of the date first above written.

SIGNED for and on behalf of
Kavak Petroleum Asia Ltd (Thailand) Ltd.

Talel B. *C. P. A.*
By
Title:

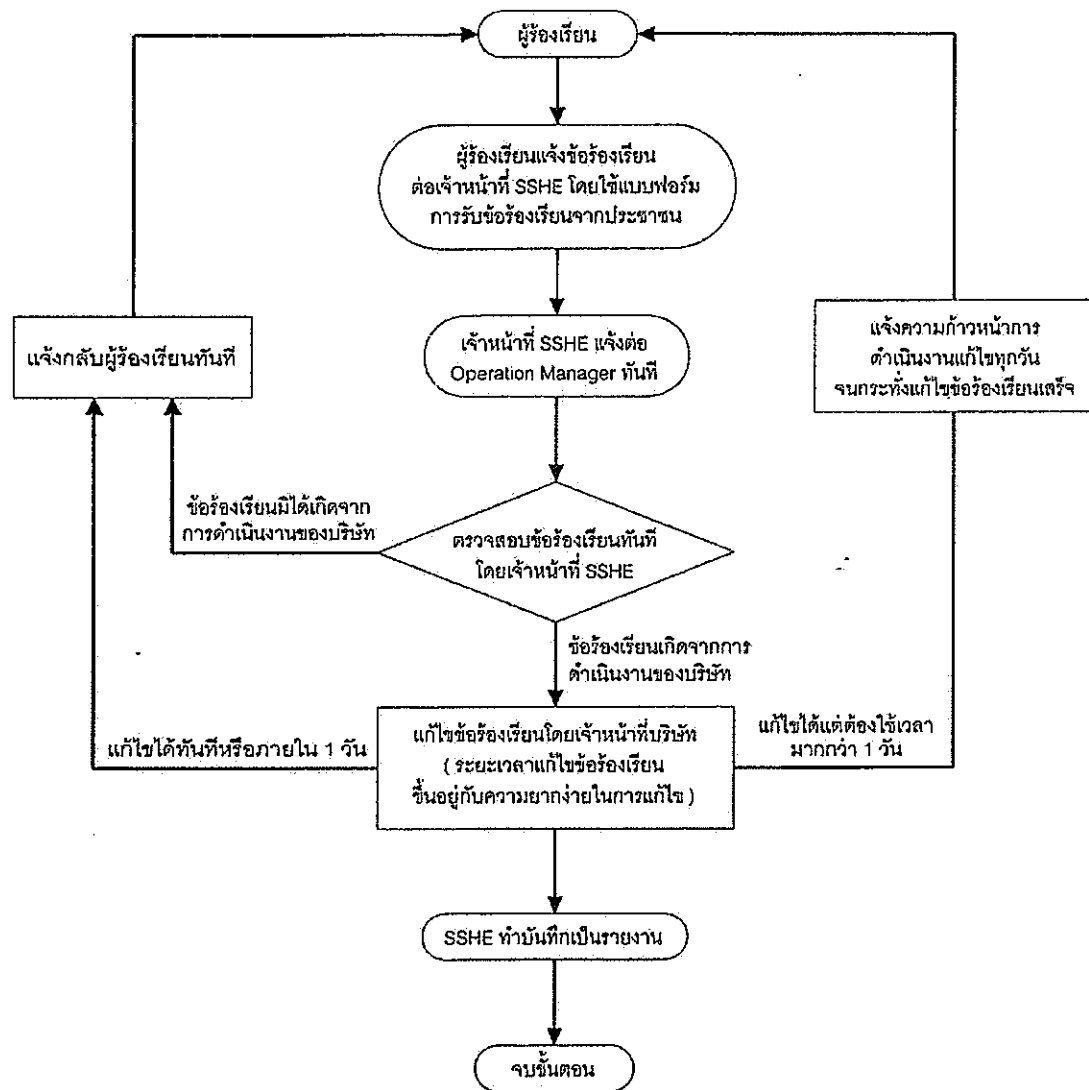
SIGNED for and on behalf of
T.S. Group Management Co., Ltd.

Dr. Thawatchai Sangthong

By: Dr. Thawatchai Sangthong
Title: Chairman & Chief Executive Officer

ภาคผนวก ข.2

แผนผังการรับซื้อโรงเรียน



แผนผังการรับข้อร้องเรียน

โครงการท่อส่งน้ำมัน บริษัท กูเวต ปิโตรเลียม เอวिएชั่น (ประเทศไทย) จำกัด

แบบฟอร์มการรับข้อร้องเรียนจากประชาชน
บริษัท คูเวต ปิโตรเลียม เอวีเอชั่น (ประเทศไทย) จำกัด

วันที่.....

ชื่อและนามสกุลของผู้ร้องเรียน ที่อยู่.....

.....เบอร์โทรศัพท์.....

ข้อร้องเรียนเพื่อให้บริษัทดำเนินการแก้ไข มีดังนี้

.....
.....
.....
.....

ทั้งนี้บริษัทจะรีบตรวจสอบตามข้อร้องเรียนของท่าน หากพบว่าเหตุดังกล่าวเกิดขึ้นจากการดำเนินงานของบริษัท
บริษัทจะรีบแก้ไขโดยเร็วที่สุดและจะแจ้งให้ท่านได้รับทราบทันทีที่เหตุดังกล่าวได้รับการแก้ไขแล้ว

ลงนามผู้ร้องเรียน

.....

()

ลงนามผู้รับข้อร้องเรียน

.....

()

แบบฟอร์มการรับข้อร้องเรียน

โครงการท่อส่งน้ำมัน บริษัท คูเวต ปิโตรเลียม เอวีเอชั่น (ประเทศไทย) จำกัด

ภาคผนวก ข.3

เอกสารการตรวจสอบแนวท่อส่งน้ำมันและถังเก็บน้ำมัน

การเดินสำรวจทุกวัน (Pipeline Patrolling)

บริษัท อวทปโครเดิม เอวิเฮน (ประเทศไทย) จำกัด

ประเทศไทย

Q8 Aviation

1. Wastewater Treatment Plant
2. Pipe Bridge 1
3. Pipe Bridge 2

ข้อมูลตาม		41 Q8		42 Q8		43 Q8		44 Q8		45 Q8		46 Q8		47 Q8		48 Q8		49 Q8		50 Q8		51 Q8		52 Q8		53 Q8		54 Q8		55 Q8		56 Q8		57 Q8		58 Q8		59 Q8		60 Q8		61 Q8		62 Q8		63 Q8		64 Q8		65 Q8		66 Q8		67 Q8		68 Q8		69 Q8		70 Q8		71 Q8		72 Q8		73 Q8		74 Q8		75 Q8		76 Q8		77 Q8		78 Q8		79 Q8		80 Q8		81 Q8		82 Q8		83 Q8		84 Q8		85 Q8		86 Q8		87 Q8		88 Q8		89 Q8		90 Q8		91 Q8		92 Q8		93 Q8		94 Q8		95 Q8		96 Q8		97 Q8		98 Q8		99 Q8		100 Q8		101 Q8		102 Q8		103 Q8		104 Q8		105 Q8		106 Q8		107 Q8		108 Q8		109 Q8		110 Q8		111 Q8		112 Q8		113 Q8		114 Q8		115 Q8		116 Q8		117 Q8		118 Q8		119 Q8		120 Q8		121 Q8		122 Q8		123 Q8		124 Q8		125 Q8		126 Q8		127 Q8		128 Q8		129 Q8		130 Q8		131 Q8		132 Q8		133 Q8		134 Q8		135 Q8		136 Q8		137 Q8		138 Q8		139 Q8		140 Q8		141 Q8		142 Q8		143 Q8		144 Q8		145 Q8		146 Q8		147 Q8		148 Q8		149 Q8		150 Q8		151 Q8		152 Q8		153 Q8		154 Q8		155 Q8		156 Q8		157 Q8		158 Q8		159 Q8		160 Q8		161 Q8		162 Q8		163 Q8		164 Q8		165 Q8		166 Q8		167 Q8		168 Q8		169 Q8		170 Q8		171 Q8		172 Q8		173 Q8		174 Q8		175 Q8		176 Q8		177 Q8		178 Q8		179 Q8		180 Q8		181 Q8		182 Q8		183 Q8		184 Q8		185 Q8		186 Q8	
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บริษัท อวตารโกลบอล จำกัด (มหาชน) (ประเทศไทย) จำกัด

กรมการขนส่งทางบก Thailand

Q8 Aviation

**** มาตรการควบคุมการติดเชื้อ Toxoplasma GS**
1. การตรวจพบเชื้อ Toxoplasma
2. Pipe Bridge 1
3. Pipe Bridge 2

ชื่อผู้โดยสาร

วันที่ขึ้นเครื่อง

เที่ยวบิน

ชื่อ Q8

2

Q8 Empty Land

ชื่อผู้โดยสาร

วันที่ขึ้นเครื่อง

เที่ยวบิน

ชื่อผู้โดยสาร

วันที่ขึ้นเครื่อง

เที่ยวบิน

ชื่อ Q8

2

Q8 Empty Land

ชื่อผู้โดยสาร

วันที่ขึ้นเครื่อง

เที่ยวบิน

บริษัท อวาคิโตะเคมียูเอ เอวิเจชัน (ประเทศไทย) จำกัด

[illegible]

Q8 Aviation

2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

บริษัท อุตสาหกรรมปิโตรเลียม ไทย จำกัด (ประเทศไทย) จำกัด

ASSOCIATION OF THE THEFT

Q8 Aviation

1.คลองระบายน้ำฝั่ง Thaiqll.
2.Pipe Bridge 1
3.Pipe Bridge 2

Aviation

ฝั่งเหนือ

ฝั่งใต้

1

2

ทางระบายน้ำ

ถนน

QA Empty Land

** ฝายระบายน้ำของ Thaioli To ทางรถไฟ QA

1.คลองระบายน้ำฝั่ง Thaioli

2.Pipe Bridge 1

3.Pipe Bridge 2

วันที่	เวลา	คลองระบายน้ำฝั่ง Thaioli			เวลา	Pipe Bridge 1			เวลา	Pipe Bridge 2			
		ปกติ	ไม่ปกติ	อื่นๆ		ปกติ	ไม่ปกติ	อื่นๆ		ปกติ	ไม่ปกติ	อื่นๆ	
9-1-65	7:00	/				/				/			
	8:00	/				/				/			
	9:45	/				/				/			
	10:30	/				/				/			
	11:15	/				/				/			
	12:00	/				/				/			
	12:45	/				/				/			
	13:30	/				/				/			
	14:15	/				/				/			
	15:00	/				/				/			
9-1-65	15:45	/				/				/			
	16:30	/				/				/			
	17:15	/				/				/			
	18:00	/				/				/			
	18:45	/				/				/			
	19:30	/				/				/			
	20:15	/				/				/			
	21:15	/				/				/			
	22:00	/				/				/			
	22:45	/				/				/			
9-1-65 6-1-65	23:30	/				/				/			
	0:15	/				/				/			
	1:00	/				/				/			
	1:45	/				/				/			
	2:30	/				/				/			
	3:15	/				/				/			
	4:00	/				/				/			
	4:45	/				/				/			
	5:30	/				/				/			
	6:15	/				/				/			
6-1-65	6:30	/				/				/			
	6:15	/				/				/			

ไม่พบข้อมูล

บริษัท กรุงเทพประกันภัย จำกัด (มหาชน) ขอสงวนสิทธิ์ในข้อมูล

[illegible]

Q8 Aviation

2. โครงการพัฒนาระบบชลประทาน
2.1. โครงการพัฒนาระบบชลประทาน
2.2. โครงการพัฒนาระบบชลประทาน
2.3. โครงการพัฒนาระบบชลประทาน

[illegible]

บริษัท กวตงปิโตรเลียม เอเชียจัน (ประเทศไทย) จำกัด

การตรวจศพของนาย Thaleh

Q8  **Aviation**

* ไม่ตรวจสอบหน่วย ThaiOil To มาตรา G3
1. โครงสร้างภายใน ThaiOil
2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

บริษัท กูแวกปีโตรเลียียม (ประเทศไทย) จำกัด

บริษัท 2000 เมจิก ไทยอิล

Q8 Aviation

2. น้ำประปาหมู่บ้าน Thaioli To munda Q8
1. แหล่งน้ำหมู่บ้าน Thaioli
2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

บริษัท การค้าปลีกไทย จำกัด (มหาชน)

00211012080100Kino Thalott

Q8  Aviation

1. สะพานข้ามแม่น้ำเจ้าพระยา
2. สะพานข้ามแม่น้ำเจ้าพระยา
3. สะพานข้ามแม่น้ำเจ้าพระยา

การตรวจพบห่าน Thaiolt

Aviation

ฝั่งตะวันออก

ฝั่ง Q8

** ให้อากาศยาน Thaiolt To สนาม Q8
 1. การตรวจพบห่าน Thaiolt
 2. Pipe Bridge 1
 3. Pipe Bridge 2

1

ถนน

2

OS Empty Land

3

วันที่	เวลา	การตรวจพบห่าน Thaiolt			เวลา	Pipe Bridge 1			เวลา	Pipe Bridge 2		
		ปกติ	ไม่ปกติ	อื่นๆ		ปกติ	ไม่ปกติ	อื่นๆ		ปกติ	ไม่ปกติ	อื่นๆ
17/8/75	7:00	/				/				/		
	9:00	/				/				/		
	9:45	/				/				/		
	10:30	/				/				/		
	11:15	/				/				/		
	12:00	/				/				/		
	12:45	/				/				/		
	13:30	/				/				/		
	14:15	/				/				/		
	15:00	/				/				/		
17/8/75	16:45	/				/				/		
	18:30	/				/				/		
	17:15	/				/				/		
	18:00	/				/				/		
	18:45	/				/				/		
	19:30	/				/				/		
	20:15	/				/				/		
	21:00	/				/				/		
	21:45	/				/				/		
	22:30	/				/				/		
18/8/75 21/8/75	22:45	/				/				/		
	23:30	/				/				/		
	0:15	/				/				/		
	1:00	/				/				/		
	1:45	/				/				/		
	2:30	/				/				/		
	3:15	/				/				/		
	4:00	/				/				/		
	4:45	/				/				/		
	5:30	/				/				/		
21/8/75	6:15	/				/				/		

บริษัท กูวตาลีโตร์สเคม เอวิเอชัน (ประเทศไทย) จำกัด

Q8 
Aviation

**** ใ้ทราบข้อมูลเกี่ยวกับ Thailand To มาแล้ว Q8**
1.คลองพระยาสุเมธี Thailand
2.Pipe Bridge 1
3.Pipe Bridge 2

[illegible]

บริษัท อูเวคปิโตรเลียม เอวิเอชัน (ประเทศไทย) จำกัด

Q8 Aviation

1. น้ำประปาหมู่บ้าน Thaiolt To nurnia 08
2. น้ำประปาหมู่บ้าน Thaiolt
3. น้ำประปาหมู่บ้าน Thaiolt
4. น้ำประปาหมู่บ้าน Thaiolt
5. น้ำประปาหมู่บ้าน Thaiolt
6. น้ำประปาหมู่บ้าน Thaiolt
7. น้ำประปาหมู่บ้าน Thaiolt
8. น้ำประปาหมู่บ้าน Thaiolt
9. น้ำประปาหมู่บ้าน Thaiolt
10. น้ำประปาหมู่บ้าน Thaiolt

[illegible]

บริษัท ญวณปิโตรเลียม เอวิเอชัน (ประเทศไทย) จำกัด

Q8 
Aviation

1. ตลาดสะพานหิน Thaioil To มุมที่ Q8
 2. Pipe Bridge 1
 3. Pipe Bridge 2

[illegible]

บริษัท อุตสาหกรรมปูนซีเมนต์ จำกัด (มหาชน)

Q8  **Aviation**

1. คลองระบมปากน้ำโพธิ์
2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

[illegible]

2. Pipe Bridge 1

[illegible]

สายการบิน

เที่ยวบิน

Flt Q8

2

Aviation
**** ใบเสร็จออกใบเสร็จ Thailoi To ทาง Q8**
1.กล่องกระดาษ Thailoi
2.Pipe Bridge 1
3.Pipe Bridge 2

Q8 Empty Land

3

วันที่	เวลา	กล่องกระดาษ Thailoi				Pipe Bridge 1				Pipe Bridge 2			
		กล่อง	ใบกล่อง	อื่นๆ	เวลา	กล่อง	ใบกล่อง	อื่นๆ	เวลา	กล่อง	ใบกล่อง	อื่นๆ	
01/04/65	7:00	/				/				/			
	8:00	/				/				/			
	9:45	/				/				/			
	10:30	/				/				/			
	11:15	/				/				/			
	12:00	/				/				/			
	12:45	/				/				/			
	13:30	/				/				/			
	14:15	/				/				/			
	15:00	/				/				/			
01/04/65	15:45	/				/				/			
	16:30	/				/				/			
	17:15	/				/				/			
	18:00	/				/				/			
	18:45	/				/				/			
	19:30	/				/				/			
	20:15	/				/				/			
	21:00	/				/				/			
	21:45	/				/				/			
	22:30	/				/				/			
01/04/65	22:45	/				/				/			
	23:30	/				/				/			
	01:15	/				/				/			
	1:00	/				/				/			
	1:45	/				/				/			
	2:30	/				/				/			
	3:15	/				/				/			
	4:00	/				/				/			
	4:45	/				/				/			
	5:30	/				/				/			
01/04/65	6:15	/				/				/			
	6:30	/				/				/			

4. โครงการสนับสนุนทาง Thai Oil To สนับสนุน
1.โครงการสนับสนุนทาง Thai Oil
2. Pipe Bridge 1
3. Pipe Bridge 2

Aviation

สนามบินภูเก็ต

ฝั่ง Q8

** ท่าอากาศยานภูเก็ต Thailand To ยุโรป Q8

ท่าอากาศยานภูเก็ต

หมู่

2

Q8 Empty Land

1. ท่าอากาศยานภูเก็ต Thailand

2. Pipe Bridge 1

3. Pipe Bridge 2

3

ท่าอากาศยานภูเก็ต Thailand

Pipe Bridge 1

Pipe Bridge 2

วันที่	เวลา	บิน	ไม่บิน	บิน	เวลา	บิน	ไม่บิน	บิน	เวลา	บิน	ไม่บิน	บิน
0 / 00 / 00	7:00	/				/				/		
"	9:00	/				/				/		
"	9:45	/				/				/		
"	10:30	/				/				/		
"	11:15	/				/				/		
"	12:00	/				/				/		
"	12:45	/				/				/		
"	13:30	/				/				/		
"	14:15	/				/				/		
"	15:00	/				/				/		
"	15:45	/				/				/		
# 100 / 00	16:30	/				/				/		
"	17:15	/				/				/		
"	18:00	/				/				/		
"	18:45	/				/				/		
"	19:30	/				/				/		
"	20:15	/				/				/		
"	21:00	/				/				/		
"	21:45	/				/				/		
"	22:30	/				/				/		
"	23:15	/				/				/		
# 00 / 00	1:00	/				/				/		
"	1:45	/				/				/		
"	2:30	/				/				/		
"	3:15	/				/				/		
"	4:00	/				/				/		
"	4:45	/				/				/		
"	5:30	/				/				/		
# 100 / 00	6:15	/				/				/		

บริษัท สวทปิโตรเลียม เอเชียจีน (ประเทศไทย) จำกัด

การนำร่องของมูลนิธิ The Holt

Q8 
Aviation

1. คลองระบายน้ำห้วยทรายทอง
2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

บริษัท การค้าปลีกอาหารและยา เอชวีเอสบี (ประเทศไทย) จำกัด

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

Q8  Aviation

“ Information on Thailand To sum up CS
1. การปรับปรุงโครงสร้าง Thailand
2. Pipe Bridge 1
3. Pipe Bridge 2

[illegible]

บริษัท อวตารอินเตอร์เนชั่นแนล จำกัด (มหาชน) จักร

WITNANTONGWUNTHO Thakol

Q8 
Aviation

1. Sanctuary of the Thai
2. Pine Bridge 1
3. Pine Bridge 2

สถานีควบคุม		ปี ๑๓		ปี ๑๔		ปี ๑๕		ปี ๑๖		ปี ๑๗		ปี ๑๘		ปี ๑๙		ปี ๒๐		ปี ๒๑		ปี ๒๒		ปี ๒๓		ปี ๒๔		ปี ๒๕		ปี ๒๖		ปี ๒๗		ปี ๒๘		ปี ๒๙		ปี ๓๐		ปี ๓๑		ปี ๓๒		ปี ๓๓		ปี ๓๔		ปี ๓๕		ปี ๓๖		ปี ๓๗		ปี ๓๘		ปี ๓๙		ปี ๔๐		ปี ๔๑		ปี ๔๒		ปี ๔๓		ปี ๔๔		ปี ๔๕		ปี ๔๖		ปี ๔๗		ปี ๔๘		ปี ๔๙		ปี ๕๐		ปี ๕๑		ปี ๕๒		ปี ๕๓		ปี ๕๔		ปี ๕๕		ปี ๕๖		ปี ๕๗		ปี ๕๘		ปี ๕๙		ปี ๖๐		ปี ๖๑		ปี ๖๒		ปี ๖๓		ปี ๖๔		ปี ๖๕		ปี ๖๖		ปี ๖๗		ปี ๖๘		ปี ๖๙		ปี ๗๐		ปี ๗๑		ปี ๗๒		ปี ๗๓		ปี ๗๔		ปี ๗๕		ปี ๗๖		ปี ๗๗		ปี ๗๘		ปี ๗๙		ปี ๘๐		ปี ๘๑		ปี ๘๒		ปี ๘๓		ปี ๘๔		ปี ๘๕		ปี ๘๖		ปี ๘๗		ปี ๘๘		ปี ๘๙		ปี ๙๐		ปี ๙๑		ปี ๙๒		ปี ๙๓		ปี ๙๔		ปี ๙๕		ปี ๙๖		ปี ๙๗		ปี ๙๘		ปี ๙๙		ปี ๑๐๐		ปี ๑๐๑		ปี ๑๐๒		ปี ๑๐๓		ปี ๑๐๔		ปี ๑๐๕		ปี ๑๐๖		ปี ๑๐๗		ปี ๑๐๘		ปี ๑๐๙		ปี ๑๑๐		ปี ๑๑๑		ปี ๑๑๒		ปี ๑๑๓		ปี ๑๑๔		ปี ๑๑๕		ปี ๑๑๖		ปี ๑๑๗		ปี ๑๑๘		ปี ๑๑๙		ปี ๑๒๐		ปี ๑๒๑		ปี ๑๒๒		ปี ๑๒๓		ปี ๑๒๔		ปี ๑๒๕		ปี ๑๒๖		ปี ๑๒๗		ปี ๑๒๘		ปี ๑๒๙		ปี ๑๓๐		ปี ๑๓๑		ปี ๑๓๒		ปี ๑๓๓		ปี ๑๓๔		ปี ๑๓๕		ปี ๑๓๖		ปี ๑๓๗		ปี ๑๓๘		ปี ๑๓๙		ปี ๑๔๐		ปี ๑๔๑		ปี ๑๔๒		ปี ๑๔๓		ปี ๑๔๔		ปี ๑๔๕		ปี ๑๔๖		ปี ๑๔๗		ปี ๑๔๘
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บริษัท กวดไปสวเคียม เอวิเอชัน (ประเทศไทย) จำกัด

การนำร่องฉบับนี้จัดทำขึ้นโดย

Q8  Aviation

1. กองงานช่างไทย
2. Pipe Bridge 1
3. Pipe Bridge 2

ฝ่ายควบคุม

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

ฝ่าย QA

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

ฝ่าย QA

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. **รายชื่อผู้ควบคุม**

2. **รายชื่อผู้ควบคุม**

1. 100

[illegible]

Aviation

ข้อมูลเบื้องต้น

As Q8

** ปรากฏการณ์ที่ Thaioil To หน้า Q8
 1.ถนนพระยาพิชัย Thaioil
 2.Pipe Bridge 1
 3.Pipe Bridge 2

1

วันที่รับทราบ

2

ชื่อ

Q8 Empty Land

3

วันที่	เวลา	ถนนพระยาพิชัย Thaioil			Pipe Bridge 1				Pipe Bridge 2				
		ปกติ	ไม่ปกติ	อื่นๆ	เวลา	ปกติ	ไม่ปกติ	อื่นๆ	เวลา	ปกติ	ไม่ปกติ	อื่นๆ	
01/03/68	7:30	/				/				/			
	9:00	/				/				/			
	9:45	/				/				/			
	10:30	/				/				/			
	11:15	/				/				/			
	12:00	/				/				/			
	12:45	/				/				/			
	13:30	/				/				/			
	14:15	/				/				/			
	15:00	/				/				/			
01/03/68	16:45	/				/				/			
	18:30	/				/				/			
	17:15	/				/				/			
	18:00	/				/				/			
	18:45	/				/				/			
	19:30	/				/				/			
	20:15	/				/				/			
	21:00	/				/				/			
	22:00	/				/				/			
	22:45	/				/				/			
01/03/68	23:30	/				/				/			
02/03/68	0:15	/				/				/			
	1:00	/				/				/			
	1:45	/				/				/			
	2:30	/				/				/			
	3:15	/				/				/			
	4:00	/				/				/			
	4:45	/				/				/			
	5:30	/				/				/			
02/03/68	6:15	/				/				/			

หน้า 3 จาก 3

หน้า 3 จาก 3

สํานักงาน		ผ. ๐๘		Aviation									
1		2		** สถานการณ์ของ Thai Oil To มณฑล ๐๘ 1. สถานการณ์ของ Thai Oil 2. Pipe Bridge 1 3. Pipe Bridge 2									
การตรวจ		การ		๐๘ Empty Land									
				3									
วันที่	เวลา	สถานการณ์ของ Thai Oil				Pipe Bridge 1				Pipe Bridge 2			
		ปกติ	ผิดปกติ	อื่นๆ	เวลา	ปกติ	ผิดปกติ	อื่นๆ	เวลา	ปกติ	ผิดปกติ	อื่นๆ	เวลา
4/5/65	7:00	/				/				/			
	9:00	/				/				/			
	9:45	/				/				/			
	10:30	/				/				/			
	11:15	/				/				/			
	12:00	/				/				/			
	12:45	/				/				/			
	13:30	/				/				/			
	14:15	/				/				/			
	15:00	/				/				/			
5/5/65	15:45	/				/				/			
	16:30	/				/				/			
	17:15	/				/				/			
	18:00	/				/				/			
	18:45	/				/				/			
	19:30	/				/				/			
	20:15	/				/				/			
	21:00	/				/				/			
	21:45	/				/				/			
	22:30	/				/				/			
6/5/65	23:15	/				/				/			
	0:00	/				/				/			
	0:45	/				/				/			
	1:30	/				/				/			
	2:15	/				/				/			
	3:00	/				/				/			
	3:45	/				/				/			
	4:30	/				/				/			
	5:15	/				/				/			
	6:00	/				/				/			

[illegible]

** Information to be provided to the Q8
1. Location of the Q8
2. Pipe Bridge 1
3. Pipe Bridge 2

Date/Time		Q8		Q8 Empty Land	
1	2	3	4	5	6
วันที่	เวลา	สถานะ	สถานะ	สถานะ	สถานะ
2-6-65	7:00	✓	✓	✓	✓
	8:00	✓	✓	✓	✓
	9:00	✓	✓	✓	✓
	10:00	✓	✓	✓	✓
	11:15	✓	✓	✓	✓
	12:00	✓	✓	✓	✓
	12:45	✓	✓	✓	✓
	13:30	✓	✓	✓	✓
	14:15	✓	✓	✓	✓
	15:00	✓	✓	✓	✓
	16:45	✓	✓	✓	✓
	18:30	✓	✓	✓	✓
	19:15	✓	✓	✓	✓
	20:00	✓	✓	✓	✓
	20:45	✓	✓	✓	✓
	21:30	✓	✓	✓	✓
	22:15	✓	✓	✓	✓
	23:00	✓	✓	✓	✓
	23:45	✓	✓	✓	✓
	0:15	✓	✓	✓	✓
	1:00	✓	✓	✓	✓
	1:45	✓	✓	✓	✓
	2:30	✓	✓	✓	✓
	3:15	✓	✓	✓	✓
	4:00	✓	✓	✓	✓
	4:45	✓	✓	✓	✓
	5:30	✓	✓	✓	✓
	6:15	✓	✓	✓	✓

** Information to be provided to the Q8
1. Location of the Q8
2. Pipe Bridge 1
3. Pipe Bridge 2

Date/Time		Q8		Q8 Empty Land	
1	2	3	4	5	6
วันที่	เวลา	สถานะ	สถานะ	สถานะ	สถานะ
2-6-65	7:00	✓	✓	✓	✓
	8:00	✓	✓	✓	✓
	9:00	✓	✓	✓	✓
	10:00	✓	✓	✓	✓
	11:15	✓	✓	✓	✓
	12:00	✓	✓	✓	✓
	12:45	✓	✓	✓	✓
	13:30	✓	✓	✓	✓
	14:15	✓	✓	✓	✓
	15:00	✓	✓	✓	✓
	16:45	✓	✓	✓	✓
	18:30	✓	✓	✓	✓
	19:15	✓	✓	✓	✓
	20:00	✓	✓	✓	✓
	20:45	✓	✓	✓	✓
	21:30	✓	✓	✓	✓
	22:15	✓	✓	✓	✓
	23:00	✓	✓	✓	✓
	23:45	✓	✓	✓	✓
	0:15	✓	✓	✓	✓
	1:00	✓	✓	✓	✓
	1:45	✓	✓	✓	✓
	2:30	✓	✓	✓	✓
	3:15	✓	✓	✓	✓
	4:00	✓	✓	✓	✓
	4:45	✓	✓	✓	✓
	5:30	✓	✓	✓	✓
	6:15	✓	✓	✓	✓

** Information to be provided to the Q8
1. Location of the Q8
2. Pipe Bridge 1
3. Pipe Bridge 2

Date/Time		Q8		Q8 Empty Land	
1	2	3	4	5	6
วันที่	เวลา	สถานะ	สถานะ	สถานะ	สถานะ
2-6-65	7:00	✓	✓	✓	✓
	8:00	✓	✓	✓	✓
	9:00	✓	✓	✓	✓
	10:00	✓	✓	✓	✓
	11:15	✓	✓	✓	✓
	12:00	✓	✓	✓	✓
	12:45	✓	✓	✓	✓
	13:30	✓	✓	✓	✓
	14:15	✓	✓	✓	✓
	15:00	✓	✓	✓	✓
	16:45	✓	✓	✓	✓
	18:30	✓	✓	✓	✓
	19:15	✓	✓	✓	✓
	20:00	✓	✓	✓	✓
	20:45	✓	✓	✓	✓
	21:30	✓	✓	✓	✓
	22:15	✓	✓	✓	✓
	23:00	✓	✓	✓	✓
	23:45	✓	✓	✓	✓
	0:15	✓	✓	✓	✓
	1:00	✓	✓	✓	✓
	1:45	✓	✓	✓	✓
	2:30	✓	✓	✓	✓
	3:15	✓	✓	✓	✓
	4:00	✓	✓	✓	✓
	4:45	✓	✓	✓	✓
	5:30	✓	✓	✓	✓
	6:15	✓	✓	✓	✓

** Information to be provided to the Q8
1. Location of the Q8
2. Pipe Bridge 1
3. Pipe Bridge 2

Date/Time		Q8		Q8 Empty Land	
1	2	3	4	5	6
วันที่	เวลา	สถานะ	สถานะ	สถานะ	สถานะ
2-6-65	7:00	✓	✓	✓	✓
	8:00	✓	✓	✓	✓
	9:00	✓	✓	✓	✓
	10:00	✓	✓	✓	✓
	11:15	✓	✓	✓	✓
	12:00	✓	✓	✓	✓
	12:45	✓	✓	✓	✓
	13:30	✓	✓	✓	✓
	14:15	✓	✓	✓	✓
	15:00	✓	✓	✓	✓
	16:45	✓	✓	✓	✓
	18:30	✓	✓	✓	✓
	19:15	✓	✓	✓	✓
	20:00	✓	✓	✓	✓
	20:45	✓	✓	✓	✓
	21:30	✓	✓	✓	✓
	22:15	✓	✓	✓	✓
	23:00	✓	✓	✓	✓
	23:45	✓	✓	✓	✓
	0:15	✓	✓	✓	✓
	1:00	✓	✓	✓	✓
	1:45	✓	✓	✓	✓
	2:30	✓	✓	✓	✓
	3:15	✓	✓	✓	✓
	4:00	✓	✓	✓	✓
	4:45	✓	✓	✓	✓
	5:30	✓	✓	✓	✓
	6:15	✓	✓	✓	✓

ฝั่งไทย		ฝั่ง Q8		ฝั่ง Q8 Empty Land	
1	2	3	4	5	6
วันที่	เวลา	ฝั่งไทย	ฝั่ง Q8	ฝั่ง Q8 Empty Land	ฝั่ง Q8
1	2	3	4	5	6
4/1/65	7:00	✓			
	8:00	✓			
	9:00	✓			
	10:00	✓			
	11:00	✓			
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การตรวจสอบตามวาระ

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE Inches	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAC	VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.007	-1.590	-1.590	-1.590	-1.590	-1.590	-1.590	
	24"	P2	0.008	-1.590	-1.590	-1.590	-1.590	-1.590	-1.590	
CBT-B3	10"	P1	0.008	-1.616	-1.616	-1.616	-1.616	-1.616	-1.616	
	24"	P2	0.008	-1.617	-1.617	-1.617	-1.617	-1.617	-1.617	
CBT-B4	10"	P1	0.008	-1.591	-1.590	-1.590	-1.590	-1.590	-1.590	
	24"	P2	0.010	-1.591	-1.590	-1.590	-1.590	-1.590	-1.590	
CBT-BB1	10"	P1	0.009	-1.616	-1.613	-1.613	-1.613	-1.613	-1.613	
	24"	P2	0.008	-1.616	-1.613	-1.613	-1.613	-1.613	-1.613	
	-	PTT 1	0.009	-0.619						
	-	PTT 2	0.008	-0.619						

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของพื้นที่นั้นๆ
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by.....*สม.ด.*..... Date.....*14/01/22*.....

Check by.....*อ.ร.น.*..... Date.....*14/01/22*.....

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE Inches	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAC	VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.018	-1.562	-1.561	-1.561	-1.562	-1.562	-1.562	
	24"	P2	0.018	-1.562	-1.561	-1.561	-1.562	-1.562	-1.562	
CBT-B3	10"	P1	0.019	-1.571	-1.571	-1.572	-1.572	-1.572	-1.572	
	24"	P2	0.019	-1.580	-1.572	-1.572	-1.572	-1.572	-1.572	
CBT-B4	10"	P1	0.017	-1.573	-1.572	-1.572	-1.572	-1.572	-1.572	
	24"	P2	0.017	-1.573	-1.572	-1.572	-1.572	-1.572	-1.572	
CBT-BB1	10"	P1	0.017	-1.574	-1.573	-1.573	-1.573	-1.573	-1.573	
	24"	P2	0.017	-1.575	-1.573	-1.573	-1.573	-1.573	-1.573	
	-	PTT 1	0.082	-0.588						
	-	PTT 2	0.082	-0.588						
	10"	P1								Disconnected pipe line
	24"	P2								Disconnected pipe line

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของพื้นที่นั้นๆ
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by.....*สม.ด.*..... Date.....*12/2/22*.....

Check by.....*MR. N. A.*..... Date.....*12/2/22*.....

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE Inches	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAG	VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.010	-1.576	-1.577	-1.575	-1.575	-1.574	-1.574	
	24"	P2	0.010	-1.596						
CBT-B3	10"	P1	0.010	-1.590	-1.589	-1.589	-1.561	-1.561	-1.561	
	24"	P2	0.010	-1.590						
CBT-B4	10"	P1	0.011	-1.579	-1.574	-1.574	-1.574	-1.574	-1.574	
	24"	P2	0.010	-1.579						
CBT-BB1	10"	P1	0.010	-1.690						
	24"	P2	0.010	-1.603	-1.607	-1.607	-1.606	-1.606	-1.606	
	-	PTT 1	0.031	-0.60						
	-	PTT 2	0.050	-0.60						

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของพื้นที่นั้นๆ
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by: สมชาย Date: 04/03/22

Check by: สมชาย Date: 04/03/22

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE Inches	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAG	VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.010	-1.587	-1.590	-1.590	-1.590	-1.590	-1.590	
	24"	P2	0.010	-1.587						
CBT-B3	10"	P1	0.010	-1.541	-1.541	-1.541	-1.541	-1.541	-1.541	
	24"	P2	0.010	-1.541						
CBT-B4	10"	P1	0.010	-1.563	-1.562	-1.562	-1.562	-1.562	-1.562	
	24"	P2	0.010	-1.563						
CBT-BB1	10"	P1	0.010	-1.592						
	24"	P2	0.010	-1.594						
	-	PTT 1	0.034	-0.573	-1.594	-1.594	-1.594	-1.594	-1.594	
	-	PTT 2	0.095	-0.593						
	10"	P1								Disconnected pipe line
	24"	P2								Disconnected pipe line

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของพื้นที่นั้นๆ
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by: สมชาย Date: 04/03/22

Check by: สมชาย Date: 04/03/22

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE INCHES	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAC	-VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.034	-1.560	-1.562	-1.560	-1.562	-1.562	-1.562	
	24"	P2	0.034	-1.569						
CBT-B3	10"	P1	0.162	-1.562	-1.506	-1.506	-1.530	-1.530	-1.530	
	24"	P2	0.197	-1.562						
CBT-B4	10"	P1	0.013	-1.560	-1.557	-1.557	-1.557	-1.557	-1.557	
	24"	P2	0.004	-1.550						
CBT-BB1	10"	P1	0.010	-1.560	-1.556	-1.556	-1.556	-1.556	-1.556	
	24"	P2	0.010	-1.558						
	-	PTT 1	0.049	0.569						
	-	PTT 2	0.089	0.569						

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของแท่งที่ฝัง
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by..... *[Signature]* Date 24/05/22

Check by..... *[Signature]* Date 24/05/22

PIPE TO SOIL POTENTIAL SURVEY RECORD SHEET

TEST BOX LOCATION	PIPE INCHES	TEST CABLE	ON-POTENTIAL		ANODE POTENTIAL (-VDC)					REMARK
			VAC	-VDC	A-1	A-2	A-3	A-4	A-5	
CBT-B2	10"	P1	0.007	-1.540	-1.545	-1.545	-1.545	-1.545	-1.545	
	24"	P2	0.009	-1.549						
CBT-B3	10"	P1	0.003	-1.549	-1.566	-1.565	-1.565	-1.565	-1.565	
	24"	P2	0.007	-1.549						
CBT-B4	10"	P1	0.007	-1.540	-1.567	-1.567	-1.567	-1.567	-1.567	
	24"	P2	0.007	-1.540						
CBT-BB1	10"	P1	0.003	-1.580	-1.543	-1.547	-1.543	-1.543	-1.543	
	24"	P2	0.009	-1.535						
	-	PTT 1	0.089	0.549						
	-	PTT 2	0.073	0.549						

Remark:

- > ผลของ DC ต้องไม่มากกว่า -0.850 โวลต์ โดยพิจารณาจาก IR drop ของแท่งที่ฝัง
- > ผลของ DC ต้องไม่น้อยกว่า -3.0 โวลต์
- > ผลของ AC โวลต์ต้องไม่มากกว่า 15 โวลต์

Survey by..... *[Signature]* Date 5/6/11

Check by..... *[Signature]* Date 5/6/22



COPY

ที่ DITT-L21138/KW.mw

วันที่ 8 พฤศจิกายน 2564

เรื่อง นำส่งรายงานผลการทดสอบและตรวจสอบถังบรรจุน้ำมัน ตามวาระ 1 ปี

เรียน อธิบดีกรมธุรกิจพลังงาน

- สิ่งที่ส่งมาด้วย 1. หนังสือส่งผลการทดสอบและตรวจสอบ DITT-L21138/KW.mw จำนวน 1 ฉบับ
 2. สำเนาหนังสือมอบอำนาจลงนามแทนกรรมการบริษัทฯ จำนวน 1 ฉบับ
 3. ผลการทดสอบและตรวจสอบ จำนวน 8 ชุด
 4. สำเนาหนังสือรับรองเป็นผู้ทดสอบและตรวจสอบ และสำเนาหนังสือรับรอง จำนวน 1 ชุด
 เป็นผู้ปฏิบัติงานเกี่ยวกับการทดสอบและตรวจสอบ
 5. สรุปผลการทดสอบและตรวจสอบ DITT-L21137/KW.mw จำนวน 1 ฉบับ

ตามที่บริษัท ดาคอน อินสเปกชัน เทคโนโลยี จำกัด (เลขประจำตัวผู้เสียภาษีอากร 0105539054961) สำนักงานเลขที่ 78/4-5 หมู่ 6 ถนนสุขุมวิท ตำบลบ้านฉาง อำเภอบ้านฉาง จังหวัดระยอง 21130 โดยได้รับการรับรองจากกรมธุรกิจพลังงานให้เป็นผู้ทดสอบ และตรวจสอบน้ำมัน ระดับที่ 3 แบบ ทส.น.2 เลขที่ พ.น.กพย.3-004/2564 ออกให้ ณ วันที่ 26 สิงหาคม 2564 ใช้ได้จนถึงวันที่ 19 กรกฎาคม 2567 แล้วนั้น

โดยทางบริษัทฯ ได้รับมอบหมายจากบริษัท คูเวตปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด ตั้งอยู่เลขที่ 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขลา อำเภอศรีราชา จังหวัดชลบุรี ให้ดำเนินการทดสอบและตรวจสอบถังบรรจุน้ำมัน ระบบท่อ และอุปกรณ์ ตามวาระ 1 ปี จำนวน 8 ถัง (รายละเอียดดังแนบ)

บัดนี้ การดำเนินการทดสอบและตรวจสอบดังกล่าว เสร็จเรียบร้อยแล้ว ทางบริษัทฯ จึงมีความประสงค์ที่จะขอส่งผลการทดสอบและตรวจสอบให้ทางท่านพิจารณาอนุมัติต่อไป

จึงเรียนมาเพื่อโปรดพิจารณาอนุมัติให้ทางบริษัทฯ ด้วย จะเป็นพระคุณยิ่ง

DACON INSPECTION TECHNOLOGIES CO., LTD.



ขอแสดงความนับถือ

ลงชื่อ.....

(นางสาวเขมรัตน์ วานิชปัญญ)

ผู้รับมอบอำนาจ

ชื่อผู้มาติดต่อ นางสาวมินตรา วงษ์วิราช

Email: mintra.wongwirat@dacon-inspection.com

โทรศัพท์ +66(0)33 012484-7 ต่อ 163 โทรสาร +66(0)33 012530



รายละเอียดการทดสอบ

สถานที่ทดสอบ : บริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด
 คลังน้ำมันตั้งอยู่เลขที่ 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขลา อำเภอศรีราชา จังหวัดชลบุรี

ลำดับ	หมายเลขถัง	เส้นผ่านศูนย์กลาง (มม.)	ความสูงของถัง (มม.)	ความจุ (ลิตร)	ปีที่เริ่มใช้ (พ.ศ.)	ชนิดน้ำมัน	หลังคา
1	CB-1	43.89	21.95	33,236,250	2538	High Speed Diesel	หลังคาติดตาย
2	CB-2	48.76	18.28	33,521,447	2538	High Speed Diesel	หลังคาติดตาย
2	CB-3	27.43	20.73	12,015,086	2538	JP-8	หลังคาติดตาย
4	CB-4	27.43	20.73	12,211,754	2538	JP-8	หลังคาติดตาย
5	CB-5	12.19	18.28	2,099,390	2538	High Speed Diesel	หลังคาติดตาย
6	CB-6	12.19	18.28	2,132,975	2538	High Speed Diesel	หลังคาติดตาย
7	CB-7	12.19	18.28	2,130,528	2538	High Speed Diesel	หลังคาติดตาย
8	CB-8	12.19	18.28	2,128,007	2538	High Speed Diesel	หลังคาติดตาย

ชื่อผู้ประกอบการ	Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานที่ประกอบกิจการ	Srinacha, Chonburi
ประเภทผลิตภัณฑ์/บริการ	CB-1
วันที่ลงนาม/ที่ทดสอบและตรวจควบคุมตัวการ	14 กุมภาพันธ์ 2021
ผู้ควบคุมและตรวจสอน (บริษัท)	Dacon Inspection Technologies Co., Ltd.
พนักงานวิศวกรทดสอบ	นายสิริวัตร แซ่ลิ้ว

ทดสอบและตรวจสัณฐานถึงกับน้ำมูกตามวาระ

- สรุปบทความปฏิบัติกาทดสอบและตรวจสอน

(นามตั้งกูร แห้วโจ้ว)
 น้ามน้ำใจตัวกรวดผดผน

(นางสาวเจนรัตน์ วาณิชกัญญา)
อธิบดีกรมการช่าง/ กรรมการบริหาร

(
អ្នកប្រកាស/អ្នកប្រកាស

ข้อมูลการตรวจสอน

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รวมการตรวจสอบสภาพโดยทั่วไปของดง

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2

ผลการตรวจสอบความถี่ของผนังถ้ำ

7

ผลการตรวจสอบการเทรดด้วยกองกำลัง

B

ผลการตรวจสอบระบบสามชั้นรอบค

13

DRAGON

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Noted:
Monitoring required on area where slight bulging at area of top shell course section.

Noted:

VISUAL INSPECTION

DAÇON

Inspection Information of Tank CB-1

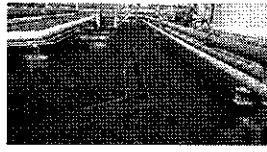
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สภาพของเขื่อน กำแพง หรือป้องกันน้ำนองคัน (Dike area, Bund wall and site drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการหกกระจาย รั่วซึม ของน้ำมัน บริเวณโดยรอบ

รูปภาพ

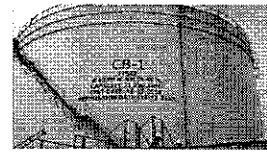


ข้อมูลแสดงรายละเอียด (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อมูลของถังชัดเจน

รูปภาพ

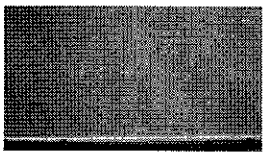
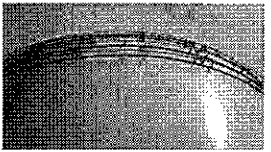


สภาพของสวิตช์ทากาน้ำมันก้นถัง

รายละเอียดและข้อสังเกต

สภาพโดยดีและมองเห็นถังรวมปกติ

รูปภาพ



VISUAL INSPECTION

DAÇON

Inspection Information of Tank CB-1

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อุปกรณ์(เครื่องวัดระดับน้ำมัน ถังวัดอุณหภูมิ ราน์ถังอุปกรณ์สัญญาณเตือนภัย (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

สภาพอุปกรณ์โดยรวมปกติ แต่พบว่ามีคราบสกปรกบริเวณ Flange ของ Nozzle ตรวจทำความสะอาดเพื่อป้องกันอันตรายที่เกิดสนิม

รูปภาพ

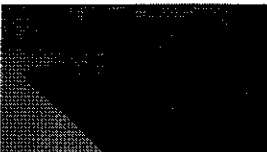


Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการหกกระจาย หรือ รั่วไหล ของน้ำมัน

รูปภาพ



อุปกรณ์ระบายไอน้ำมันแบบแรงดันสูญญากาศ(PV vent) และ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ สะอาดไม่พบสิ่งอุดตัน ไม่มีการรั่ว หรือเสียหาย

รูปภาพ



VISUAL INSPECTION

DAÇON

Inspection Information of Tank CB-1

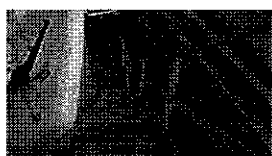
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บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

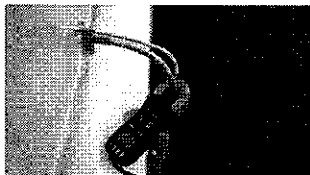


ระบบป้องกันสิ่งหล่นจากฟ้าผ่า หรือระบบสายดินรอบฐานถัง

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่หลวม หรือจุดเสียหายของจุดต่อ และค่าความต้านทานที่ผ่านได้ค่าน้อยกว่า 10 โอห์มของเกณฑ์ของระบบ

รูปภาพ

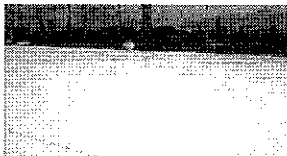


สภาพของหลังคาถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION

DAÇON

Inspection Information of Tank CB-1

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สภาพและความแข็งแรงของราวกับเหล็กบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

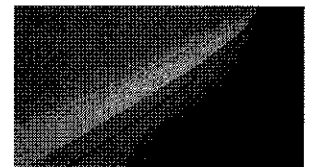
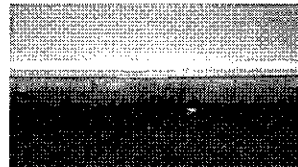


การรั่วซึมของน้ำมันข้างส่วนที่ติดกับถัง

รายละเอียดและข้อสังเกต

ถังติดตั้งส่วนป้องกันการไหลย้อนของน้ำมันเข้าสู่ใต้ถังด้วยการเชื่อมแผ่นเหล็กติดกับแนบพื้นถังส่วนที่ติดกับฐานควบคุมการไหล (Stop plate -Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ



ระบบท่อ นำ ท่อไอน้ำ และอุปกรณ์สำหรับดับเพลิงที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-1

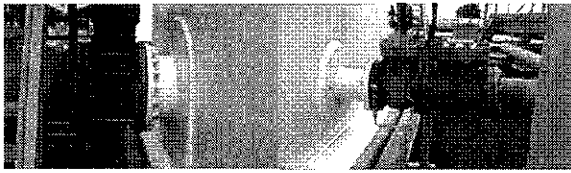
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เพื่อรับ รวบรวม และดูปลอกในบริเวณที่ผิดปกติ

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



Stiffener ring and top angle

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



ความเสียหายหรือความผิดปกติอื่นๆที่พบและแนะนำแก้ไข (ถ้ามี)

รายละเอียดและข้อสังเกต

ไม่มีรายงานความเสียหายเพิ่มเติม

รูปภาพ

ไม่มีรายงานความเสียหายเพิ่มเติม

SETTLEMENT EVALUATION

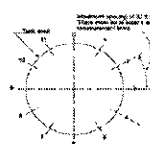


Inspection Information of Tank CB-1

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Inspection Principle

- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653 Paragraph 12.5 and B.2.1
- Number of measurement point as Indication by equation:
 $N = D/10$ when;
 N = Number of measurement points.
 D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.

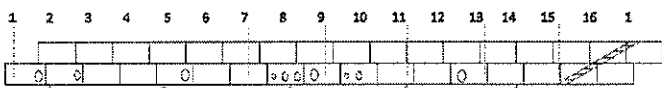


NOTE: These must be at least eight different points. The maximum location of the measurement points is at 8 points (in clockwise direction).

Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/ distance above or below reference level (mm)
1	8,618	0 / 137,090	2346
2	8,618	8,618	2349
3	8,618	17,236	2355
4	8,618	25,854	2351
5	8,618	34,472	2355
6	8,618	43,090	2353
7	8,618	51,708	2349
8	8,618	60,326	2349
9	8,618	68,944	2345
10	8,618	77,562	2343
11	8,618	86,180	2338
12	8,618	94,798	2341
13	8,618	103,416	2344
14	8,618	112,034	2346
15	8,618	120,652	2347
16	8,618	129,270	2344

Surveying location/Direction



PLUMBNESS TESTING



Inspection Information of Tank CB-1

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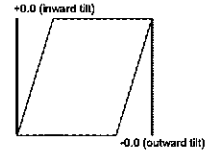
Inspection Principle

Tilt measurements were made at 8 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Test point	Measurement location Degree (°)	Measurement point		Deviations (mm)	Acceptance criteria H: 21.95 m	Result
		Bottom	Top			
1	0	27,052	27,072	20	Inward	Accepted
2	45	39,395	39,445	50	Inward	Accepted
3	90	37,889	37,896	7	Inward	Accepted
4	135	23,039	23,059	20	Inward	Accepted
5	180	31,007	31,015	8	Inward	Accepted
6	225	66,005	66,045	40	Inward	Accepted
7	270	74,813	74,878	65	Inward	Accepted
8	315	79,102	79,162	60	Inward	Accepted

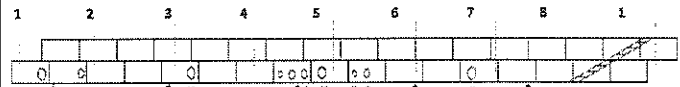
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slight deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



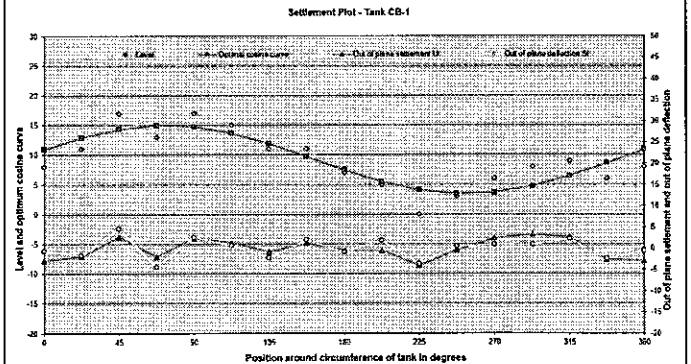
SETTLEMENT EVALUATION



Inspection Information of Tank CB-1

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Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Sub Para. B.3.2 - Shell Settlement

Calculation of Maximum Out of Plane Deflection

$$S \leq \frac{(L^2 \times Y \times 11)}{2(E \times H)}$$

Where:

S = Deflection (ft) 28.27 (Max. 32 feet)
 L = Arc length between measurement points (ft) 32.000 (Min Specified Yield Stress [ksi], API 653 Table 4.1)
 Y = Yield strength (ksi) 32,000
 E = Young's Modulus (ksi) 28,500,000 PSI ***ASME BPVC, I.D.C. - 2015 Table TM-1
 H = Tank Height (ft) 72.81 ft or 21.95 m

n = Number of measurement points 16

S = 0.0086 ft

S = 20.90 mm

API 653, Para B.2.2.4 - Determination of actual settlement

$$S = U_1 - (0.5U_1 + 1 \times 0.5U_2 + 1)$$

U₁ = 2.60

U₂ = 1.29

U₃ = 1.96

S = 4.61 mm

R² = 0.77

Predicted Deflection (mm) = 5.80 mm at 253 degrees clockwise from shell datum

Data concurrence (predicted vs. actual)

SETTLEMENT EVALUATION



Inspection Information of Tank CB-1

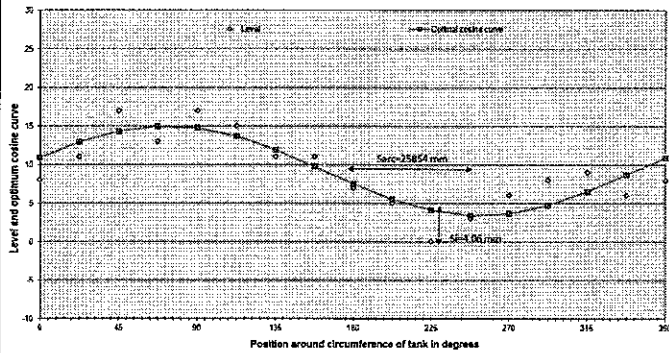
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Settlement Evaluation Note:

As specified in the API 653 Annex B – Evaluation of tank bottom settlement. A tank shell need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated r2 value of optimal cosine curve in this a report is lower than 0.90 (that specified at Clause B.2.2.4 the r2 shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.

Settlement Plot - Tank CB-1



SETTLEMENT EVALUATION



Inspection Information of Tank CB-1

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Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S-arc is effective settlement arc in mm 35854
 S-arc is effective settlement arc in feet 84.82
 D = Diameter in feet 144.00
 Y = Yield Strength (lb/in²) 32000 (Min Specified Yield Stress (lb/in²) Obtained from API653 Table 4.1)
 E = Young's Modulus (lb/in²) 28500000 (ASME BPV. II D-2015)
 H = Tank Height in feet 72.01
 K = coefficient 2.3

S_{max} 0.4385 in.

S_{max} 11.13 mm.

Assessment:

Acceptance per API 653			
The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2			
S _{max}	SI	Result	
11.13	4.05	Accepted	

$$S_{max,b} = \min \left[K' \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{Y}{E} \right), 4.0 \right]$$

Tank Diameter D	Open Top Tanks, K'	Fixed Roof Tanks, K'
D ≤ 50	24.7	10.5
50 < D ≤ 80	7.8	5.8
80 < D ≤ 120	6.5	3.9
120 < D ≤ 160	4.0	2.3
160 < D ≤ 240	3.6	Not applicable
240 < D ≤ 300	2.4	Not applicable
300 < D	Not applicable	Not applicable

where

S_{max, in} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION

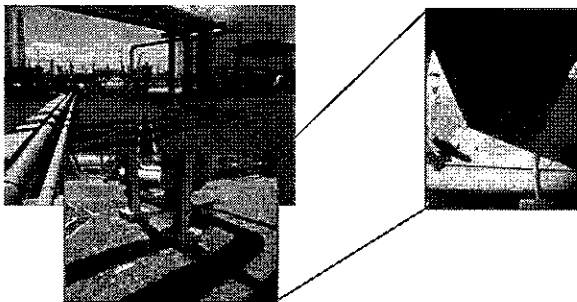
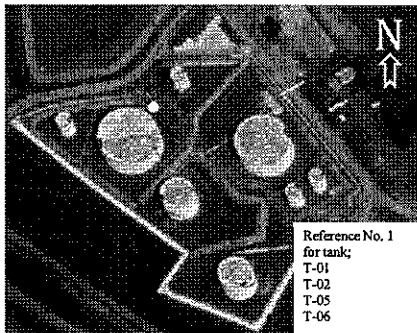


Inspection Information of Tank CB-1

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Reference Location, Temporary reference level

Location No. Point 1
 Area Description The reference point was marked on the support pipe.



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-1

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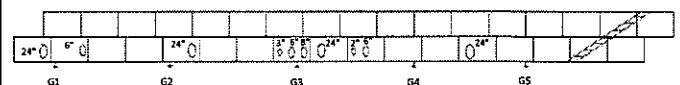
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	0.62	Accepted
2	1.40	Accepted
3	2.15	Accepted
4	1.53	Accepted
5	0.49	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOEB.

Measurement Layout





Certificates



API Individual Certification Programs verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2018-2019 (2019) Printed in the USA



Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Phone: (66) 0 3301 2484-7 Fax: (66) 0 3301 2530

Certificate of Verification

Equipment : Earth Ground Clamp
Manufacturer : HIOKI
Model : FT6380
Serial No. : 180808367
ID No. : FLS 36
Description : -
Customer : Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date : 17 June 2021
Calibration Date : 17 June 2021

Cert. No. : DIST111-2021
Page : Page 1 of 2

Environmental Conditions : Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure : According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments :

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by :
(Mr. Worawat Vacharatassanakul)
Issue Date : 17 June 2021

Approved by :
(Mr. David Kuakamchad)

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

Verification Results

Cert. No. : DIST111-2021
Page : 2 of 2

Result of Calibration : Without adjustment
Scale range : 0.02-1600 Ω
Resolution : 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (±)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria : Customer Required

Verification interval will very based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



THAI HEART CALIBRATION CO., LTD.
229/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer: DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA Model: CX-105
Serial No.: GS0728 ID No.: TE001064

Environmental Conditions: Ambient Temperature: $(20 \pm 1) ^\circ\text{C}$
Relative Humidity: $(55 \pm 15) \%$
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3

Received Date: 21 May 2021

Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by: Act as Technical Manager
Approved by: Representative of Managing Director

() (Krisyos K.) (x) (Sakda Y.) (Dr. Ekachai Puttittwong)
() (Patiphan K.) () (Onnapa P.)
() (Pongsak H.) () (Niruphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pranong P.) () (Noppol P.)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.



THAI HEART CALIBRATION CO., LTD.
229/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21 Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

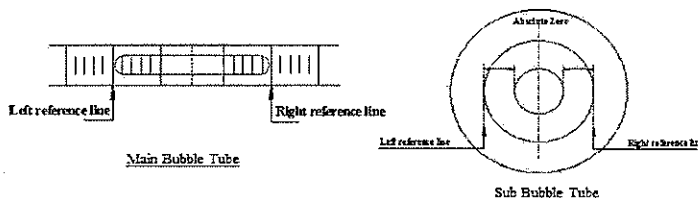
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -



THAI HEART CALIBRATION CO., LTD.
229/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.

- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinator	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by: Adisak
REV.02 26/01/53

F-029

แบบสรุปรายงานผลการทดสอบและตรวจสอบ
ถังเก็บน้ำมันและอุปกรณ์(ตามวาระประจำปี พ.ศ. ๒๕๖๔)

ชื่อผู้ประกอบการ	Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานประกอบการ	Sriracha, Chonburi
หมายเลขถังเก็บน้ำมัน	CB-2
วันที่ดำเนินการ ทดสอบและตรวจสอบความวาระ	14 ตุลาคม 2021
ผู้ทดสอบและตรวจสอบ (บริษัท)	Dacon Inspection Technologies Co., Ltd.
พนักงานวิศวกรทดสอบ	นางฉัตรพร แซ่โง้ว

๑.รายละเอียดของถังเก็บน้ำมันหมายเลข CB-2

เส้นผ่านศูนย์กลาง	48.76 เมตร
ความสูงถัง	18.28 เมตร
ความจุถังเก็บน้ำมัน	33,521,447 ลิตร
ชนิดของน้ำมัน	High Speed Diesel
อุปกรณ์ของถังเก็บน้ำมัน	วาล์วไฟฟ้า
ชนิดของถัง	ถังเก็บน้ำมันแบบฝัง
ชนิดของวัสดุ	เหล็กกล้าตีเกลียว
ชนิดของถัง	2539

ทดสอบและตรวจสอบถังเก็บน้ำมันตามวาระ

๑) การตรวจสอบการรั่วซึมและการสึกกร่อนของถังเก็บน้ำมัน และสภาพของถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	พบมีรอยร้าวเล็กน้อยบริเวณขอบของถังเก็บน้ำมัน
๒) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและระบบระบายน้ำ	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๓) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมัน อุปกรณ์ ระบบการระบายน้ำและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๔) ระบบระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๕) ระบบระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	ไม่มี (ถังเก็บน้ำมันแบบฝัง)
๖) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๗) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๘) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	ไม่มี (ถังเก็บน้ำมันแบบฝัง)
๙) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	ไม่มี (ถังเก็บน้ำมันแบบฝัง)
๑๐) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๑๑) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๑๒) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๑๓) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๑๔) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	
๑๕) อุปกรณ์การระบายน้ำจากถังเก็บน้ำมันและถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน	

- ตรวจการรั่วซึมของถังเก็บน้ำมันและถังเก็บน้ำมัน

ผู้ควบคุมการปฏิบัติงานทดสอบและตรวจสอบ

(นายฉัตรพร แซ่โง้ว) (นางสาวฉัตรพร แซ่โง้ว) (ผู้ประกอบกิจการ/ผู้แทน)

หัวหน้าวิศวกรทดสอบ (ผู้ควบคุมงานช่าง/กรรมการบริษัท)

EXTERNAL TANK INSPECTION REPORT

KUWAIT PETROLEUM AVIATION (THAILAND) LIMITED

SRIRACHA, CHONBURI

CB-2

Thursday, 14 October 2021

REPORT NO.2110012

INSPECTED BY

Dacon Inspection Technologies Company Limited

78/4-5 Moo 6, Sukhumvit Road
Ban Chang, 21130 Rayong
Thailand

Tel: 033-012-484-7
Fax: 033-012-530

INSPECTION TEAM

1. Mr. Thanapon	Suktam	API 653 INSPECTOR
2. Mr. Panpob	Nokaewboot	INSPECTION ENGINEER
3. Mr. Anut	Sawadee	INSPECTOR LEVEL II

API 653 Inspector : Mr. Thanapon Suktam

(ผู้ตรวจสอบการทดสอบและตรวจสอบ API-653)

Inspection Engineer : Mr. Panpob Nokaewboot

(วิศวกรตรวจสอบ)

Head of Inspection Engineer : Mr. Angkoon Sae-Ngow

(หัวหน้าวิศวกรตรวจสอบ)

Date : 14-Oct-21

Date : 14-Oct-21

Date : 14-Oct-21

สารบัญ	
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รายการตรวจสอบสภาพโดยทั่วไปของถัง	1
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TANK INSPECTION CHECKLIST

(FIXED ROOF)

Page No.: 1 of 13

Part/Component	Inspection checklist	Severity Status	Comment / Recommendation
		Level	
Tank label or Name plate	ไม่, กรณี, ไม่พบ (Not available/ade away or incorrect)	Major	
Tank compound	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Bund wall	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Site drainage system	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Foundation/Berm	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Bottom seal	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Protection of Bottom plate	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Shell to Bottom weld	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Earth Grounding	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Critical shell	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Shell nozzle and Manhole	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Shell plate and weld	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Stiffener ring/Wind girder	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Bottom drain valve and p	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Product pipe	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Valve	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
PSV or PRD	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Stairway and Handrail	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Stairway platform	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Roof handrail	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Fire water pipe	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Foam pipe	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Foam chamber	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Tank gauging & Transmitter	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Level/Temperature/Alarm	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Roof nozzle and Manhole	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Roof	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Dip hatch	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Rim Vent	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
PV Vent / Free Vent / Tank Bleeder	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Tank Settlement	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	
Tank plumbness	พบ, กรณี, ไม่พบ (Found, case, not found)	Minor	

Noted:
 Monitoring required on area where slight bulging at area of top shell course section.

VISUAL INSPECTION



Inspection Information of Tank CB-2

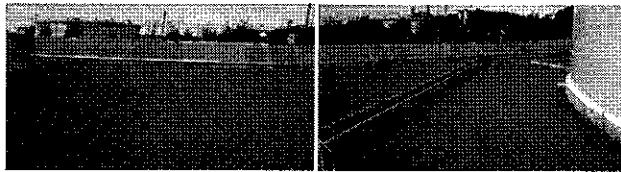
Page No.: 2 of 13

สภาพของเขื่อน กำแพง หรือปลวกกันน้ำพร้อมทั้ง (Dike area, Bund wall and sill drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทกรั่วซึม รั่วซึม ของน้ำใน บริเวณโดยรอบ

รูปภาพ

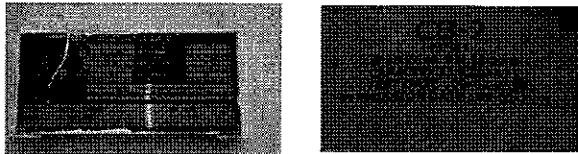


พิกัดแสดงรายละเอียด (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และพิกัดของถังน้ำ

รูปภาพ

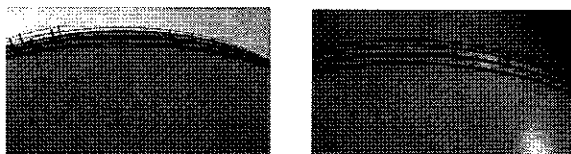


สภาพของฮีททาบบนถัง

รายละเอียดและข้อสังเกต

สภาพโดยทั่วไปและพิกัดของถังน้ำ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-2

Page No.: 3 of 13

อุปกรณ์เครื่องวัดระดับน้ำใน ถัง (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

อุปกรณ์โดยทั่วไปปกติ แต่พบว่ามีสิ่งสกปรกที่ Flange ของ Nozzle ควรทำความสะอาดเพื่อป้องกันเกิดสนิม

รูปภาพ

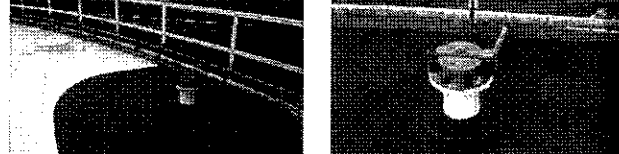


Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทกรั่วซึม หรือ รั่วไหล ของน้ำมัน

รูปภาพ



อุปกรณ์ระบายไอน้ำมันแบบแรงดันสูง (PV vent) หรือ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ สะอาด ไม่พบสิ่งสกปรก ไม่เสียหาย หรือเสียหาย

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-2

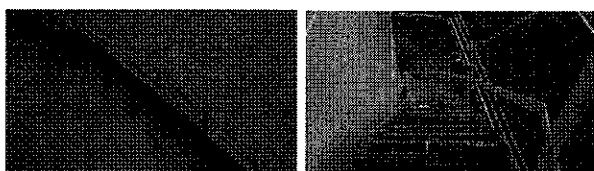
Page No.: 4 of 13

บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

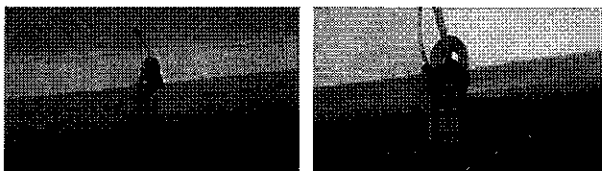


ระบบป้องกันอันตรายจากฟ้าผ่า หรือระบบสายล่อฟ้า

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่พบรอยร้าวหรือจุดอ่อนของวัสดุ และค่าความต้านทานที่อ่านได้พบว่าอยู่ในช่วงของเกณฑ์ยอมรับได้

รูปภาพ

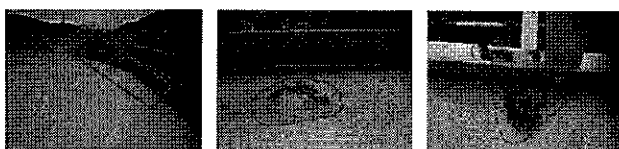


สภาพของหลังคา

รายละเอียดและข้อสังเกต

พบสีเคลือบผิวและสนิมเล็กน้อยบริเวณขอบของหลังคา ควรทำการทาสีเพื่อป้องกันเกิดสนิม

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-2

Page No.: 5 of 13

สภาพหลังคาและเชิงระฆังราวกับดักน้ำหลังคา (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

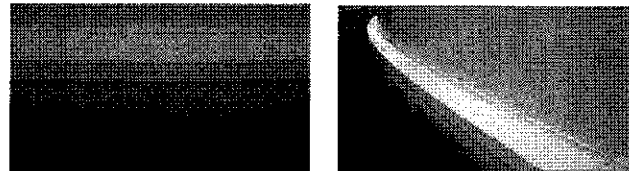


การจำแนกของพื้นผิววัสดุที่ติดตั้งกับพื้น

รายละเอียดและข้อสังเกต

ติดตั้งส่วนป้องกันการไหลของน้ำเข้าสู่ใต้พื้นหลังการเชื่อมแผ่นเหล็กติดกับแผ่นพื้นด้วยระบบการเชื่อม (Strip plate - Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ



ระบบท่อเข้า โซลิท และอุปกรณ์สำหรับดับเพลิงที่ติดตั้งกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



SETTLEMENT EVALUATION



Inspection Information of Tank CB-2

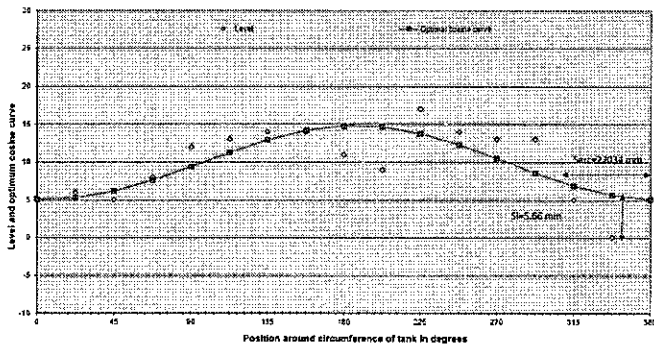
Page No.: 10 of 13

Settlement Evaluation Note:

As specified in the API 653 Annex B – Evaluation of tank bottom settlement. A tank shell need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated r2 value of optimal cosine curve in this report is lower than 0.90 (that specified at Clause B.2.2.4 the r2 shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.

Settlement Plot - Tank CB-2



SETTLEMENT EVALUATION



Inspection Information of Tank CB-2

Page No.: 11 of 13

Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc in mm
 S_{arc} is effective settlement arc in feet
 D = Diameter in feet
 Y = Yield Strength (lb/in²)
 E = Young's Modulus (lb/in²)
 H = Tank Height in feet
 K = coefficient

S_{max} 0.4883 in.

S_{max} 12.66 mm.

Assessment:

Acceptance per API 653			
The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2	S _{max}	SI	Result
	12.66	5.66	Accepted

$$S_{max} = \min \left[K \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{Y}{E} \right), 4.0 \right]$$

Tank Diameter D	Open Top Tanks, K	Fixed Roof Tanks, K
D ≤ 50	28.7	10.5
50 < D ≤ 80	7.8	5.8
80 < D ≤ 120	6.5	3.9
120 < D ≤ 160	4.0	2.3
160 < D ≤ 240	3.6	Not applicable
240 < D ≤ 300	2.4	Not applicable
300 < D	Not applicable	Not applicable

where

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION

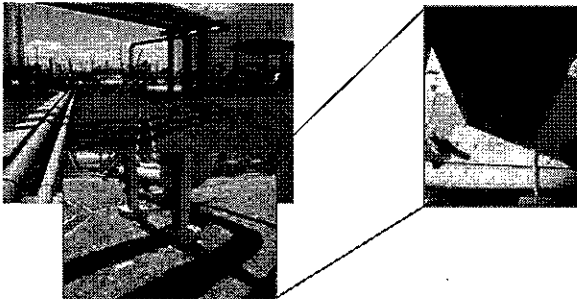
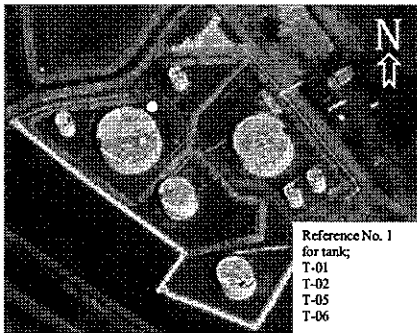


Inspection Information of Tank CB-2

Page No.: 12 of 13

Reference Location, Temporary reference level

Location No. Point 1
 Area Description The reference point was marked on the support pipe.



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-2

Page No.: 13 of 13

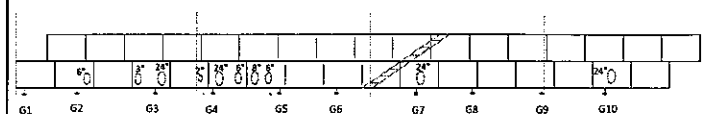
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	2.91	Accepted
2	2.34	Accepted
3	3.59	Accepted
4	5.46	Accepted
5	6.54	Accepted
6	5.94	Accepted
7	7.24	Accepted
8	5.57	Accepted
9	3.58	Accepted
10	2.64	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOEB.

Measurement Layout





Certificates



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2018-2019 (2018) Approved by USA

Dacon Inspection Technologies Co., Ltd. Tel: 033 001 5484-7 Fax: 033-012530
www.dacon-inspection.com info@dacon-inspection.com



Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Phone: (66) 0 3301 2484-7 Fax: (66) 0 3301 2530

Certificate of Verification

Equipment : Earth Ground Clamp
Manufacturer : HIOKI
Model : FT6380
Serial No. : 180808367
ID No. : FLS 36
Description : -
Customer : Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date : 17 June 2021
Calibration Date : 17 June 2021

Cert. No. : DIST111-2021
Page : Page 1 of 2

Environmental Conditions : Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure : According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments :

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by :
(Mr. Worawat Vatcharatassanakul)

Approved by :
(Mr. David Kuakanchad)

Issue Date : 17 June 2021

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

Verification Results

Cert. No. : DIST111-2021
Page : 2 of 2

Result of Calibration : Without adjustment
Scale range : 0.02-1600 Ω
Resolution : 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (±)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria : Customer Required

Verification interval will vary based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer: DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA Model: CX-105
Serial No.: GS0728 ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by

Act as Technical Manager

Approved by

Representative of Managing Director

() (Krisyos K.) (✓) (Sakda Y.)
() (Patiphan K.) () (Onnappa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Puttittong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

F-029

REV.02 26/01/53



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinometer	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by: Adisak

REV.02 26/01/53



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div.	Measured Value (mm/m)		Graduation Div.	Measured Value (mm/m)	
(Right)	Forward	Backward	(Left)	Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

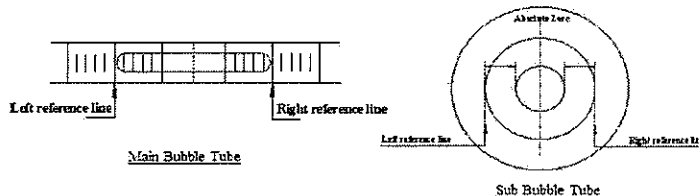
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div.	Measured Value (mm/m)		Graduation Div.	Measured Value (mm/m)	
(Right)	Forward	Backward	(Left)	Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

Calibrated by: Adisak

REV.02 26/01/53

F-029

แบบสรุปรายงานผลการทดสอบและตรวจสอบ
ถังเก็บน้ำมันและอุปกรณ์ตามวาระประจำปี พ.ศ. ๒๕๖๔

ชื่อผู้ประกอบการ	Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานประกอบการ	Sriracha, Chonburi
หมายเลขถังเก็บน้ำมัน	CB-3
วันที่สอบปี ทดสอบและตรวจตามวาระ	14 ตุลาคม 2021
ผู้ทดสอบและตรวจสอบ (บริษัท)	Dacon Inspection Technologies Co., Ltd.
เจ้าหน้าที่ควบคุมสอบ	นายณัฐกร แซ่โง้ว

๓. รายละเอียดของถังเก็บน้ำมันหมายเลข CB-3

เส้นผ่านศูนย์กลาง	27.43 เมตร
ความสูงถัง	20.73 เมตร
ความจุถังเก็บน้ำมัน	12,015,086 ลิตร
ชนิดถังเก็บน้ำมัน	JP-8
ประเภทของถังเก็บ	ถังไฟเบอร์กลาส
ชนิดของถัง	ถังเก็บน้ำมันแบบตั้ง
ชนิดของรหัสค่า	หลังคาปิดตาย
วันเดือนปี หรือ ปีที่ขึ้นไฟ	2538

ทดสอบและตรวจสอบถังเก็บน้ำมันตามวาระ

๑) การตรวจเช็คการรั่วซึมและการสึกกร่อนของถังเก็บ น้ำมัน ☒ ผ่าน ☐ ไม่ผ่าน

๒) สภาพภายนอกของถังเก็บน้ำมัน ☒ ผ่าน ☐ ไม่ผ่าน

๓) อุปกรณ์ป้องกันอันตรายจากไฟไหม้ อุปกรณ์ ระบบที่อุปกรณ์ป้องกันอันตรายจากไฟไหม้ ☒ ผ่าน ☐ ไม่ผ่าน

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ผู้ควบคุมการปฏิบัติงานทดสอบและตรวจสอบ

(นายณัฐกร แซ่โง้ว) (นางสาวณัฐกร แซ่โง้ว) (ผู้ประกอบกรรณ)

หัวหน้าวิศวกรทดสอบ ผู้ประเมินค่า/ การพิจารณา

DAICON

EXTERNAL TANK INSPECTION REPORT
KUWAIT PETROLEUM AVIATION (THAILAND) LIMITED
SRIRACHA, CHONBURI
CB-3

Thursday, 14 October 2021
REPORT NO. 2110012
INSPECTED BY
Dacon Inspection Technologies Company Limited

78/4-5 Moo 6, Sukhumvit Road
Ban Chang, 21130 Rayong
Thailand

Tel: 033-012-484-7
Fax: 033-012-530

INSPECTION TEAM

1. Mr. Thanapon Suktam API 653 INSPECTOR
2. Mr. Panpob Nokaewboot INSPECTION ENGINEER
3. Mr. Anut Sawadee INSPECTOR LEVEL II

API 653 Inspector : Mr. Thanapon Suktam Date : 14-Oct-21
(ผู้เขียนรายงานการทดสอบและตรวจสอบ API-653)

Inspection Engineer : Mr. Panpob Nokaewboot Date : 14-Oct-21
(วิศวกรตรวจสอบ)

Head of Inspection Engineer : Mr. Angkeon Sae-Ngow Date : 14-Oct-21
(หัวหน้าวิศวกรตรวจสอบ)

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TANK INSPECTION CHECKLIST
(FIXED ROOF)

DAICON

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Inspection Information of Tank CB-3		Inspection checklist		Severity Status		Comment / Recommendation
Part/Component	Anomalia	Level	N/A	Level	N/A	
Tank label or Name plate	ไม่มี, not visible, (not available) (fade away or obscured)					
Tank compound	วัชพืช, เติบโตจากถังเก็บน้ำมัน (weed growth, eas to flame)					
Roof wall	วัชพืช, เติบโตจากถังเก็บน้ำมัน (weed growth, eas to flame)					
Roof drainage system	ถังเก็บน้ำมัน (oil spillage, blockage)					
Foundation/Berm	ถังเก็บน้ำมัน (oil spillage, blockage)					
Bottom wall	ถังเก็บน้ำมัน (oil spillage, blockage)					
Projection of Bottom plate	ถังเก็บน้ำมัน (oil spillage, blockage)					
Shell to Bottom weld	ถังเก็บน้ำมัน (oil spillage, blockage)					
Earth Grounding	ถังเก็บน้ำมัน (oil spillage, blockage)					
Critical shell	ถังเก็บน้ำมัน (oil spillage, blockage)					
Shell nozzle and Manhole	ถังเก็บน้ำมัน (oil spillage, blockage)					
Shell plate and weld	ถังเก็บน้ำมัน (oil spillage, blockage)					
Stiffener ring/Wind girder	ถังเก็บน้ำมัน (oil spillage, blockage)					
Bottom drain valve and pip	ถังเก็บน้ำมัน (oil spillage, blockage)					
Product pipe	ถังเก็บน้ำมัน (oil spillage, blockage)					
Valves	ถังเก็บน้ำมัน (oil spillage, blockage)					
PSV or PRD	ถังเก็บน้ำมัน (oil spillage, blockage)					
Stairway and Handrail	ถังเก็บน้ำมัน (oil spillage, blockage)					
Stairway platform	ถังเก็บน้ำมัน (oil spillage, blockage)					
Roof handrail	ถังเก็บน้ำมัน (oil spillage, blockage)					
Fire water pipe	ถังเก็บน้ำมัน (oil spillage, blockage)					
Foam pipe	ถังเก็บน้ำมัน (oil spillage, blockage)					
Foam chamber	ถังเก็บน้ำมัน (oil spillage, blockage)					
Tank gauging & Transmitter (Level/Temperature/Alarm)	ถังเก็บน้ำมัน (oil spillage, blockage)					
Roof nozzle and Manhole	ถังเก็บน้ำมัน (oil spillage, blockage)					
Roof	ถังเก็บน้ำมัน (oil spillage, blockage)					
Dip hatch	ถังเก็บน้ำมัน (oil spillage, blockage)					
Rim Vent	ถังเก็บน้ำมัน (oil spillage, blockage)					
PV Vent / Free Vent / Tank Bleeder	ถังเก็บน้ำมัน (oil spillage, blockage)					
Tank Settlement	ถังเก็บน้ำมัน (oil spillage, blockage)					
Tank plumbness	ถังเก็บน้ำมัน (oil spillage, blockage)					

VISUAL INSPECTION



Inspection Information of Tank CB-3

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สภาพของเขื่อน คันพัง หรือป้องกันน้ำในรอนคัง (Dike area, Bund wall and side drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทรุดทรึงซึม ของน้ำใน บริเวณโดยรอบ

รูปภาพ



ชื่อและตราสัญลักษณ์ (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และปลอดภัยของถัง

รูปภาพ

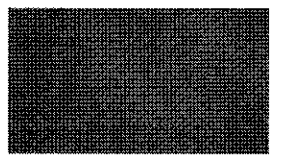
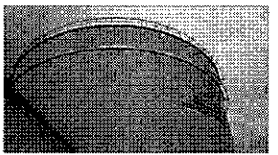


สภาพของถังภายในภายนอก

รายละเอียดและข้อสังเกต

สภาพโดยทั่วไปของถัง

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-3

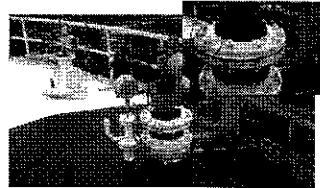
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อุปกรณ์วัดระดับ (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

สภาพอุปกรณ์โดยรวมนormal แต่พบสนิมเล็กน้อยที่ Flange ของ Nozzle ควรหาวิธีซ่อมแซมบริเวณที่เกิดสนิม

รูปภาพ

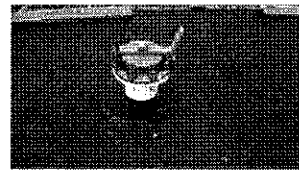


Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมนormal ไม่พบการทรุดทรึงซึม หรือ รั่วไหล ของน้ำมัน

รูปภาพ



อุปกรณ์ระบายไอน้ำมันแบบแรงดันสูง (PV vent) หรือ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

อุปกรณ์โดยรวมนormal ไม่พบสิ่งผิดปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-3

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บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมนormal ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

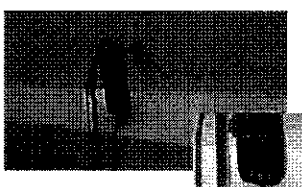
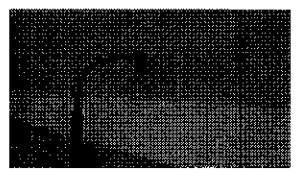


ระบบป้องกันอันตรายจากฟ้าผ่า หรือระบบสายดินรอบฐานถัง

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่พบจุดเสียหายของชุด และค่าความต้านทานที่อ่านได้พบว่ามีอยู่ในช่วงของเกณฑ์ที่ระบุไว้

รูปภาพ



สภาพของถังด้านล่าง

รายละเอียดและข้อสังเกต

สภาพโดยรวมนormal

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-3

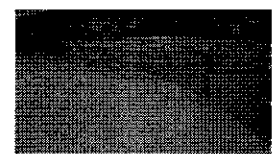
Page No.: 5 of 13

สภาพและตำแหน่งของราวกันตกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมนormal ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

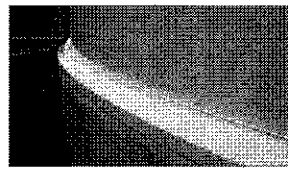
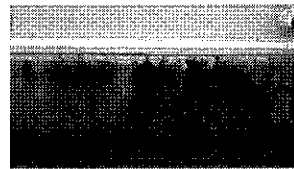


การรั่วซึมของถังด้านล่างที่ติดกับพื้นดิน

รายละเอียดและข้อสังเกต

ถังได้รับการป้องกันการไหลซึมของน้ำจากใต้ถังได้เป็นอย่างดีด้วยการเชื่อมแผ่นเหล็กปิดกั้นพื้นที่ด้านล่างโดยรอบฐานคอนกรีต (Ship plate -Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ

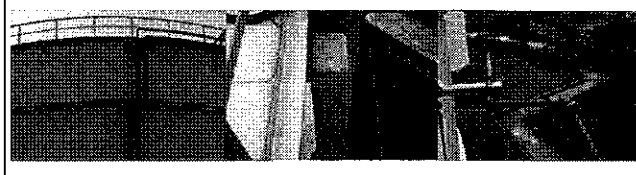


ระบบท่อปล่อยไอน้ำมัน และอุปกรณ์สำหรับดับเพลิงที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมนormal

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-3

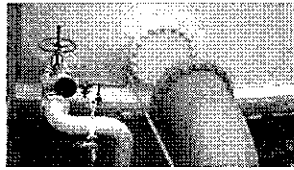
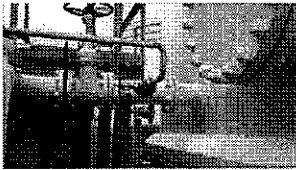
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พร้อม พร้อม และอุปกรณ์ในส่วนที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ

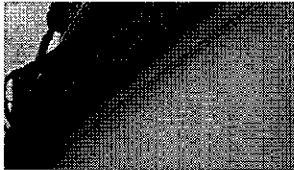
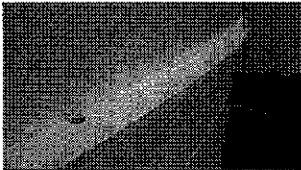


Stiffener ring and top angle

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



ความเสียหายหรือความผิดปกติที่พบและแนวโน้มน่าเป็นห่วง (ถ้ามี)

รายละเอียดและข้อสังเกต

ไม่มีรายงานความเสียหายเพิ่มเติม

รูปภาพ

ไม่มีรายงานความเสียหายเพิ่มเติม

PLUMBNESS TESTING



Inspection Information of Tank CB-3

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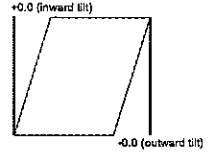
Inspection Principle

Tilt measurements were made at 10 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Test point	Measurement location Degree (°)	Measurement point		Deviations(mm.)	Acceptance criteria H: 20.73 m	Result
		Bottom	Top			
1	0 / 360	38,487	38,528	31	Inward	127
2	36	69,067	58,109	42	Inward	127
3	72	52,440	52,494	54	Inward	127
4	108	52,765	52,771	6	Inward	127
5	144	33,102	33,126	24	Inward	127
6	180	31,863	31,853	-10	Outward	127
7	216	37,404	37,418	14	Inward	127
8	252	25,653	25,668	15	Inward	127
9	288	25,658	25,672	14	Inward	127
10	324	43,276	43,270	-8	Outward	127

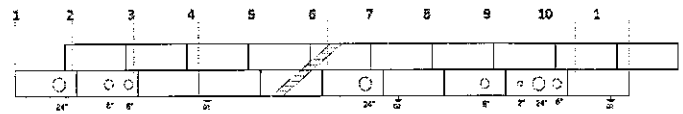
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slightly deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



SETTLEMENT EVALUATION

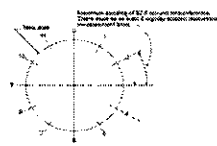


Inspection Information of Tank CB-3

Page No.: 8 of 13

Inspection Principle

- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653: Paragraph 12.5 and B.2.1
- Number of measurement point as indication by equation:
 $N = D/10$ when:
 N = Number of measurement points.
 D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.

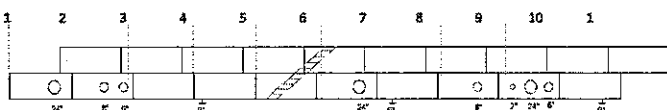


NOTE: - These results are based on the settlement analysis. For maximum, minimum of the settlement analysis, it is recommended to use the following formula:
 $M = 2.5 \times \frac{W}{L^2}$ where M = Maximum settlement, W = Weight of the tank, L = Length of the tank.

Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/distance above or below reference level (mm)
1	8,617	0/86174	3362
2	8,617	8,617	3364
3	8,617	17,235	3365
4	8,617	25,852	3359
5	8,617	34,470	3362
6	8,617	43,087	3358
7	8,617	51,704	3364
8	8,617	60,322	3363
9	8,617	68,939	3363
10	8,617	77,556	3360

Surveying location/Direction



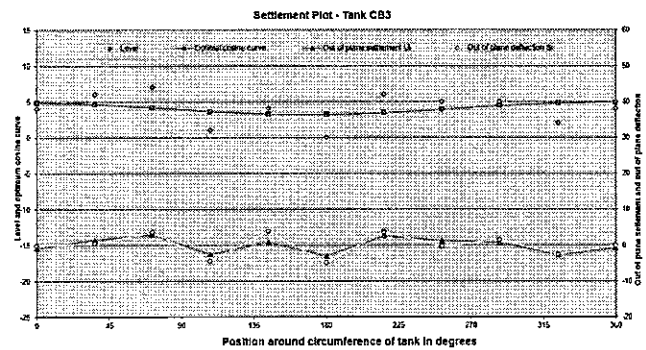
SETTLEMENT EVALUATION



Inspection Information of Tank CB-3

Page No.: 9 of 13

Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Sub Para. B.3.2 - Shell Settlement

Calculation of Maximum Out of Plane Deflection

$$S = \frac{(L^2 \times Y \times 11)}{2(E \times H)}$$

Where: S = Deflection (in) 28.27 (Max. 32 feet)
 L = Arc length between measurement points (ft) 30.000 (Min Specified Yield Stress (ksi/MPa), (API653 Table 4.1)
 Y = Yield strength (ksi/MPa) 28,500,000 PSI
 E = Young's Modulus (ksi/MPa) 29,000,000 PSI
 H = Tank Height (ft) 68.03 ft or 20.73 m
 n = Number of measurement points 10

$$S = \frac{0.6588 \times 11}{28.74 \text{ ksi}}$$

API 653, Para B.2.2.4 - Determination of actual settlement

$$S = U_1 \cdot (0.5U_1 + 1 + 0.5U_1 + 1)$$

$$U_1 = \frac{3.155}{0.771}$$

$$U_1 + 1 = 2.602$$

$$S = 4.658 \text{ mm}$$

$$R^2 = 0.08$$

Predicted deflection (mm) = 1.32 mm at 170 degrees clockwise from shell datum

SETTLEMENT EVALUATION



Inspection Information of Tank CB-3

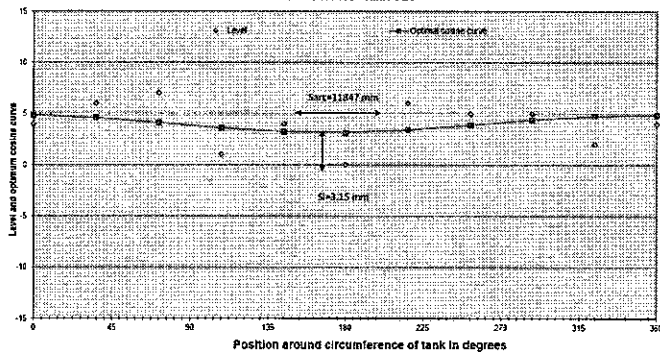
Page No.: 10 of 13

Settlement Evaluation Note:

As specified in the API 653 Annex B – Evaluation of tank bottom settlement. A tank shell need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated $r2$ value of optimal cosine curve in this report is lower than 0.90 (that specified at Clause B.2.2.4 the $r2$ shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.

Settlement Plot - Tank CB3



SETTLEMENT EVALUATION



Inspection Information of Tank CB-3

Page No.: 11 of 13

Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc in mm **11847**
 S_{arc} is effective settlement arc in feet **50.87**
 D = Diameter in feet **50.00**
 Y = Yield Strength (lb/in²) **30000** (Min Specified Yield Stress (lb/in²) Obtained from API653 Table 4.1)
 E = Young's Modulus (lb/in²) **28500000** (ASME BPV, II D-2010)
 H = Tank Height in feet **63.91**
 K = coefficient **3.9**

S_{max} 0.2112 in.

S_{max} 5.35 mm.

Assessment:

Acceptance per API 653

The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2

S_{max}	SI	Result
5.36	3.15	Accepted

$$S_{max} = \min \left[K \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{1}{D} \right), 4.0 \right]$$

Tank Diameter ft	Open Top Tanks, ft	Fixed Roof Tanks, ft
$D \leq 50$	22.7	10.5
$50 < D \leq 80$	7.8	5.8
$80 < D \leq 120$	6.5	3.9
$120 < D \leq 180$	4.0	2.3
$180 < D \leq 240$	3.6	Not applicable
$240 < D \leq 300$	2.4	Not applicable
$300 < D$	Not applicable	Not applicable

where

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION

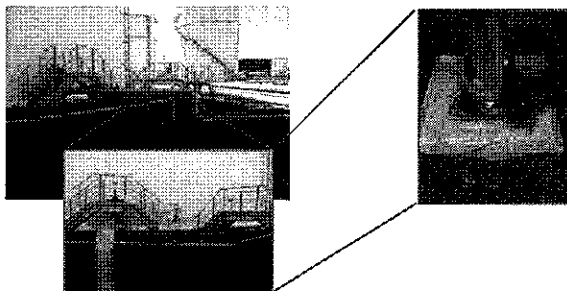
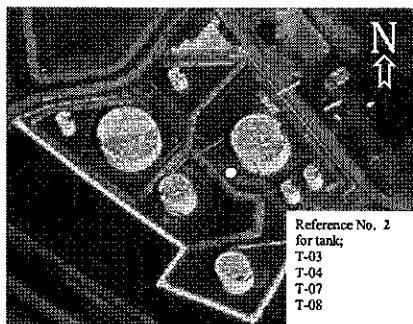


Inspection Information of Tank CB-3

Page No.: 12 of 13

Reference Location, Temporary reference level

Location No. Point 2
 Area Description The reference point was marked on the support fire water pipe basement.



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-3

Page No.: 13 of 13

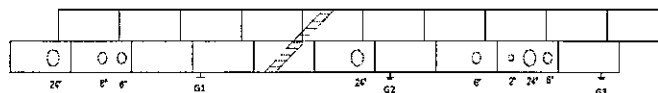
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	1.04	Accepted
2	0.84	Accepted
3	0.26	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOE.

Measurement Layout





Certificates



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2019-2561 (ICP) Printed in the USA



Certificate of Verification

Equipment : Earth Ground Clamp
Manufacturer : HIOKI
Model : FT6380
Serial No. : 180808367
ID No. : FLS 36
Description : -
Customer : Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date : 17 June 2021
Calibration Date : 17 June 2021

Cert. No. : DIST111-2021
Page : Page 1 of 2

Environmental Conditions : Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure : According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments :

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST1127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by :
(Mr. Worawat Vatcharattassanakul)

Approved by :
(Mr. David Kuakamchad)

Issue Date : 17 June 2021

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

Verification Results

Cert. No. : DIST111-2021
Page : 2 of 2

Result of Calibration : Without adjustment
Scale range : 0.02-1600 Ω
Resolution : 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (Ω)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria : Customer Required

Verification interval will vary based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment Survey Camera (Theodolite)
Manufacturer SOKKIA **Model** CX-105
Serial No. GS0728 **ID No.** TE001064

Environmental Conditions Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location Dimension Laboratory 3
Received Date 21 May 2021
Calibration Date 22 May 2021

Date of Issue 24 May 2021

Checked by

Act as Technical Manager

Approved by

Representative of Managing Director

() (Krisyosi K.) (✓) (Sakda Y.)
() (Patiphan K.) () (Onnappa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Prumong P.) () (Noppol P.)

(Dr. Ekachai Puttittong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

F-029



Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinator	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by Adisak

REV.02 26/01/53

F-029



Certificate No.: S0-2105006/21

Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

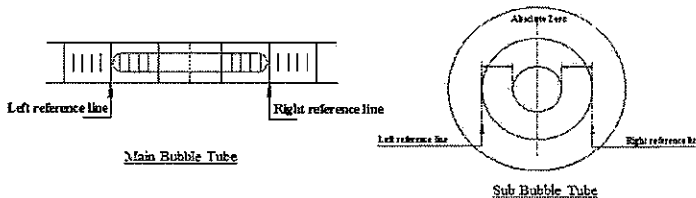
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

Calibrated by Adisak

REV.02 26/01/53

F-029

VISUAL INSPECTION



Inspection Information of Tank CB-4

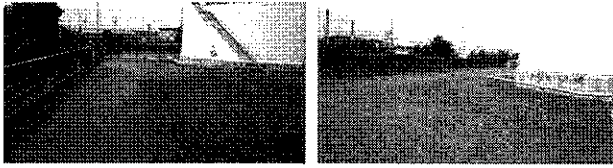
Page No.: 2 of 13

สภาพของเขื่อน กำแพง บริเวณใกล้กับกำแพงกันน้ำ (Dike area, Bund wall and site drainage system)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบการทรุดทรึง ร้าวซึม ของน้ำขึ้น บริเวณโดยรอบ

รูปภาพ

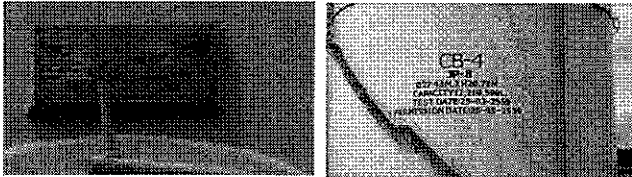


ข้อมูลสแตมป์และชื่อถัง (Tank name plate and label)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ และระบุชื่อของถังชัดเจน

รูปภาพ

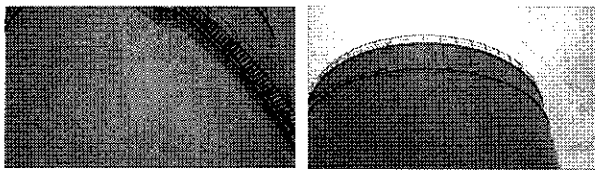


สภาพของอีทีทากาบลอกหนึ่งถัง

รายละเอียดและข้อสังเกต:

สภาพโดยดีและมองเห็นถังรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-4

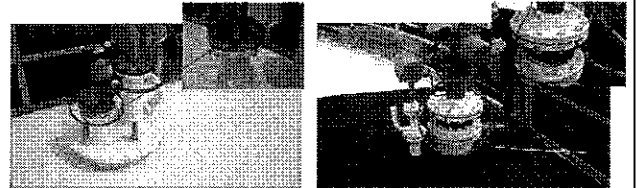
Page No.: 3 of 13

อุปกรณ์เครื่องวัดระดับน้ำใน ถัง (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต:

สภาพอุปกรณ์โดยรวมปกติ แต่พบสนิมเล็กน้อยบริเวณ Flange ของ Nozzle ตรวจพบสีของน้ำมันบริเวณที่ติดตั้ง

รูปภาพ

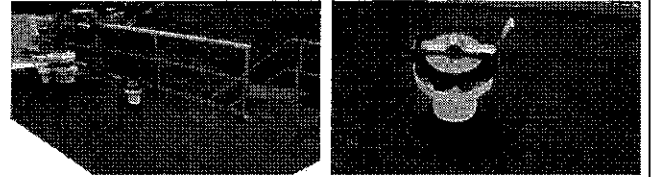


Product sample hatch

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบการทรุดทรึง หรือ ร้าวซึม ของน้ำมัน

รูปภาพ

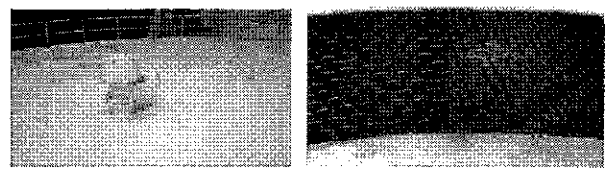


อุปกรณ์ระบายไอน้ำในแบบแรงดันสูญญากาศ (PV vent) หรือ อุปกรณ์ระบายไอน้ำ (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต:

อยู่ในสภาพปกติและตรวจพบไม่พบสิ่งอุดตัน

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-4

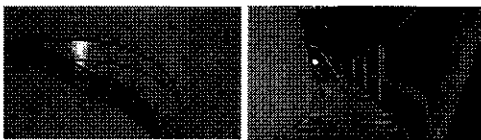
Page No.: 4 of 13

บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

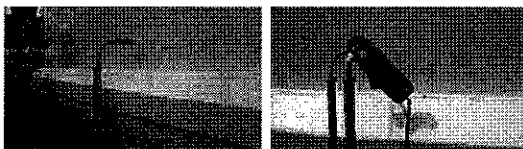


ระบบป้องกันอันตรายจากฟ้าผ่า เนื่องจากระบบสายดินรอบฐานถัง

รายละเอียดและข้อสังเกต:

สภาพทั่วไป แข็งแรง ไม่พบสนิมหรือจุดเสียหายของจุดต่อ และค่าความต้านทานที่อ่านได้พบว่าอยู่ในช่วงของเกณฑ์ที่ยอมรับได้

รูปภาพ

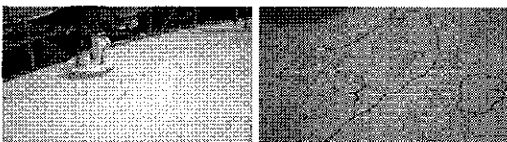


สภาพของหลังคาถัง

รายละเอียดและข้อสังเกต:

พบสีเสื่อมสภาพเล็กน้อย

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-4

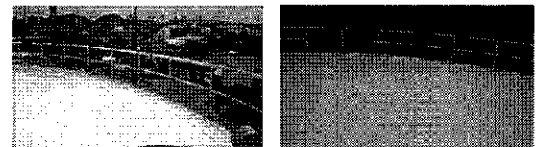
Page No.: 5 of 13

สภาพและตารางเชิงแรงของราวกับดกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

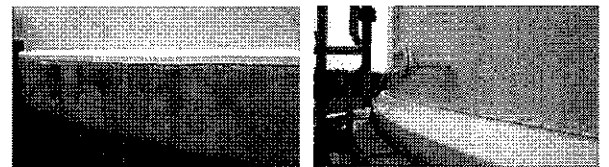


การรั่วซึมของผนังชั้นล่างถังที่ติดตั้งค้ำถัง

รายละเอียดและข้อสังเกต:

ถังติดตั้งส่วนป้องกันการไหลของน้ำเข้าสู่ใต้พื้นถังด้วยการเชื่อมเหล็กค้ำถังแผ่นพื้นถังส่วนนี้โดยรอบฐานถังและปิด (Strip plate -Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ



ระบบให้น้ำ หรือ โฟม และอุปกรณ์สำหรับดับเพลิงที่ติดตั้ง

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-4

Page No.: 6 of 13

ภาพรวมของถังและอุปกรณ์ที่เกี่ยวข้อง

ภาพโดยรวมปกติ

รูปภาพ

Stiffener ring and top angle

ภาพโดยรวมปกติ

รูปภาพ

ภาพเขียนหรือความผิดปกติอื่นๆที่พบและบันทึกไว้ (ถ้ามี)

ภาพโดยรวมปกติ

รูปภาพ

ภาพเขียนหรือความผิดปกติอื่นๆที่พบและบันทึกไว้ (ถ้ามี)

PLUMBNESS TESTING



Inspection Information of Tank CB-4

Page No.: 7 of 13

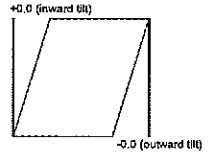
Inspection Principle

Tilt measurements were made at 10 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Measurement location	Measurement point	Deviations(mm.)	Acceptance criteria	Result
Test point	Degree (°)	Bottom	Top	
1	0/360	63,663	63,593	30 Inward 127 Accepted
2	36	27,284	27,264	-20 Outward 127 Accepted
3	72	34,111	34,144	33 Inward 127 Accepted
4	108	23,021	23,046	25 Inward 127 Accepted
5	144	19,863	19,913	50 Inward 127 Accepted
6	180	24,691	24,736	45 Inward 127 Accepted
7	216	25,112	25,162	50 Inward 127 Accepted
8	252	36,098	37,010	12 Inward 127 Accepted
9	288	33,161	33,181	20 Inward 127 Accepted
10	324	66,061	66,105	44 Inward 127 Accepted

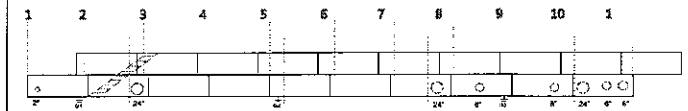
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slightly deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



SETTLEMENT EVALUATION

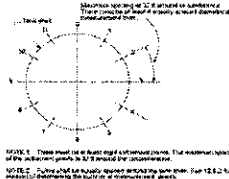


Inspection Information of Tank CB-4

Page No.: 8 of 13

Inspection Principle

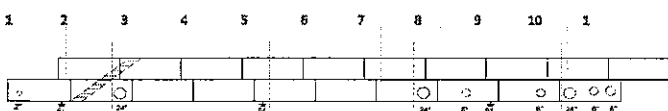
- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653 Paragraph 12.5 and B.2.1
- Number of measurement point as indication by equation:
 $N = D/10$ when;
 N = Number of measurement points.
 D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.



Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/ distance above or below reference level (mm)
1	8,617	0/86174	3328
2	8,617	8,617	3322
3	8,617	17,235	3319
4	8,617	25,852	3315
5	8,617	34,470	3318
6	8,617	43,087	3324
7	8,617	51,704	3323
8	8,617	60,322	3320
9	8,617	68,939	3324
10	8,617	77,556	3327

Surveying location/Direction



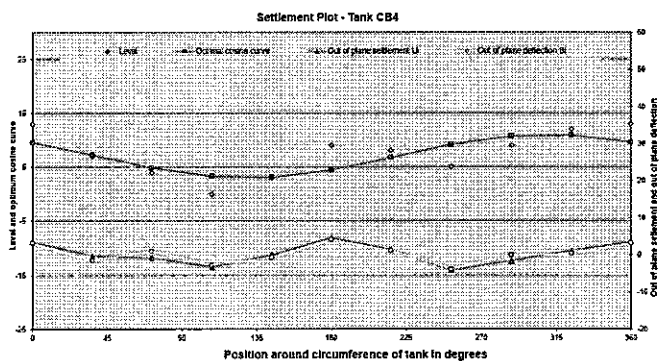
SETTLEMENT EVALUATION



Inspection Information of Tank CB-4

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Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Sub Para. B.3.2 - Shell Settlement

Calculation of Maximum Out of Plane Deflection

$$S = \frac{(L^2 \times Y \times 1)}{2(E \times H)}$$

Where: S = Deflection (ft) 28.27 (Max. 32 feet)
 L = Arc length between measurement points (ft) 30,000 (Min Specified Yield Stress (ksi): (API653 Table 4.1)
 Y = Yield strength (ksi) 28,500,000 PSI ***ASME BPVC II D.C - 2015 Table TM-1
 E = Young's Modulus (ksi) 68,900 R or 20.73 m
 H = Tank Height (ft) 10

$$S = \frac{(L^2 \times Y \times 1)}{2(E \times H)}$$

API 653, Para B.2.2.4 - Determination of actual settlement

$$S = U \times (0.5U + 1)$$

$$U = \frac{S}{0.5U + 1}$$

$$U = \frac{S}{0.5U + 1}$$

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SETTLEMENT EVALUATION



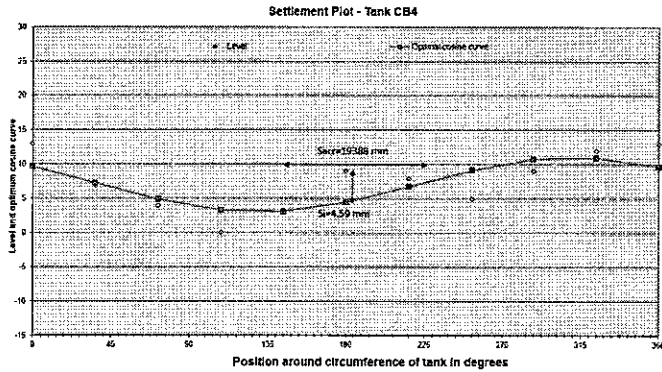
Inspection Information of Tank CB-4

Page No.: 10 of 13

Settlement Evaluation Note:

As specified in the API 653 Annex B – Evaluation of tank bottom settlement. A tank shall need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated r2 value of optimal cosine curve in this report is lower than 0.90 (that specified at Clause B.2.2.4 the r2 shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.



SETTLEMENT EVALUATION



Inspection Information of Tank CB-4

Page No.: 11 of 13

Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc in mm
 S_{arc} is effective settlement arc in feet
 D = Diameter in feet
 Y = Yield Strength (lb/in²)
 E = Young's Modulus (lb/in²)
 H = Tank Height in feet
 K = coefficient

S_{max} 0.3455 in.

S_{max} 8.78 mm.

Assessment:

Acceptance per API 653			
The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2			
S_{max}	SI	Result	
8.78	4.59	Accepted	

$$S_{max} = \min \left[K \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{Y}{E} \right), 4.0 \right]$$

Tank Diameter, ft	Open Top Tanks, ft	Fixed Roof Tanks, ft
$D \leq 50$	23.7	10.5
$50 < D \leq 80$	7.8	5.8
$80 < D \leq 120$	6.5	3.9
$120 < D \leq 180$	4.0	2.3
$180 < D \leq 240$	3.6	Not applicable
$240 < D \leq 300$	2.4	Not applicable
$300 < D$	Not applicable	Not applicable

where

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION



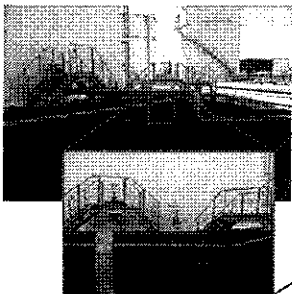
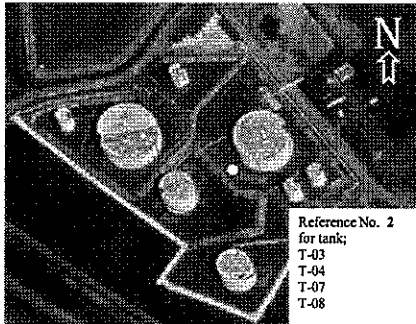
Inspection Information of Tank CB-4

Page No.: 12 of 13

Reference Location, Temporary reference level

Location No. Point 2
 Area Description The reference point was marked on the support fire water pipe basement.

CB-4



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-4

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Inspection Data

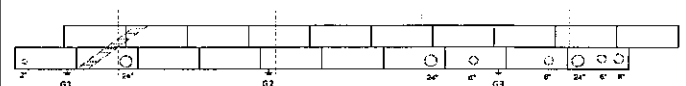
Grounding No.	Resistance to Ground (Ω)	Note
1	0.22	Accepted
2	1.10	Accepted
3	0.31	Accepted

CB-4

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOEB.

Measurement Layout





Certificates

Dacon Inspection Technologies Co., Ltd. Tel (66) 0 3301 2484-7 Fax (66) 0 3301 2530
www.dacon-inspection.com

DAICON Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Phone: (66) 0 3301 2484-7 Fax: (66) 0 3301 2530

Certificate of Verification

Equipment : Earth Ground Clamp
Manufacturer : HIOKI
Model : FT6380
Serial No. : 180808367
ID No. : FLS 36
Description : -
Customer : Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date : 17 June 2021
Calibration Date : 17 June 2021

Cert. No. : DIST111-2021
Page : Page 1 of 2

Environmental Conditions : Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure : According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments :

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by :
(Mr. Worawat Vatcharatassanakul)
Issue Date : 17 June 2021
Approved by :
(Mr. David Kuakamehad)

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2018-2019 ICP Printed in the USA

Verification Results

Cert. No. : DIST111-2021
Page : 2 of 2

Result of Calibration : Without adjustment
Scale range : 0.02-1600 Ω
Resolution : 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (Ω)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria : Customer Required

Verification interval will vary based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



THAI HEART CALIBRATION CO., LTD.
229/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer: DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA Model: CX-105
Serial No.: GS0728 ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by

Act as Technical Manager

Approved by

Representative of Managing Director

() (Krisyosi K.) (✓) (Sakda Y.)
() (Patiphan K.) () (Onnasa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Puttittong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.



THAI HEART CALIBRATION CO., LTD.
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Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinator	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by: Adisak
REV.02 26/01/53

F-029



THAI HEART CALIBRATION CO., LTD.
229/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

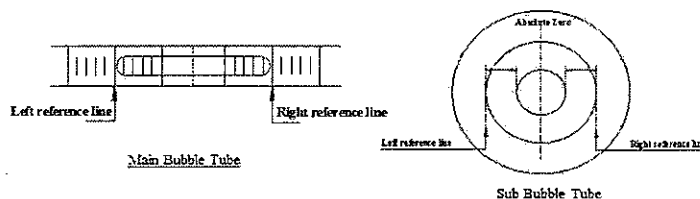
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k=2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

Calibrated by: Adisak
REV.02 26/01/53

F-029

แบบสุ่มรายงานผลการทดสอบและตรวจสอบ
ถังเก็บน้ำมันและอุปกรณ์ตามวาระประจำปี พ.ศ. ๒๕๖๔

ชื่อผู้ประกอบกิจการ: Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานประกอบการ: Sriracha, Chonburi
หมายเลขถังเก็บน้ำมัน: CB-5
วันที่เดือนปี ที่ทดสอบและตรวจสอบตามวาระ: 15 ตุลาคม 2021
ผู้ทดสอบและตรวจสอบ (บริษัท): Dacon Inspection Technologies Co., Ltd.
หัวหน้าวิศวกรทดสอบ: นายสิริกร แซ่โล้ว

๑. รายละเอียดของถังเก็บน้ำมันหมายเลข CB-5

เส้นผ่านศูนย์กลาง	12.19 เมตร
ความสูง/ยาว	18.28 เมตร
ความจุถังเก็บน้ำมัน	2,099,390 ลิตร
ชนิดของน้ำมัน	High Speed Diesel
ประเภทของน้ำมัน	น้ำมันอากาศยาน
ชนิดของถัง	ถังเก็บน้ำมันแบบฝัง
ชนิดของถัง	เหล็กกล้าตีเกลียว
วันที่เดือนปี หรือ ปีที่เก็บไว้	2538

ทดสอบและตรวจสอบถังเก็บน้ำมันตามวาระ:

๓) การตรวจสอบการรั่วซึมและการสึกกร่อนของถังเก็บน้ำมัน และสภาพรอยเชื่อมตามปกติ ☒ ผ่าน ☐ ไม่ผ่าน

๔) อุปกรณ์ป้องกันความดันเกินและระบบความปลอดภัย ☒ ผ่าน ☐ ไม่ผ่าน

๕) อุปกรณ์ป้องกันความดันเกินและระบบความปลอดภัย ☒ ผ่าน ☐ ไม่ผ่าน

๖) ระบบระบายน้ำจากถังเก็บน้ำมัน ☒ ผ่าน ☐ ไม่ผ่าน

๗) ระบบระบายน้ำจากถังเก็บน้ำมัน ☒ ผ่าน ☐ ไม่ผ่าน

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ผู้ควบคุมการปฏิบัติงานทดสอบและตรวจสอบ

(นายสิริกร แซ่โล้ว) (นางสาวเจนนิเฟอร์ วานิชญ์) ()
หัวหน้าวิศวกรทดสอบ ผู้ประเมินรายงาน/ กรรมการบริษัท ผู้ประกอบการ/ผู้ถือ

DACON

EXTERNAL TANK INSPECTION REPORT
KUWAIT PETROLEUM AVIATION (THAILAND) LIMITED
SRIRACHA, CHONBURI
CB-5



Friday, 15 October 2021
REPORT NO.2110012
INSPECTED BY
Dacon Inspection Technologies Company Limited

784-5 Moo 6, Sukhumvit Road Tel: 033-012-484-7
Ban Chang, 21130 Rayong Fax: 033-012-530
Thailand

INSPECTION TEAM

1. Mr. Thanapon Suktam API 653 INSPECTOR
2. Mr. Pannob Nokawboot INSPECTION ENGINEER
3. Mr. Anul Sawadee INSPECTOR LEVEL II

API 653 Inspector : Mr. Thanapon Suktam Date : 15-Oct-21
(ผู้ประเมินการทดสอบและตรวจสอบ API 653)

Inspection Engineer : Mr. Pannob Nokawboot Date : 15-Oct-21
(วิศวกรตรวจสอบ)

Head of Inspection Engineer : Mr. Angkoon Sae-Ngow Date : 15-Oct-21
(หัวหน้าวิศวกรตรวจสอบ)

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TANK INSPECTION CHECKLIST (FIXED ROOF)

Inspection Information of Tank CB-5

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Part/Component	Inspection checklist	Severity Status	Comment / Recommendation
	Anomalies	Level	N/A
Tank label or Name plate	ไม่มี, ไม่พบ, ไม่พบ (Not available / Not found)		
Tank compound	พบ, ไม่พบ (Found / Not found)		
Band wall	พบ, ไม่พบ (Found / Not found)		
Site drainage system	พบ, ไม่พบ (Found / Not found)		
Foundation/Berm	พบ, ไม่พบ (Found / Not found)		
Bottom seal	พบ, ไม่พบ (Found / Not found)		
Projection of Bottom plate	พบ, ไม่พบ (Found / Not found)		
Shell to Bottom weld	พบ, ไม่พบ (Found / Not found)		
Earth Grounding	พบ, ไม่พบ (Found / Not found)		
Critical shell	พบ, ไม่พบ (Found / Not found)		
Shell nozzle and Manhole	พบ, ไม่พบ (Found / Not found)		
Shell plate and weld	พบ, ไม่พบ (Found / Not found)		
Stiffener ring/Wind girder	พบ, ไม่พบ (Found / Not found)		
Bottom drain valve and pipe	พบ, ไม่พบ (Found / Not found)		
Product pipe	พบ, ไม่พบ (Found / Not found)		
Valves	พบ, ไม่พบ (Found / Not found)		
PSV or PRD	พบ, ไม่พบ (Found / Not found)		
Stairway and Handrail	พบ, ไม่พบ (Found / Not found)		
Stairway platform	พบ, ไม่พบ (Found / Not found)		
Roof handrail	พบ, ไม่พบ (Found / Not found)		
Fire water pipe	พบ, ไม่พบ (Found / Not found)		
Foam pipe	พบ, ไม่พบ (Found / Not found)		
Foam chamber	พบ, ไม่พบ (Found / Not found)		
Tank gauging & Transmitter (Level/Temperature/Alarm)	พบ, ไม่พบ (Found / Not found)		
Roof nozzle and Manhole	พบ, ไม่พบ (Found / Not found)		
Roof	พบ, ไม่พบ (Found / Not found)		
Dip hatch	พบ, ไม่พบ (Found / Not found)		
Rim Vent	พบ, ไม่พบ (Found / Not found)		
PV Vent / Free Vent / Tank Bleeder	พบ, ไม่พบ (Found / Not found)		
Tank Settlement	พบ, ไม่พบ (Found / Not found)		
Tank plumbness	พบ, ไม่พบ (Found / Not found)		

VISUAL INSPECTION



Inspection Information of Tank CB-5

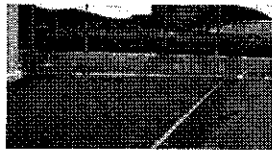
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สภาพของเขื่อน กำแพง หรือปลวกเก็บกักน้ำในรอนคัง (Dike wall and site drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทรุดทรึง รุ่ยพัง ของน้ำขึ้น บริเวณโดยรอบ

รูปภาพ



ชื่อและตราของถัง (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อสังเกตของถัง

รูปภาพ

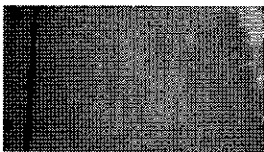
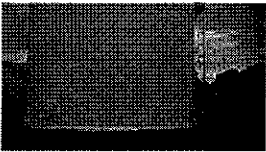


สภาพของลิ้นชักระบายของถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อสังเกตของถัง

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-5

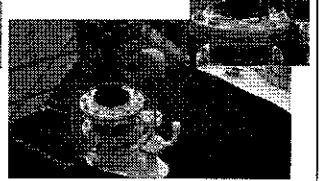
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อุปกรณ์วัดระดับหรือระดับน้ำใน ถัง (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

สภาพอุปกรณ์วัดระดับหรือระดับน้ำใน ถัง (Tank gauging, Thermo gauge and level alarm)

รูปภาพ



Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทรุดทรึง หรือ รุ่ยพัง ของน้ำขึ้น

รูปภาพ

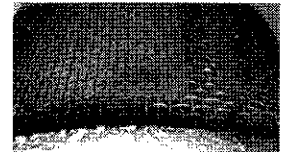


อุปกรณ์ระบายน้ำในแบบเร่งด่วนฉุกเฉิน (PV vent) หรือ อุปกรณ์ระบายน้ำใน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อสังเกตของถัง

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-5

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บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ



ระบบป้องกันอันตรายจากฟ้าผ่า หรือระบบสายดินระบบฐานถัง

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่พบจุดอันตรายหรือจุดเสี่ยงของจุดต่อ และค่าความต้านทานที่อ่านได้พบว่ามีอยู่ในช่วงของเกณฑ์ที่ยอมรับได้

รูปภาพ

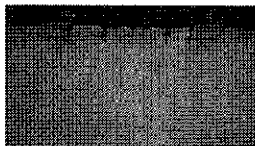
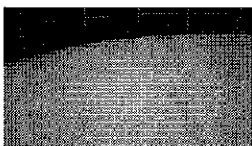


สภาพของถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-5

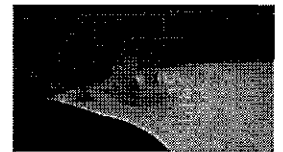
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สภาพและความแข็งแรงของราวกันตกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

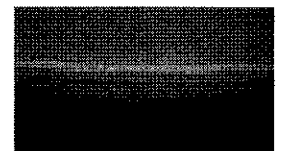
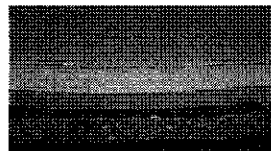


การรั่วซึมของของเหลวจากส่วนที่ติดกับพื้นถัง

รายละเอียดและข้อสังเกต

ถังได้รับการป้องกันไม่ให้น้ำหรือของเหลวซึมเข้าสู่ถังโดยผ่านการเชื่อมแผ่นที่ติดกับพื้นถังโดยตลอดจนการปิดผนึก (Ship plate -Bottom sealed, Permanantly prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ



ระบบท่อส่ง หรือท่อ และอุปกรณ์ส่วนสลับที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-5

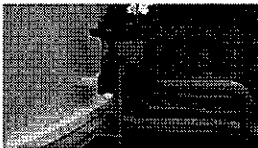
Page No.: 6 of 13

ภาพรวมของถังและอุปกรณ์ที่เกี่ยวข้อง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



Stiffener ring and top angle

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



การประเมินหาแนวหรือความผิดปกติอื่นๆที่พบและแนะนำให้แก้ไข (ถ้ามี)

รายละเอียดและข้อสังเกต

ไม่มีรายงานความเสียหายเพิ่มเติม

รูปภาพ

ไม่มีรายงานความเสียหายเพิ่มเติม

PLUMBNESS TESTING



Inspection Information of Tank CB-6

Page No.: 7 of 13

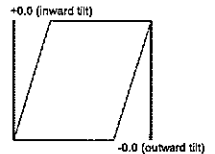
Inspection Principle

Tilt measurements were made at 8 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Measurement location		Measurement point		Deviations(mm.)		Acceptance criteria	Result
Test point	Degree (°)	Bottom	Top			H : 18.28 m	
1	0 / 360	25769	25788	19	Inward	127	Accepted
2	45	24821	24833	12	Inward	127	Accepted
3	90	27302	27308	6	Inward	127	Accepted
4	135	16268	16271	3	Inward	127	Accepted
5	180	17833	17805	-28	Outward	127	Accepted
6	225	12244	12248	5	Inward	127	Accepted
7	270	10183	10183	-10	Outward	127	Accepted
8	315	11671	11663	-8	Outward	127	Accepted

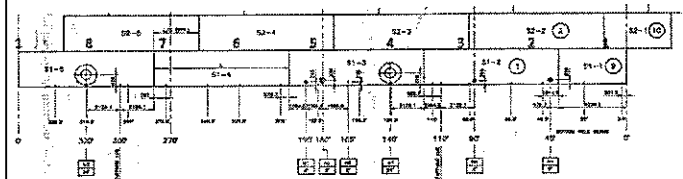
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slightly deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



SETTLEMENT EVALUATION

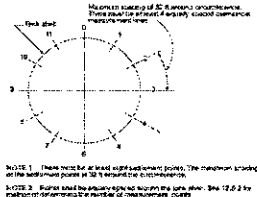


Inspection Information of Tank CB-5

Page No.: 8 of 13

Inspection Principle

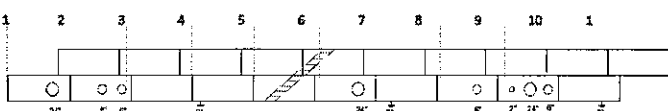
- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653 Paragraph 12.5 and B.2.1
- Number of measurement point as indication by equation:
 $N = D/10$ when:
 N = Number of measurement points.
 D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.



Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/ distance above or below reference level (mm)
1	4,787	0 / 38,323	3022
2	4,787	4,787	3024
3	4,787	9,574	3021
4	4,787	14,361	3018
5	4,787	19,148	3020
6	4,787	23,935	3018
7	4,787	28,722	3023
8	4,787	33,509	3022

Surveying location/Direction



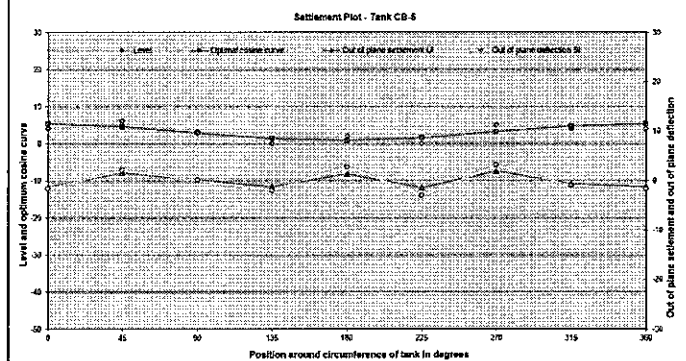
SETTLEMENT EVALUATION



Inspection Information of Tank CB-5

Page No.: 9 of 13

Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Sub Para. B.3.2 - Shell Settlement

Calculation of Maximum Out of Plane Deflection

$$S = \frac{(L^2 \times Y \times 11)}{2(E \times H)}$$

Where:

- S = Deflection (ft)
- L = Arc length between measurement points (ft)
- Y = Yield strength (ksi)
- E = Young's Modulus (ksi)
- H = Tank Height (ft)
- n = Number of measurement points

15.71 (Max. 32 feet)
 30,000 (Min Specified Yield Stress (ksi)); (API653 Table 4.1)
 29,500,000 PSI
 59.92 ft or 18.28 m

n = 8
 S = 0.0238 ft
 S = 7.26 mm

API 653, Para B.2.2.4 - Determination of actual settlement

$$S_U = (1 - 0.5U) \times 1 + 0.5U \times 1$$

$$U_n = -1.50$$

$$U_1 = 1.27$$

$$U_2 = 1.85$$

$$S_U = -3.06 mm$$

$$R^2 = 0.61$$

Predicted deflection (ft) = 6.82 mm at 175 degrees clockwise from shell datum

SETTLEMENT EVALUATION



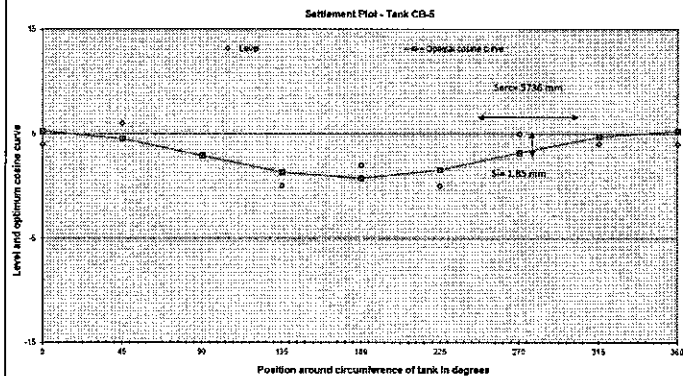
Inspection Information of Tank CB-5

Page No.: 10 of 13

Settlement Evaluation Note

As specified in the API 653 Annex B – Evaluation of tank bottom settlement. A tank shall need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated r2 value of optimal cosine curve in this report is lower than 0.90 (that specified at Clause B.2.2.4 the r2 shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.



SETTLEMENT EVALUATION



Inspection Information of Tank CB-5

Page No.: 11 of 13

Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S-arc is effective settlement arc in mm: 18.82
 S-arc is effective settlement arc in feet: 0.745
 D = Diameter in feet: 40.00
 Y = Yield Strength (ksi/in²): 30000 (Min Specified Yield Stress [ksi/in²] Obtained from API 653 Table 4.1)
 E = Young's Modulus (ksi/in²): 29000000 (ASME BPV, II D-2015)
 H = Tank Height in feet: 59.97
 K = coefficient: 10.5

S_{max} 0.1367 in.

S_{max} 3.52 mm.

Assessment:

Acceptance per API 653			
The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2	S _{max}	R1	Result
	3.52	1.85	Accepted

$$S_{max} = \min \left[K \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{Y}{E} \right), 4.0 \right]$$

Tank Diameter ft	Open Top Tanks, ft	Fixed Roof Tanks, ft
D ≤ 50	28.7	10.5
50 < D ≤ 80	7.8	5.8
80 < D ≤ 120	6.5	3.9
120 < D ≤ 180	4.0	2.3
180 < D ≤ 240	3.8	Not applicable
240 < D ≤ 300	2.4	Not applicable
300 < D	Not applicable	Not applicable

where

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION

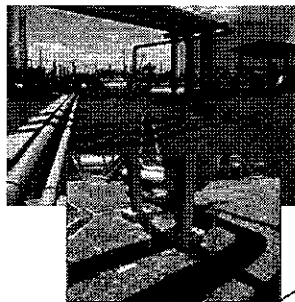
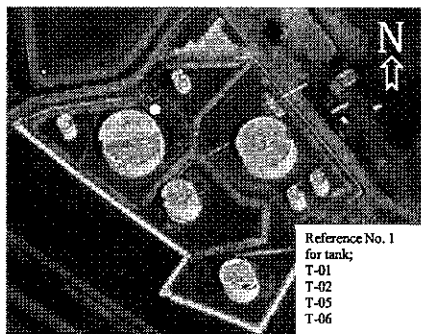


Inspection Information of Tank CB-5

Page No.: 12 of 13

Reference Location, Temporary reference level

Location No. Point 1
 Area Description The reference point was marked on the support pipe.



Noted: Reference location here is just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-6

Page No.: 13 of 13

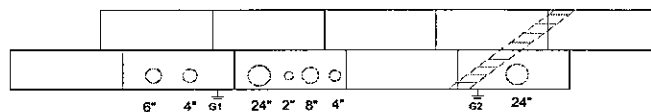
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	2.35	Accepted
2	2.57	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOEB.

Measurement Layout





Certificates



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2019-2021 (USA) Printed in the USA



Certificate of Verification

Equipment : Earth Ground Clamp
Manufacturer : HIOKI
Model : FT6380
Serial No. : 180808367
ID No. : FLS 36
Description : -
Customer : Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date : 17 June 2021
Calibration Date : 17 June 2021

Cert. No. : DIST111-2021
Page : Page 1 of 2

Environmental Conditions : Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure : According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments :

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by :
(Mr. Worawat Vatcharattassanakul)

Approved by :
(Mr. David Kuakamchad)

Issue Date : 17 June 2021

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

Verification Results

Cert. No. : DIST111-2021
Page : 2 of 2

Result of Calibration : Without adjustment
Scale range : 0.02-1600 Ω
Resolution : 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (t)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria : Customer Required

Verification interval will very based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer: DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA Model: CX-105
Serial No.: GS0728 ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by

Act as Technical Manager

Approved by

Representative of Managing Director

() (Krisyos K.) () (Sakda Y.)
() (Patiphan K.) () (Onnana P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Putitwong)

This calibration certificate shall not be reproduced, stored, transmitted or used in any form without the prior written approval of the Thai Heart Calibration Co., Ltd.

F-029

REV.02 26/01/53



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21 Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

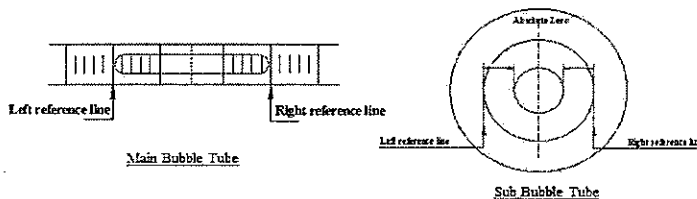
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

Calibrated by Adisak

REV.02 26/01/53

F-029



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinometer	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by Adisak

REV.02 26/01/53

F-029

แบบสรุปรายงานผลการทดสอบและตรวจซ่อม
ถังเก็บน้ำมันและอุปกรณ์ตามวาระประจำปี พ.ศ. ๒๕๖๔
ชื่อผู้ประกอบกิจการ: Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานประกอบการ: Sriracha, Chonburi
หมายเลขถังเก็บน้ำมัน: CB-6
วันที่สอบ: 15 ตุลาคม 2021
ผู้ทดสอบและตรวจซ่อม (บริษัท): Dacon Inspection Technologies Co., Ltd.
ช่างนำตัวรถทดสอบ: นายสิริกร แซ่โจ้ว

รายละเอียดของถังเก็บน้ำมันตามแบบ CB-6
เส้นผ่านศูนย์กลาง: 12.19 เมตร
ความสูง/ยาว: 18.28 เมตร
ความจุถังเก็บน้ำมัน: 2,132,975 ลิตร
ชนิดของน้ำมัน: High Speed Diesel
ประเภทของน้ำมัน: ไร้ไฟฟ้าน้ำมันกลาง
ชนิดของถัง: ถังเก็บน้ำมันแนวนอน
ชนิดของพื้ผิว: เหล็กเคลือบด้วย
วันที่สอบปี หรือ ปีที่เก็บไว้: 2538
ทดสอบและตรวจซ่อมถังเก็บน้ำมันตามวาระ
1) การตรวจพิจารณาวัชพืชและการขึ้นของสิ่งมีชีวิต: ผ่าน
2) อุปกรณ์ยึดตรึง: ผ่าน
3) อุปกรณ์เคลื่อนย้าย: ผ่าน
4) ระบบระบายน้ำจากถัง: ผ่าน
5) ระบบระบายน้ำจากถัง: ผ่าน
6) การไหลเวียนของน้ำมัน: ผ่าน
7) การไหลเวียนของน้ำมัน: ผ่าน
8) การไหลเวียนของน้ำมัน: ผ่าน
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12) การไหลเวียนของน้ำมัน: ผ่าน
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34) การไหลเวียนของน้ำมัน: ผ่าน
35) การไหลเวียนของน้ำมัน: ผ่าน
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100) การไหลเวียนของน้ำมัน: ผ่าน

EXTERNAL TANK INSPECTION REPORT
KUWAIT PETROLEUM AVIATION (THAILAND) LIMITED
SRIRACHA, CHONBURI
CB-6
Friday, 15 October 2021
REPORT NO.2110012
INSPECTED BY
Dacon Inspection Technologies Company Limited
78/4-5 Moo 8, Sukhumvit Road Tel: 033-012-484-7
Ban Chang, 21130 Rayong Fax: 033-012-5330
Thailand
INSPECTION TEAM
1. Mr. Thanapon Suktam API 653 INSPECTOR
2. Mr. Panpob Nokaewboot INSPECTION ENGINEER
3. Mr. Anut Sawadee INSPECTOR LEVEL II
API 653 Inspector : Mr. Thanapon Suktam Date : 15-Oct-21
Inspection Engineer : Mr. Panpob Nokaewboot Date : 15-Oct-21
Head of Inspection Engineer : Mr. Angkoon Sae-Ngow Date : 15-Oct-21

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TANK INSPECTION CHECKLIST (FIXED ROOF)

Part/Component	Inspection checklist	Severity Status	Level	Comment / Recommendation
Tank label or Name plate	ไม่พบ, ไม่ชัดเจน/ไม่อ่านได้/หายไป/ไม่ถูกต้อง	Major	N/A	
Tank compound	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Blind wall	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Site drainage system	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Foundation/Berm	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Bottom seal	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Projection of Bottom plate	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Shell to Bottom weld	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Earth Grounding	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Critical shell	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Shell nozzle and Manhole	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Shell plate and weld	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Stiffener ring/Wind girder	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Bottom drain valve and pipe	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Product pipe	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Valves	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
PSV or PRD	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Stairway and Handrail	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Stairway platform	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Roof handrail	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Fire water pipe	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Foam pipe	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Foam chamber	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Tank gauging & Filling pipe	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Roof nozzle and Manhole	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Roof	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Dip hatch	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Rim Vent	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
PV Vent / Free Vent / Tank Bleder	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Tank Settlement	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	
Tank pumbers	พบ, ไม่พบ/พบเล็กน้อย/พบมาก/พบมาก	Minor	N/A	

VISUAL INSPECTION



Inspection Information of Tank CB-6

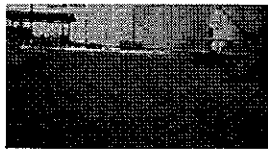
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สภาพของเขื่อน กำแพง หรือป้อมป้องกันน้ำนอง (Dike area, Bund wall and site drainage system)

รายละเอียดและข้อสังเกต:

สภาพโดยรอบปกติ ไม่พบการหกกระจาย รั่วซึม ของน้ำมัน บริเวณโดยรอบ

รูปภาพ



ข้อมูลสัณฐานและชื่อถัง (Tank name plate and label)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ และระบุชื่อถังชัดเจน

รูปภาพ

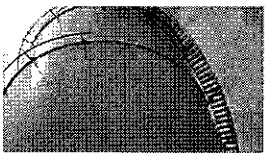
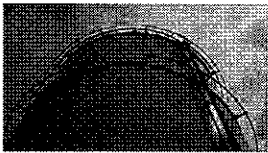


สภาพของลิ้นชักภายนอกถังหนึ่งตัว

รายละเอียดและข้อสังเกต:

สภาพโดยปกติ และไม่มีสิ่งอุดตัน

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-6

Page No.: 3 of 11

อุปกรณ์ตรวจสอบระดับของเหลว (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต:

พบสิ่งผิดปกติบริเวณ Flange ตรวจหาสิ่งผิดปกติบริเวณที่เกิดสนิม

รูปภาพ



Product sample hatch

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบการหกกระจาย หรือ รั่วไหล ของน้ำมัน

รูปภาพ



อุปกรณ์ระบายไอน้ำมันแบบแรงดันสูงฉุกเฉิน (PV vent) หรือ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ตรวจไม่พบสิ่งอุดตัน ไม่ผิดปกติ หรือเสียหาย

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-6

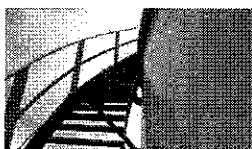
Page No.: 4 of 11

บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

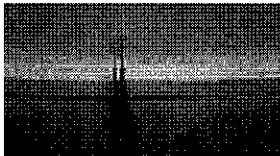


ระบบป้องกันอันตรายจากฟ้าผ่า หรือระบบสายดินรอบฐานถัง

รายละเอียดและข้อสังเกต:

สภาพทั่วไป แข็งแรง ไม่หลวม หรือจุดเสียหายของจุดต่อ และค่าความต้านทานที่ผ่านได้พบว่าอยู่ในช่วงของเกณฑ์ที่ยอมรับได้

รูปภาพ

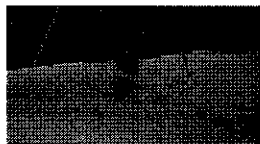


สภาพของหลังคาถัง

รายละเอียดและข้อสังเกต:

พบสิ่งผิดปกติที่ขอบของหลังคาถัง ตรวจหาสิ่งผิดปกติบริเวณที่เกิดสนิม

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-6

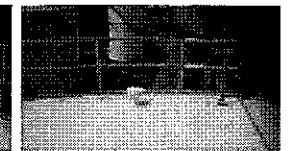
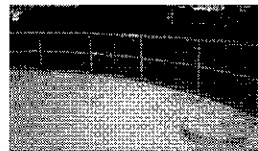
Page No.: 5 of 11

สภาพและความแข็งแรงของราวกันตกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

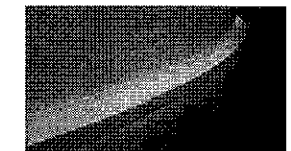
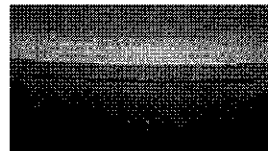


การจำแนกของพื้นชั้นล่างส่วนที่ติดกับพื้นถัง

รายละเอียดและข้อสังเกต:

สังเกตเห็นส่วนที่ติดกับพื้นถังของน้ำมันใต้ถังที่ติดกับพื้นถังที่ติดกับพื้นถังที่ติดกับพื้นถัง (Strip plate - Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ

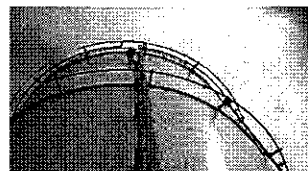


ระบบท่อน้ำ ท่อไอน้ำ และอุปกรณ์สำหรับดับเพลิงที่ติดกับถัง

รายละเอียดและข้อสังเกต:

สภาพโดยรวมปกติ

รูปภาพ



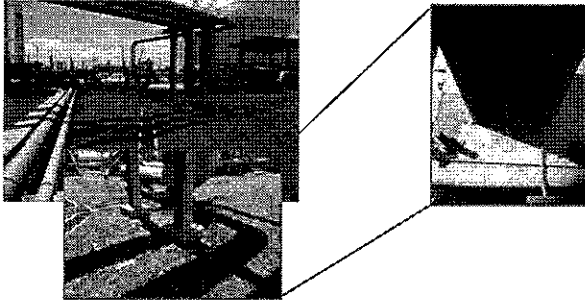
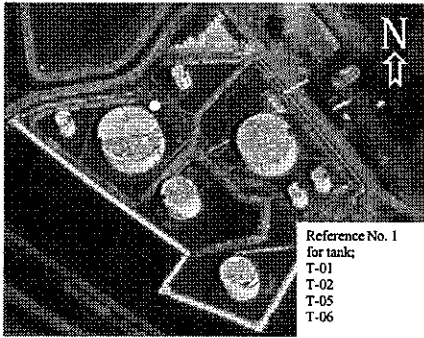
SETTLEMENT EVALUATION **DAÇON**

Inspection Information of Tank CB-6

Page No.: 10 of 11

Reference Location, Temporary reference level

Location No. Point 1
Area Description The reference point was marked on the support pipe.



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT **DAÇON**

Inspection Information of Tank CB-6

Page No.: 11 of 11

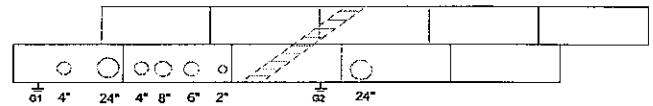
Inspection Date

Grounding No.	Resistance to Ground (Ω)	Note
1	2.35	Accepted
2	2.28	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOE.

Measurement Layout



Kuwait Petroleum Aviation (Thailand) Limited
Tank Inspection
External Tank
Location: Sriracha, Chonaburi

Report: 2110012_Rev.00

Certificates



AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

[Signature]

Manager, Individual Certification Programs



2019-237-2014 Printed in the USA 1-800-393-6644

Certificate of Verification

Equipment: Earth Ground Clamp
Manufacturer: HIOKI
Model: FT6380
Serial No.: 180808367
ID No.: FLS 36
Description: -
Customer: Store section
Daicon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date: 17 June 2021
Calibration Date: 17 June 2021

Cert. No.: DIST111-2021
Page: Page 1 of 2

Environmental Conditions: Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

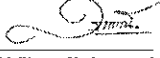
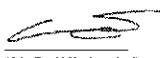
Calibration Procedure: According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments:

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by: 
(Mr. Worawat Vatcharattanasakul)
Issue Date: 17 June 2021
Approved by: 
(Mr. David Kuakamchad)

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

F-PTEC13-03 Rev.02

Effective Date : 03-Mar-2021

Result of Calibration: Without adjustment
Scale range: 0.02-1600 Ω
Resolution: 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (t)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria: Customer Required

Verification interval will vary based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

F-PTEC13-03 Rev.02

End of Certificated.
Effective Date : 03-Mar-2021

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 **Page 1 of total 3 pages**

Customer: DAICON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA
Model: CX-105
Serial No.: GS0728
ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by: 
Act as Technical Manager
Approved by: 
Representative of Managing Director

() (Krisyos K.) () (Sakda Y.)
() (Patiphan K.) () (Onnapa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pranong P.) () (Noppol P.)



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Mueang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-5507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinator	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle Inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by **Adisak**

REV.02 26/01/53

F-029

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

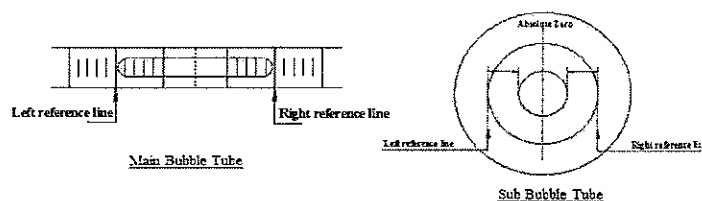
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

แบบสุปรางงานผลการทดสอบและตรวจสอบ
ถังเก็บน้ำมันและอุปกรณ์ตามวาระประจำปี พ.ศ. ๒๕๖๔

ชื่อผู้ประกอบการ	Kuwait Petroleum Aviation (Thailand) Limited
ที่ตั้งสถานประกอบการ	Sriracha, Chonburi
หมายเลขถังเก็บน้ำมัน	CB-7
วันที่สอบปี ที่ทดสอบและตรวจสอบตามวาระ	15 ตุลาคม 2021
ผู้ทดสอบและตรวจสอบ (บริษัท)	Dacon Inspection Technologies Co., Ltd.
ผู้กำกับโครงการทดสอบ	นายธีรยุทธ แซ่โง้ว

๑. รายละเอียดของถังเก็บน้ำมันตามเลข CB-7

เส้นผ่าศูนย์กลาง	12.19 เมตร
ความสูงถัง	18.28 เมตร
ความจุถังเก็บน้ำมัน	2,130,528 ลิตร
ชนิดของน้ำมัน	High Speed Diesel
ประเภทของน้ำมัน	น้ำมันอากาศยาน
ชนิดของถัง	ถังเก็บน้ำมันแบบตั้ง
ชนิดของเหล็ก	เหล็กกล้าคาร์บอน
วันที่สอบปี หรือ ปีที่เก็บไป	2538

ทดสอบและตรวจสอบถังเก็บน้ำมันตามวาระ

๑) การตรวจพิจารณาถังเก็บน้ำมันและการฝึกซ้อมของพนักงาน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๒) อุปกรณ์การวัดระดับของถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๓) อุปกรณ์การวัดระดับของถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๔) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๕) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๖) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๗) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๘) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๙) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๐) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๑) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๒) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๓) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๔) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๕) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๖) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๗) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๘) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๑๙) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน
๒๐) ระบบระบายน้ำจากถังเก็บน้ำมัน	<input checked="" type="checkbox"/> ผ่าน <input type="checkbox"/> ไม่ผ่าน

ผลการตรวจสอบ

ถังเก็บน้ำมันและอุปกรณ์ตามวาระประจำปี พ.ศ. ๒๕๖๔

ผู้ควบคุมการปฏิบัติงานทดสอบและตรวจสอบ

(นายธีรยุทธ แซ่โง้ว) (นางสาวเบญจมาภรณ์ วาณิชยกุล) (ผู้ประกอบกร/ผู้แทน)

DAICON

EXTERNAL TANK INSPECTION REPORT
KUWAIT PETROLEUM AVIATION (THAILAND) LIMITED
SRIRACHA, CHONBURI
CB-7

Friday, 15 October 2021
REPORT NO. 2110012
INSPECTED BY
Dacon Inspection Technologies Company Limited

784-5 Moo 6, Sukhumvit Road
Ban Chang, 21130 Rayong
Thailand

Tel: 033-012-484-7
Fax: 033-012-530

INSPECTION TEAM

1. Mr. Thanapon Sukkam	Sukkam	API 653 INSPECTOR
2. Mr. Panpob Nokaewboot	Nokaewboot	INSPECTION ENGINEER
3. Mr. Anut Sawadee	Sawadee	INSPECTOR LEVEL II

API 653 Inspector : **Mr. Thanapon Sukkam** Date : **15-Oct-21**
(ผู้เขียนรายงานการทดสอบและตรวจสอบ API-653)

Inspection Engineer : **Mr. Panpob Nokaewboot** Date : **15-Oct-21**
(วิศวกรตรวจสอบ)

Head of Inspection Engineer : **Mr. Angkoon Sae-Ngow** Date : **15-Oct-21**
(หัวหน้าวิศวกรตรวจสอบ)

สารบัญ

ข้อมูลการตรวจสอบ	หน้า
รายการตรวจสอบสภาพโดยทั่วไปของถัง	1
รูปภาพ รายละเอียด และข้อเสนอแนะ	2
ผลการตรวจสอบความแข็งแรงของผนังถัง	7
ผลการตรวจสอบการหลุดตัวของถัง	8
ผลการตรวจสอบระบบสายดินรอบฐานถัง	13

TANK INSPECTION CHECKLIST
(FIXED ROOF)

DAICON

Page No.: 1 of 13

Inspection Information of Tank CB-7		Severity Status		Comment / Recommendation
Part/Component	Inspection checklist	Level	N/A	
Tank label or Name plate	ไม่มี, หมดอายุ, ไม่ถูกต้อง (not available/late away or incorrect)			
Tank compound	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Roof wall	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Site drainage system	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Foundation (Bolt)	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Bottom seal	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Projection of Bottom plate	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Shell to Bottom weld	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Earth Grounding	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Critical shell	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Shell nozzle and Manhole	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Shell plate and weld	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Stiffener ring/Wind girder	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Bottom drain valve and pipe	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Product pipe	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Valves	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
PSV or PRD	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Stairway and Handrail	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Stairway platform	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Roof handrail	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Fire water pipe	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Foam pipe	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Foam chamber	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Tank gauging & Transmitter	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Roof nozzle and Manhole	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Roof	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Dip hatch	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Run Vent	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
PV Vent / Free Vent / Tank Bleeder	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Tank Settlement	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			
Tank plumbness	มี, หมดอายุ, ไม่ถูกต้อง (available/late away or incorrect)			

VISUAL INSPECTION



Inspection Information of Tank CB-7

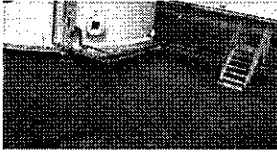
Page No.: 2 of 13

สภาพของเขื่อน คันพัง หรือปลวกกินก้นถัง (Dike area, Bund wall and sile drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการหกกระจาย รั่วซึม ของน้ำมัน บริเวณโดยรอบ

รูปภาพ



ข้อมูลบนสกริปและฉลากถัง (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อมูลของถังชัดเจน

รูปภาพ

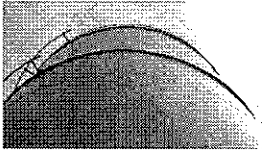


สภาพของลิ้นชักระบายมลพิษ

รายละเอียดและข้อสังเกต

สภาพโดยสิ้นเชิงและลิ้นชักรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-7

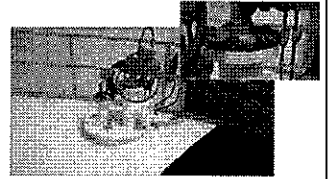
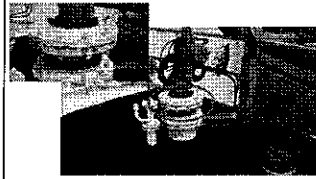
Page No.: 3 of 13

อุปกรณ์เพื่อตรวจสอบระดับน้ำมัน ถัดจาก ถังวัดอุณหภูมิ (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

พบสนิมเล็กน้อยบริเวณ Flange ของ Nozzle ตรวจพบสิ่งแปลกปลอมที่กีดขวาง

รูปภาพ



Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการหกกระจาย หรือ รั่วไหล ของน้ำมัน

รูปภาพ



อุปกรณ์ระบายไอน้ำมันแบบแรงดันสูงฉุกเฉิน (PV vent) หรือ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และท่อน้ำมันที่หลุดคืน ไม่เสียหาย หรือเสียหาย

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-7

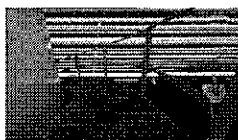
Page No.: 4 of 13

บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

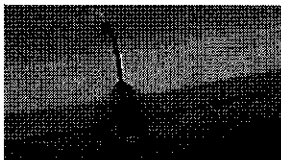


ระบบป้องกันล้มจากฟ้าผ่า หรือระบบสายดินบริเวณฐานถัง

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่พบจุดเสียหายของจุดต่อ และค่าความต้านทานที่อ่านได้พบว่ามีอยู่ในช่วงของเกณฑ์ที่ยอมรับได้

รูปภาพ

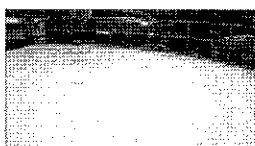
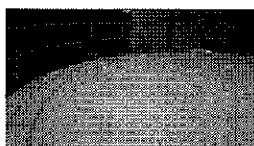


สภาพของพื้นลาดชัน

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-7

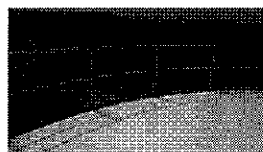
Page No.: 5 of 13

สภาพและความแข็งแรงของราวกันตกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

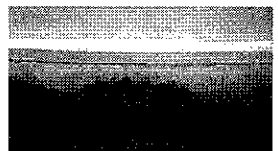


การรั่วซึมของหมันขันส่วนที่ติดกับพื้นผิว

รายละเอียดและข้อสังเกต

สังเกตเห็นร่องน้ำซึมจากถังเข้าสู่อ่างเก็บน้ำใต้ถัง ซึ่งมีความเสี่ยงต่อการเกิดสนิมที่พื้นผิวถัง โดยตรงตามข้อกำหนด (Sip plate - Bottom sealed, Permanently prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ

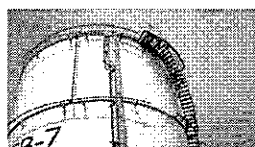


ระบบท่อฆ่าเชื้อ และอุปกรณ์ในส่วนที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-7

Page No.: 6 of 13

พิกัดจุดวัด และจุดตรวจในส่วนที่ผิดปกติ

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



Stiffener ring and top angle

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



ความเสียหายหรือความผิดปกติอื่นๆที่พบและแนวทางการแก้ไข (ถ้ามี)

รายละเอียดและข้อสังเกต

ไม่ตรวจพบความเสียหายเพิ่มเติม

รูปภาพ

ไม่ตรวจพบความเสียหายเพิ่มเติม

SETTLEMENT EVALUATION

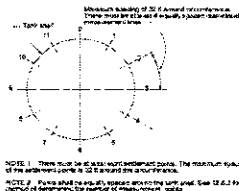


Inspection Information of Tank CB-7

Page No.: 8 of 13

Inspection Principle

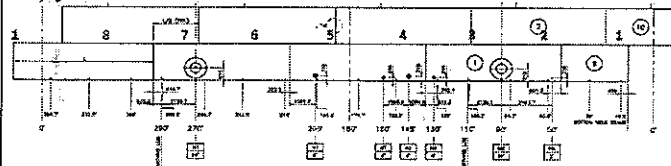
- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653: 2014 Paragraph 12.5 and 9.2.1
- Number of measurement point as indication by equation:
 $N = D/10$ when;
 N = Number of measurement points.
 D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.



Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/ distance above or below reference level (mm)
1	4,787	0 / 38,323	2982
2	4,787	4,787	2951
3	4,787	9,574	2953
4	4,787	14,361	2964
5	4,787	19,148	2965
6	4,787	23,935	2968
7	4,787	28,722	2966
8	4,787	33,509	2966

Surveying location/Direction



PLUMBNESS TESTING



Inspection Information of Tank CB-7

Page No.: 7 of 13

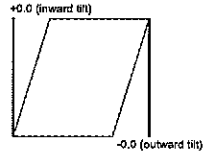
Inspection Principle

Tilt measurements were made at 8 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Measurement location		Measurement point		Deviations (mm.)		Acceptance criteria	Result
Test point	Degree (°)	Bottom	Top			H: 18.28 m	
1	0 / 360	24768	24768	20	Inward	127	Accepted
2	45	20828	20833	5	Inward	127	Accepted
3	90	25302	25301	-1	Outward	127	Accepted
4	135	17258	17271	13	Inward	127	Accepted
5	180	24360	24400	40	Inward	127	Accepted
6	225	21017	21022	5	Inward	127	Accepted
7	270	21624	21622	-2	Outward	127	Accepted
8	315	24460	24465	5	Inward	127	Accepted

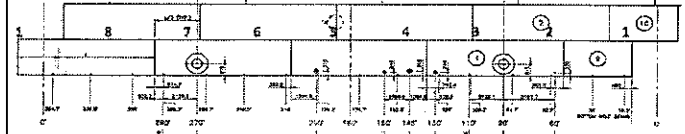
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slightly deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



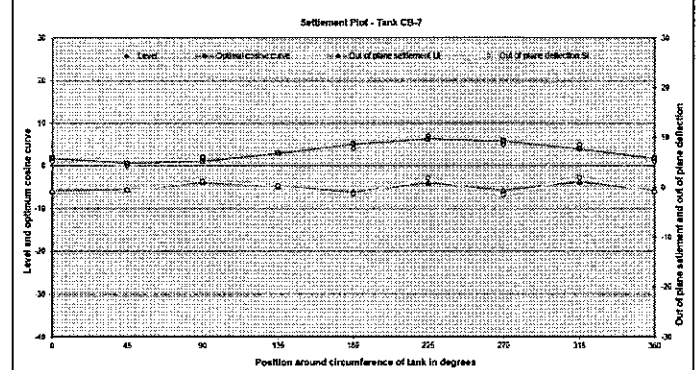
SETTLEMENT EVALUATION



Inspection Information of Tank CB-7

Page No.: 9 of 13

Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Sub Para. B.3.2 - Shell Settlement

Calculation of Maximum Out of Plane Deflection

$$S = \frac{(L^3 \times Y \times 1.1)}{2(E \times H)}$$

Where:

- S = Deflection (ft)
- L = Arc length between measurement points (ft) 15.75 (Max. 32 feet)
- Y = Yield strength (ksi) 30,000 (Min Specified Yield Stress [ksi]; API653 Table 4.1)
- E = Young's Modulus (ksi) 28,500,000 PSI (ASME BPVC VIII D.C. - 2015 Table TSM-1)
- H = Tank Height (ft) 59.97 ft or 18.28 m
- n = Number of measurement points 8
- S = 0.0028 ft
- S = 7.25 mm

API 653, Para B.2.2.4 - Determination of actual settlement

$$S = U_1 - (0.5U_1 - 1 + 0.5U_1 + 1)$$

$$U_1 = 1.12$$

$$U_1 - 1 = -0.72$$

$$U_1 + 1 = -0.74$$

$$S = 1.85 \text{ mm}$$

$$R^2 = 0.86$$

Predicted deflection (ft) = 8.56 mm at 55 degrees clockwise from shell datum

SETTLEMENT EVALUATION



Inspection Information of Tank CB-7

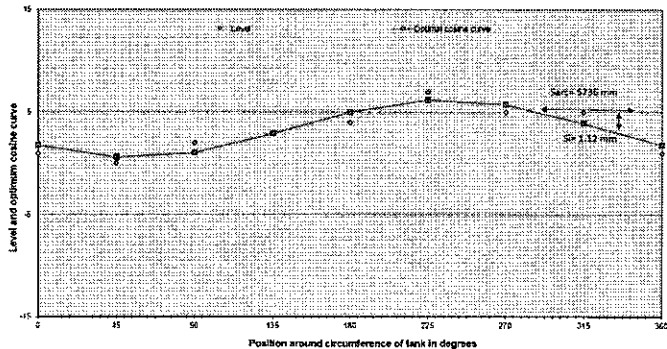
Page No.: 10 of 13

Settlement Evaluation Note:

As specified in the API 653 Annex B -- Evaluation of tank bottom settlement. A tank shell need to be evaluated based on the deformation of shell as well as out-of-plane settlement (Circumferential Settlement). The calculated r2 value of optimal cosine curve in this report is lower than 0.90 (that specified at Clause B.2.2.4 the r2 shall equal or greater than 0.90) and this renders the optimal cosine curve invalid.

Thus, the procedure specified in clause B.2.2.5.1 - (b) and calculate the maximum out-of-plane settlement as per clause B.3.2.2 needs to be followed.

Settlement Plot - Tank CB-7



SETTLEMENT EVALUATION



Inspection Information of Tank CB-7

Page No.: 11 of 13

Settlement Evaluation Summary

Determination of Permissible Settlement per API 653, Paragraph B.3.2.2

Where:

S_{max} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc in mm
 S_{arc} is effective settlement arc in foot
 D = Diameter in feet
 Y = Yield Strength (lb/in²)
 E = Young's Modulus (lb/in²)
 H = Tank Height in feet
 K = coefficient

S_{max} 0.1271 in.

S_{max} 3.23 mm.

Assessment:

Acceptance per API 653			
The maximum out of plane deflection, where the greatest deviation from the optimum cosine curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2.2	S _{max}	SI	Result
	3.23	1.12	Accepted

$$S_{max, u} = \min \left[K \times S_{arc} \times \left(\frac{D}{H} \right) \times \left(\frac{Y}{E} \right), 4.0 \right]$$

Tank Diameter ft	Open Top Tanks, ft	Fixed Roof Tanks, ft
D ≤ 50	28.7	10.5
50 < D ≤ 80	7.8	5.8
80 < D ≤ 120	6.5	3.9
120 < D ≤ 180	4.0	2.3
180 < D ≤ 240	3.6	Not applicable
240 < D ≤ 300	2.4	Not applicable
300 < D	Not applicable	Not applicable

where

S_{max, u} is permissible out-of-plane settlement, in inches;
 S_{arc} is effective settlement arc, see B.2.2.5.1, in feet;
 D is tank diameter, in feet (ft);
 Y is yield strength of the shell material, in pound force per square inch (lb/in²);
 E is Young's Modulus, in pound force per square inch (lb/in²);
 H is tank height, in feet.

SETTLEMENT EVALUATION

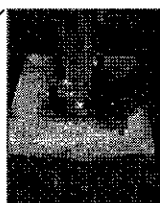
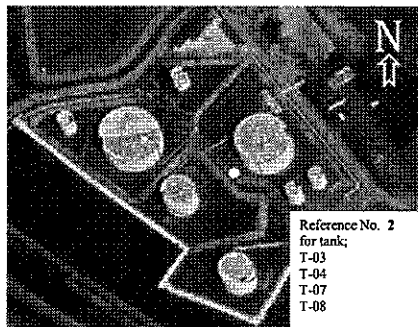


Inspection Information of Tank CB-7

Page No.: 12 of 13

Reference Location, Temporary reference level

Location No. Point 2
 Area Description The reference point was marked on the support fire water pipe basement.



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
 Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-7

Page No.: 13 of 13

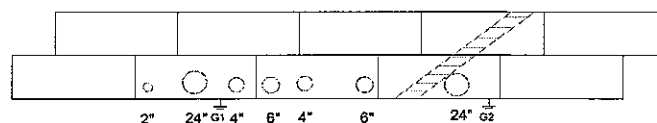
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	0.25	Accepted
2	1.39	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOE.

Measurement Layout





Certificates



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

Manager, Individual Certification Programs



2019-2021 Period to be USAI



Certificate of Verification

Equipment: Earth Ground Clamp
Manufacturer: HIOKI
Model: FT6380
Serial No.: 180808367
ID No.: FLS 36
Description: -
Customer: Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date: 17 June 2021
Calibration Date: 17 June 2021

Cert. No.: DIST111-2021
Page: Page 1 of 2

Environmental Conditions: Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure: According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments:

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by:
(Mr. Worawat Vatcharatassanakul)

Approved by:
(Mr. David Kuakamchad)

Issue Date: 17 June 2021

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

Verification Results

Cert. No.: DIST111-2021
Page: 2 of 2

Result of Calibration: Without adjustment
Scale range: 0.02-1600 Ω
Resolution: 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (Ω)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria: Customer Required

Verification interval will vary based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 Page 1 of total 3 pages

Customer: DACON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA Model: CX-105
Serial No.: GS0728 ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by

Approved by

Act as Technical Manager

Representative of Managing Director

() (Krisyos K.) () (Sakda Y.)
() (Patiphan K.) () (Onnappa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Puttitwong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

F-029

REV.02 26/01/53



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21 Page 3 of total 3 pages

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div.	Measured Value (mm/m)		Graduation Div.	Measured Value (mm/m)	
(Right)	Forward	Backward	(Left)	Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

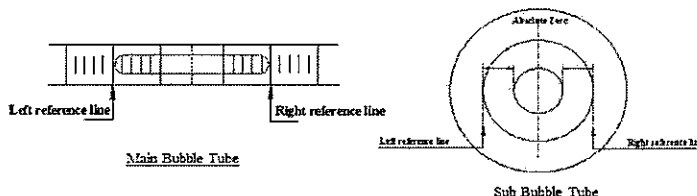
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div.	Measured Value (mm/m)		Graduation Div.	Measured Value (mm/m)	
(Right)	Forward	Backward	(Left)	Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -

Calibrated by Adisak
REV.02 26/01/53

F-029



THAI HEART CALIBRATION CO., LTD.

2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

Certificate No.: S0-2105006/21

Page 2 of total 3 pages

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinator	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by Adisak
REV.02 26/01/53

F-029

VISUAL INSPECTION



Inspection Information of Tank CB-8

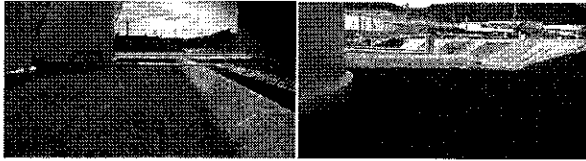
Page No.: 2 of 11

สภาพของเขื่อน กำแพง หรือปล่องเก็บกักน้ำบริเวณคัน (Dike area, Bund wall and site drainage system)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทรุดตัว รอยร้าว ของน้ำรั่วซึมบริเวณโดยรอบ

รูปภาพ



ข้อมูลและรายละเอียด (Tank name plate and label)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ และข้อมูลของถังชัดเจน

รูปภาพ

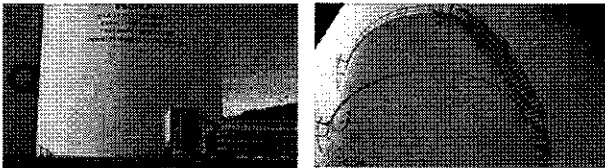


สภาพของลิ้นชักภายนอกถัง

รายละเอียดและข้อสังเกต

สภาพโดยดีและปิดสนิท

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-4

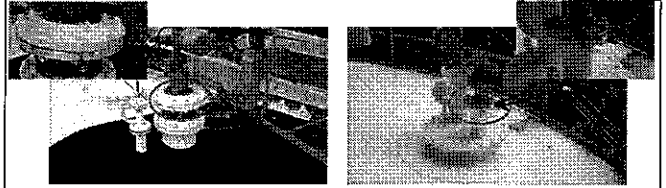
Page No.: 3 of 11

อุปกรณ์เครื่องวัดระดับน้ำ ถังเก็บน้ำ รวมทั้งอุปกรณ์สัญญาณเตือนภัย (Tank gauging, Thermo gauge and level alarm)

รายละเอียดและข้อสังเกต

พบสนิมเล็กน้อยบริเวณหน้า Flange ของ Nozzle ตรวจหาสิ่งของแขวนบริเวณที่เกิดสนิม

รูปภาพ

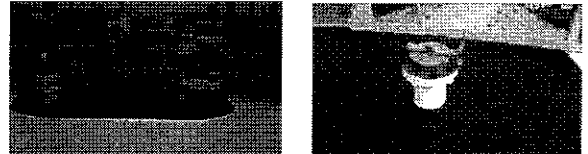


Product sample hatch

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบการทรุดตัว หรือ รั่วไหล ของน้ำมัน

รูปภาพ

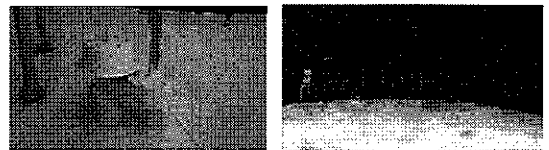


อุปกรณ์ระบายไอน้ำมันแบบแรงดันสุญญากาศ(PV vent) หรือ อุปกรณ์ระบายไอน้ำมัน (Free Vent, Emergency vent)

รายละเอียดและข้อสังเกต

ตรวจพบรอยร้าวเล็กน้อย แต่พบว่าเกิดการอุดกั้นและฉีก

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-8

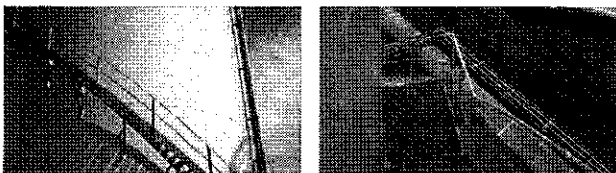
Page No.: 4 of 11

บันได (Spiral stairway and step)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ

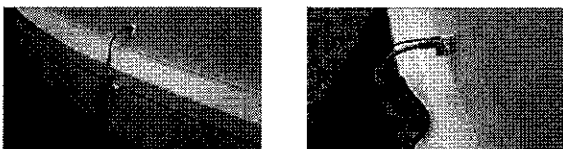


ระบบป้องกันอันตรายจากฟ้าผ่า หรือระบบสายดินบริเวณฐานถัง

รายละเอียดและข้อสังเกต

สภาพทั่วไป แข็งแรง ไม่พบจุดเสียหายของจุดต่อ และค่าความต้านทานที่อ่านได้พบว่ามีอยู่ในช่วงของเกณฑ์ที่ยอมรับได้

รูปภาพ



สภาพของหลังคาถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-8

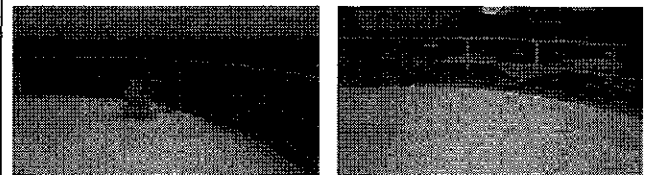
Page No.: 5 of 11

สภาพและความแข็งแรงของราวกันตกบนหลังคาถัง (Roof platform and safety handrail)

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ ไม่พบจุดอันตรายที่อาจกระทบต่อการใช้งาน

รูปภาพ



การรั่วซึมของเพนซีลบางส่วนที่ติดกับพื้นถัง

รายละเอียดและข้อสังเกต

ถึงขีดจำกัดของการไหลของน้ำเข้าสู่ถังได้ขึ้นถึงขีดจำกัดที่ระบุบนแผ่นปิดกั้นกักเก็บน้ำถาวร (Strip plate -Bottom sealed, Permanant prevention) พบว่าสภาพทั่วไปปกติ

รูปภาพ

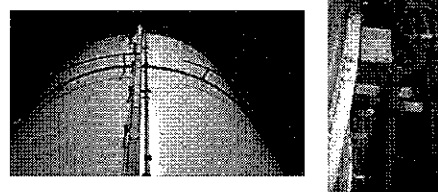


ระบบท่อฟ้า หรือไฟ และอุปกรณ์สำหรับดับเพลิงที่ติดกับถัง

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



VISUAL INSPECTION



Inspection Information of Tank CB-8

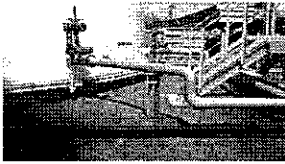
Page No.: 6 of 11

บริเวณ รัดจำ และอุปกรณ์ในส่วนที่ติดกับตัว

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



Stiffener ring and top angle

รายละเอียดและข้อสังเกต

สภาพโดยรวมปกติ

รูปภาพ



ความเสียหายหรือความผิดปกติอื่นๆที่พบและแนะนำให้แก้ไข (ถ้ามี)

รายละเอียดและข้อสังเกต

ไม่มีความเสียหายที่พบเห็น

รูปภาพ

ไม่มีความเสียหายที่พบเห็น

PLUMBNESS TESTING



Inspection Information of Tank CB-8

Page No.: 7 of 11

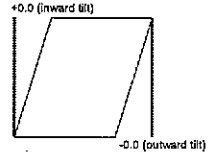
(Inspection Principle)

Tilt measurements were made at 8 locations around the circumference of the tank.

Acceptance criteria as per API 653: The maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height or maximum of 5 inch (127 mm)

All survey were made from external of tank.

Locations of measurement points was marked on shell map.



Inspection data

Test point	Measurement location		Measurement point		Deviations(mm.)	Acceptance criteria H : 18.28 m	Result
	Degree (°)	Bottom	Top				
1	0 / 360	35200	35192	-8	Outward	127	Accepted
2	45	38872	38812	40	Inward	127	Accepted
3	90	11264	11272	8	Inward	127	Accepted
4	135	14110	14156	46	Inward	127	Accepted
5	180	10191	10184	-7	Outward	127	Accepted
6	225	8767	8760	-7	Outward	127	Accepted
7	270	10386	10389	3	Inward	127	Accepted
8	315	36341	36332	-9	Outward	127	Accepted

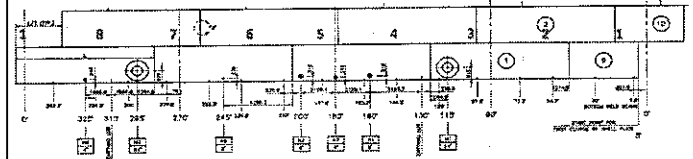
Plumbness Testing Summary

The result of plumbness, revealed no sign of significant tank tilting. A slightly deviation was noted and all were within acceptable limit.

Note:

The established allowable out-of-verticality of the tank shell, derived by this method, does not take into account the material strength of the shell, the product specific gravity, nor the maximum operational liquid/product level in the tank. It is, therefore, advised to use the above method only as a first general (rule of thumb) assessment and to perform a more in-depth and sophisticated investigation when results of out-of-verticality measurements are nearing the rejection limits, specified by the above method should be done by an engineer experienced in tank settlement analysis.

Testing location/Direction



SETTLEMENT EVALUATION

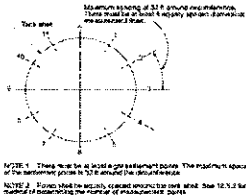


Inspection Information of Tank CB-8

Page No.: 8 of 11

Inspection Principle

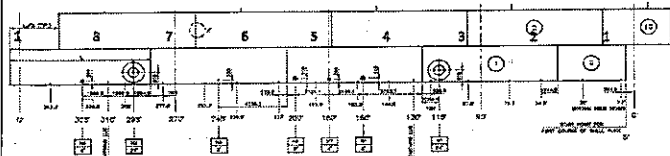
- Locations of measurement points was marked on shell map.
- Other survey points are count in clockwise positioning.
- Settlement surveys was followed the directions of API 653 Paragraph 12.5 and B.2.1
- Number of measurement point as indication by equation:
 $N = D/10$ when:
N = Number of measurement points.
D = Tank diameters in ft.
- Point of measurement was obtained by surveying the elevation of the weld between the first and second courses.



Inspection data

Evaluation location at tank (mark on shell map)	Distance between survey location (mm)	Cumulative distance around tank (mm)	Relative level/ distance above or below reference level (mm)
1	4,787	0 / 38,323	3010
2	4,787	4,787	3014
3	4,787	9,574	3016
4	4,787	14,361	3018
5	4,787	19,148	3017
6	4,787	23,935	3016
7	4,787	28,722	3013
8	4,787	33,509	3011

Surveying location/Direction



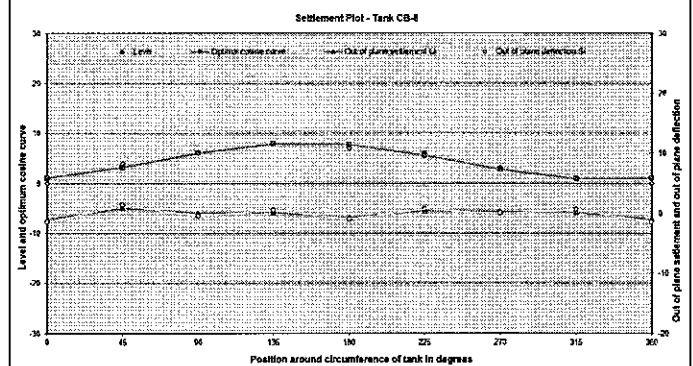
SETTLEMENT EVALUATION



Inspection Information of Tank CB-8

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Settlement Evaluation Graph



Settlement Evaluation Summary

API 653, Paragraph B.3 - Determination of Acceptable Settlement

Run Para. B.3.2 - Shell Settlement

Determination of Maximum Out of Plane Deflection:

$S = \frac{D^2 \times Y \times 11}{25 \times 10^6}$

Where:

S = Deflection (in)

L = Arc length between measurement points (ft)

Y = Yield strength (psi)

E = Young's Modulus (psi)

N = Tank height (ft)

n = Number of measurement points

S = 0.0228 in

S = 7.26 mm

API 653, Para B.2.2.4 - Determination of actual settlement

$S_{max} = (S - 1) \times 1.5$

LM = -1.33

LM = 0.14

LM = 0.93

LM = -1.52 mm

$R^2 = 0.96$

Predicted deflection (in) = 0.0228

28 degrees clockwise from shell datum

15.71 (Max. 32 inch)
30,000 (44-Specified Yield Stress (ksi)) (API 653 Table A.1)
29,000,000 psi
ASME BPVC II-D G - 2015 Table 1A-1
18.28 m

Date: 2023/05/10

28 degrees clockwise from shell datum

Acceptance per API 653

The maximum out of plane deflection, where the greatest deviation of the bottom form the optimum curve occurs over the shortest interval between measurements, shall not exceed the maximum permissible out-of-plane deflection calculated from formula in B.3.2	S-max	St	Result
	7.26	1.52	Acc.

SETTLEMENT EVALUATION

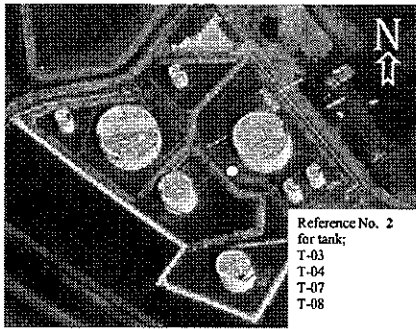


Inspection Information of Tank CB-8

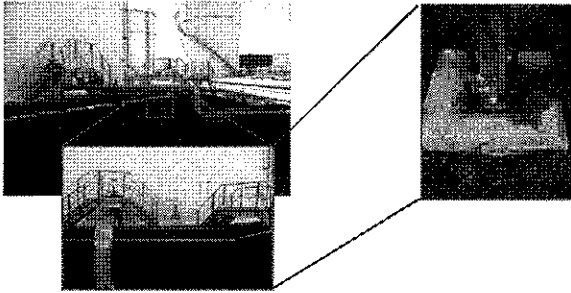
Page No.: 10 of 11

Reference Location, Temporary reference level

Location No. Point 2
Area Description The reference point was marked on the support fire water pipe basement.



Reference No. 2
for tank;
T-03
T-04
T-07
T-08



Noted: Reference location here in just simply state for bench mark or means temporary reference use, as order to set a base line on reference level only.
Please do not imply valid reference or in used for permanently reference level.

GROUNDING MEASUREMENT



Inspection Information of Tank CB-8

Page No.: 11 of 11

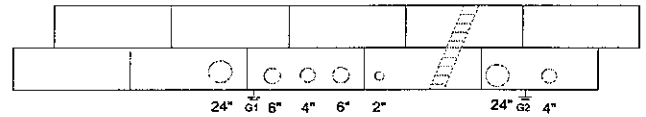
Inspection Data

Grounding No.	Resistance to Ground (Ω)	Note
1	0.21	Accepted
2	1.75	Accepted

Earth Grounding Measurement Summary

As observed and ground measurement founded satisfactory condition. Resistance reading are within acceptable range of 10 Ohms by DOE.

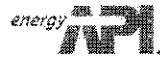
Measurement Layout



Kuwait Petroleum Aviation (Thailand) Limited
Tank inspection
External Tank
Location: Sriracha, Chonaburi

Report: 2110012_Rev.00

Certificates



AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™



API Individual Certification Programs

verifies that

Thanapon Suktam

has met the requirements for API certification

*API-653 Aboveground Storage Tank
Inspector*

Certification Number 67476

Original Certification Date August 31, 2016

Current Certification Date August 31, 2019

Expiration Date August 31, 2022

[Signature]

Manager, Individual Certification Programs



2019-02-12 (Revised in the USA) 1-10-19



Verification Results

Cert. No.: DIST111-2021
Page: 2 of 2

Certificate of Verification

Equipment: Earth Ground Clamp
Manufacturer: HIOKI
Model: FT6380
Serial No.: 180808367
ID No.: FLS 36
Description: -
Customer: Store section
Dacon Inspection Technologies Co., Ltd.
78/4-5 Moo 6, Sukhumvit Road, Ban Chang, Rayong, 21130, THAILAND
Received Date: 17 June 2021
Calibration Date: 17 June 2021

Cert. No.: DIST111-2021
Page: Page 1 of 2

Environmental Conditions: Ambient Temperature (20 ± 2) °C
Relative Humidity (55 ± 20) %

Calibration Procedure: According to Direct measurement with Standard Loop Resistance.

Condition of This result of calibration

1. Reference Standards Instruments:

Item	Instrument	Manufacturer	Model	Serial No.	Certificate No.	Due Date
1	Standard Loop Resistance	FLUKE	0.474-100Ω	CAL001-1	DIST127-2020	22-Dec-21

2. This result of calibration was found accurate as shown on date and place of calibration only
3. The measurement results are traceable to the International System of Units (SI), through the accredited laboratory's

Calibrated by:
(Mr. Worawat Vatcharattanasakul)
Issue Date: 17 June 2021
Approved by:
(Mr. David Kuakamchad)

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage k=2, providing a level of confidence of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

F-PTC13-03 Rev.02

Effective Date: 03-Mar-2021

Result of Calibration: Without adjustment
Scale range: 0.02-1600 Ω
Resolution: 0.01 Ω

This certifies that Calibration of the above Standard Loop Resistance for Clamp-on Ground Tester has been verified within the tolerance and measurement range indicated below, using Verification standards with Indicated Value Resistance traceable to the Institute of Calibration & Technologies Co., Ltd. The Calibration standards CAL001-01

Measurement Result Resistance Test

Range (Ω)	Standard Value (Ω)	Indicated Value (Ω)	Acceptance Criteria (Ω)	Judgment Result	Error (Ω)
0.02-1600 Ω	0.474 Ω	0.460 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.014
	0.5 Ω	0.490 Ω	1.5 % rdg ±0.02 Ω	Passed	-0.010
	1.0 Ω	1.000 Ω	1.5 % rdg ±0.02 Ω	Passed	0.000
	10.0 Ω	10.035 Ω	1.5 % rdg ±0.02 Ω	Passed	0.035
	25.0 Ω	25.100 Ω	1.5 % rdg ±0.05 Ω	Passed	0.100
	100.0 Ω	101.000 Ω	1.5 % rdg ±0.05 Ω	Passed	1.000

Acceptance Criteria: Customer Required

Verification interval will very based on usage handling and storage conditions. The Certificate shall not be reproduced, except in full, without the written approval of Clamp On Earth Tester.

Note:

This certificate may not be reproduced other than in full, except with the prior written approval of the Center of Industrial Instrument Calibration

F-PTC13-03 Rev.02

End of Certificated.
Effective Date: 03-Mar-2021



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com



THAI HEART CALIBRATION CO., LTD.
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507
Website: www.thaiheartcal.com E-mail: service@thaiheartcal.com

CERTIFICATE OF CALIBRATION

Certificate No.: S0-2105006/21 **Page 1 of total 3 pages**

Customer: DAICON INSPECTION TECHNOLOGIES CO., LTD
78/4-5 Moo 6, Sukhumvit Rd., Ban Chang, Rayong 21130 Thailand

Equipment: Survey Camera (Theodolite)
Manufacturer: SOKKIA
Model: CX-105
Serial No.: GS0728
ID No.: TE001064

Environmental Conditions: Ambient Temperature: (20 ± 1) °C
Relative Humidity: (55 ± 15) %
Atmospheric Pressure: -

Calibration Location: Dimension Laboratory 3
Received Date: 21 May 2021
Calibration Date: 22 May 2021

Date of Issue: 24 May 2021

Checked by:
Act as Technical Manager
Approved by:
Representative of Managing Director

- () (Krisyesl K.) (✓) (Sakda Y.) () (Dr. Ekachai Puntitwong)
() (Patiphan K.) () (Onnappa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pranong P.) () (Noppel P.)

This calibration certificate may not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

Reference Method:

- The calibration method used was an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Electronic Inclinometer	016F150-122-001, 016F150-243-001, 016F004-001	O 0267, O 0268, O 0758	DA-0033-20	Aug. 19, 2022	NIMT

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- NIMT, National Institute of Metrology (Thailand).

Measurement Results:

1. Angle inspection

Nominal Value	Instrument Reading
Horizontal	
180°	180° 00' 07"
360°	359° 59' 59"
Vertical	
90°	89° 59' 40"
270°	269° 59' 59"

2. The level deviation caused by rotating the theodolite

Position	Level deviation (mm/m)
0-360°	0.000

Calibrated by **Adisak**

F-029

REV.02 26/01/53

Measurement Results (Cont.):

3. Bubble-level measurement

Main Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	0.859	0.865	Left Reference Line	1.004	1.001

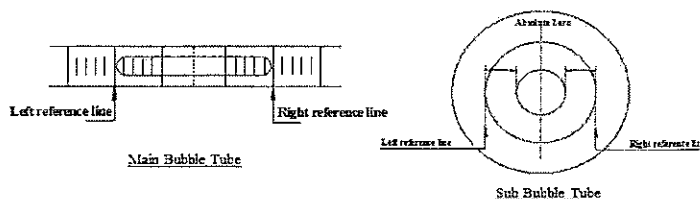
The uncertainty of measurement was ± 0.18 mm/m.

Sub Bubble Tube:

Graduation Div. (Right)	Measured Value (mm/m)		Graduation Div. (Left)	Measured Value (mm/m)	
	Forward	Backward		Forward	Backward
Right Reference Line	1.547	1.543	Left Reference Line	1.412	1.410

The uncertainty of measurement was ± 0.27 mm/m.

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.



- End of Certificate -



INSPECTION REPORT

FOR

KUWAIT PETROLEUM AVIATION
(THAILAND) COMPANY LIMITED

BULGING MEASUREMENT

OF

TANK CB-1 AND CB-2

AT

SRIRACHA, CHONBURI

14-15 OCTOBER 2021

Dacon Inspection Technologies Co., Ltd. Tel 033-0013484-7 Fax 033-012530
www.dacon-inspection.com info@daicon-inspection.com

Dacon Inspection Technologies Co., Ltd. Tel 033-0013484-7 Fax 033-012530
www.dacon-inspection.com info@daicon-inspection.com



1. INSPECTION CONCLUSION

As requested of Kuwait Petroleum Aviation (Thailand) Company Limited to performed bulging measurement on tank CB-1 and CB-2 due to the latest report (2021) that presented condition of top tank shell appeared with mechanical damage (bulging). To confirm the recommendation by taking the monitoring program, in this report was made to consider. The inspection resulted as compared with the latest record, revealed no evidence of deformation increment was noted.

2. EQUIPMENT AND TECHNIQUE USED

To measure shell deformation as typically used sweep board instead of the conventional measurement, a theodolite was subjected. Theodolite will be surveyed and an evaluation out of plane, meanwhile, to detect amount of bulge area.

3. INSPECTION RESULT

TABLE 3.1

Distance From Survey point to area of concern for Tank CB-1

TABLE 3.2

Relative distance of each measurement points to the lowest of each plane of Tank CB-1

TABLE 3.3

Distance From Survey Point to Area of Concern for Tank CB-2

TABLE 3.4

Relative Distance of Each Measurement Point to the lowest of each Plane of Tank CB-2

Inspection result

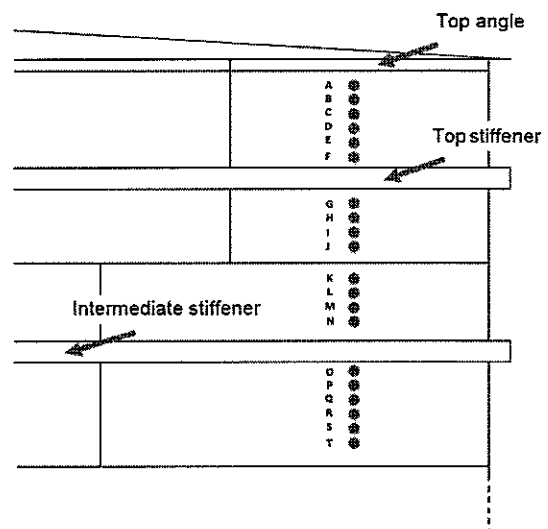
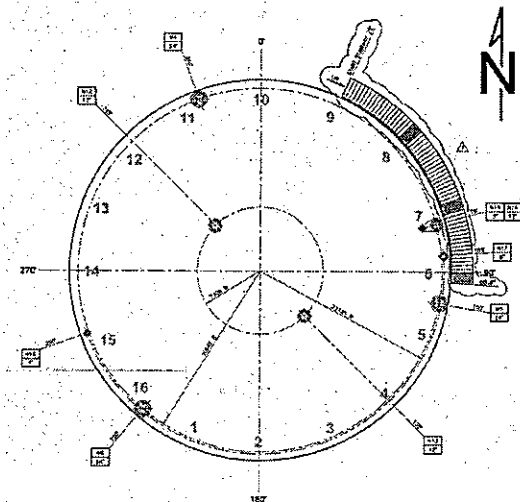


Illustration of spotting point for bulging measurement

Note

1. The tank was divided by 16 approximated equally spacing survey planes.
2. 6 measurement points for bulging measurement on top shell course only.
3. Measurement point A-F area of shell above top stiffener.
4. Each measurement point is in approximately equally interval.

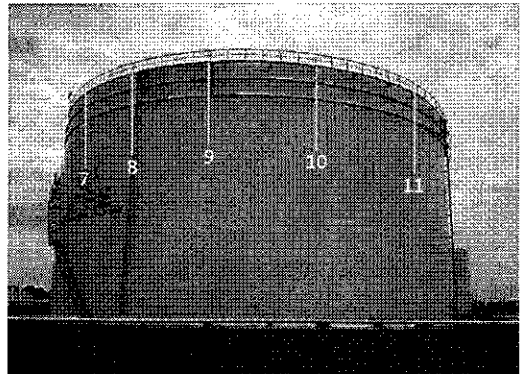
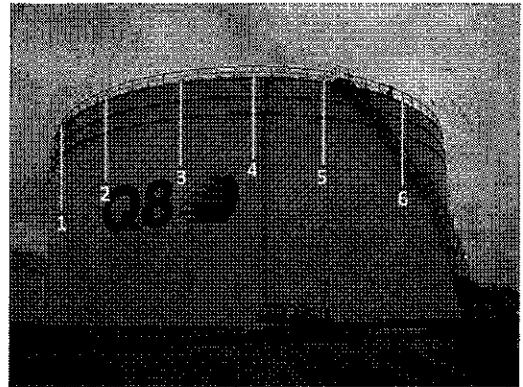
Note: Measurement point G-T is not performed in 2021



ROOF PLAN

Illustration of the location of each survey plane numbers to bulging measurement for Tank CB-1

Photograph of each Survey-plane to measurement for Tank CB-1



Photograph of each Survey-plane to measurement for Tank CB-1

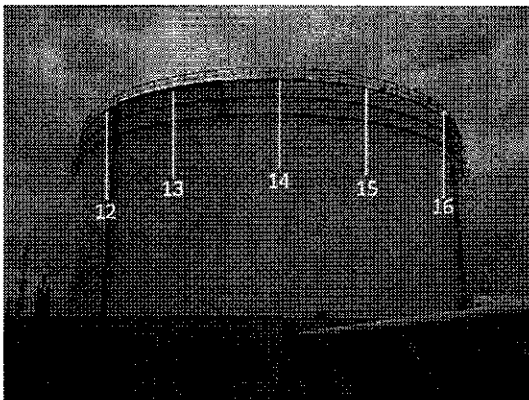


Table 3.1 Distances from Survey Point to Area of Concern for Tank CB-1

		Survey Plane (m)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A		27.052	46.360	39.395	36.048	37.889	43.842	23.039	24.541	31.007	86.883	86.005	85.820	74.813	74.897	79.102	23.693
B		27.037	46.342	39.389	36.039	37.878	43.836	23.035	24.534	31.001	86.882	86.000	85.819	74.798	74.889	79.101	23.684
C		27.030	46.327	39.391	36.029	37.867	43.838	23.030	24.541	30.982	86.878	86.002	85.817	74.783	74.886	79.100	23.678
D		27.043	46.323	39.387	36.028	37.849	43.836	23.024	24.538	30.967	86.876	86.004	85.813	74.773	74.894	79.097	23.676
E		27.047	46.330	39.384	36.024	37.842	43.838	23.022	24.532	30.952	86.878	86.002	85.812	74.771	74.893	79.096	23.670
F		27.049	46.332	39.381	36.028	37.843	43.833	23.023	24.526	30.949	86.880	86.003	85.811	74.768	74.890	79.086	23.668

Noted:

Unit is Meter.

- Each plane of surveyed was measured the distance from the measurement point to a survey camera, will express the increment of a distance if far beyond or close to the survey camera.

Table 3.2 Relative Distance of each measurement point to the Invert of each plane of Tank CB-1

2021 inspection result																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	15	18	6	9	6	4	7	6	1	5	1	15	8	1	9	
C	23	33	4	19	22	4	9	0	25	3	3	30	11	2	15	
D	9	37	8	20	40	6	15	3	10	7	1	7	40	3	5	17
E	5	30	11	24	47	4	17	9	55	5	3	8	42	4	6	23
F	3	28	14	20	46	9	16	15	53	3	2	9	45	7	16	25

2020 inspection result																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	17	21	5	10	25	2	5	6	4	1	5	2	11	9	1	9
C	19	40	2	17	25	5	9	8	31	3	3	3	27	14	2	18
D	2	39	11	21	45	4	14	2	57	1	1	11	44	8	2	22
E	3	34	15	19	52	2	15	7	67	3	3	5	48	9	6	23
F	1	33	19	15	53	6	16	12	60	3	2	4	52	6	10	22

Noted:

- No significantly increase of value comparing with 2020 inspection result.
- Unit is Millimeter.
- All values are the resulted from deviation of each lower value of each survey plane for determine the increment condition of tank bulging.

Dacon Inspection Technologies Co., Ltd. Tel 033-0013484-7 Fax 033-012530
www.dacon-inspection.com info@dacon-inspection.com

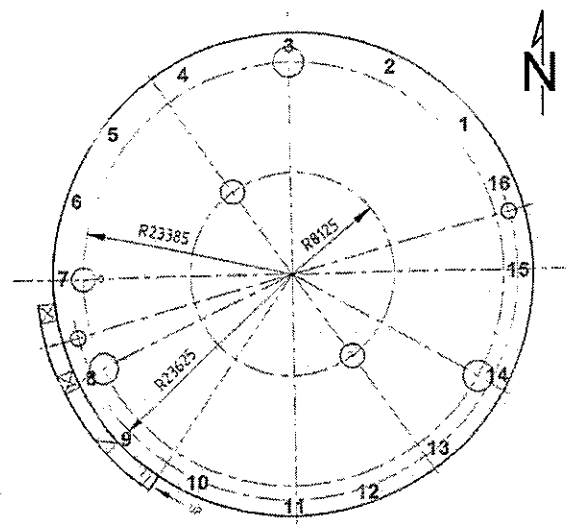
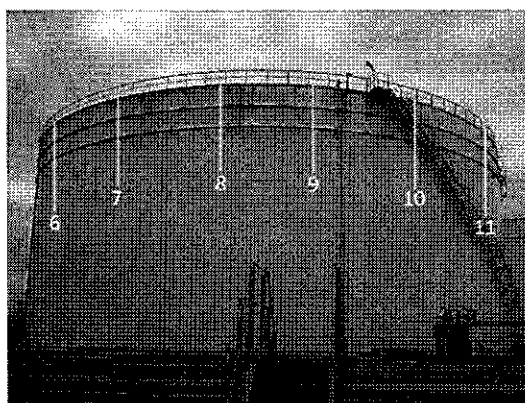
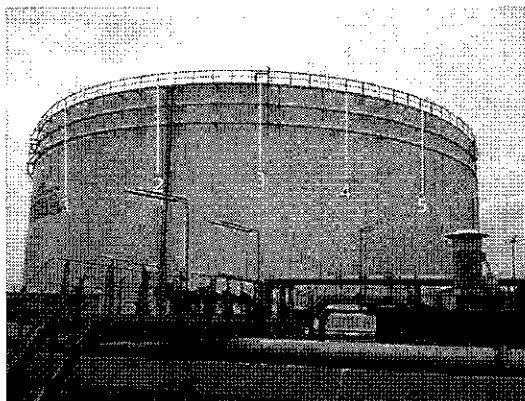


Illustration of the location of each survey plane numbers to bulging measurement for Tank CB-2

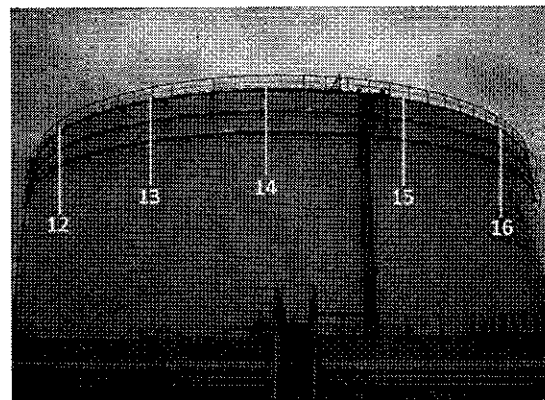
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Photographic of each survey-plane to measurement for Tank CB-2



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Photographic of each survey-plane to measurement for Tank CB-2



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Table 3.3 Distances from Survey Point to Area of Concern for Tank CB-2

	Survey Plane (m)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	16.379	23.08	29.506	23.395	22.915	21.283	16.755	19.486	23.010	22.100	20.612	23.921	18.076	18.778	22.609	16.172
B	16.299	23.073	29.502	23.395	22.914	21.268	16.740	19.479	22.985	22.09	20.602	23.881	18.061	18.757	22.593	16.150
C	16.299	23.078	29.495	23.383	22.893	21.256	16.730	19.47	22.953	22.076	20.59	23.832	18.036	18.745	22.580	16.128
D	16.314	23.073	29.489	23.376	22.858	21.238	16.715	19.46	22.933	22.065	20.575	23.813	18.019	18.739	22.577	16.115
E	16.304	23.069	29.481	23.375	22.855	21.237	16.719	19.451	22.913	22.066	20.573	23.812	18.016	18.731	22.57	16.103
F	16.294	23.063	29.481	23.371	22.838	21.237	16.720	19.456	22.912	22.067	20.583	23.811	18.015	18.729	22.576	16.102

Notes:

- Unit is Meter.

- Each plane of surveyed was measured the distance from the measurement point to a survey camera, will express the increment of a distance if far beyond or close to the survey camera.

Table 3.4 Relative Distance of each measurement point to the lowest of each plane of Tank CB-2

	2021 inspection result															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	2020 inspection result															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

- No significantly increase of value comparing with 2020 inspection result.

- Unit is Millimeter.

- All values are the resulted from deviation of each lower value of each survey plane for determine the increment condition of tank bulging.

4. INSPECTION SUMMARY

Comparing with inspection result, there was not significantly increasing out of plumbness at the interested top shell course. Coloring in table is applied for the present overall area of suspect bulging.

If considering as a roundness of top shell course. Refers to measurement diagram of top shell course, the position A assume as a roundness reference of top shell course, it was show slight out of roundness of top shell course as per finding value.

However, both tanks were found tank settlement and tank out-of-plumbness (the maximum out-of-plumbness of the top of the shell relative to the bottom of the shell shall not exceed 1/100 of the total tank height) within acceptable limit by API 653. Should be monitoring together with the period external tank inspection by annually. Alternative tool to verify tank shell condition may use a tank 3D-scan method, the advanced method for further analyze overall tank shell condition and stress analysis.

CATHODIC PROTECTION SYSTEM

PREVENTIVE MAINTENANCE SERVICE REPORT
AT Q8 PLANT

KUWAIT PETROLEUM AVIATION COMPANY LIMITED

PO Number: KPAT2021-065
Our Reference No: S21-596

A	11-Jan-21	FOR REVIEW	JUJ	EKP	TRG		
REV.	DATE	DESCRIPTION	BY	CHK	APV	AUR	

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Prepared by JST Group

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1.0 INTRODUCTION

This report documents the results of the 2021 cathodic protection routine maintenance survey of the underground pipelines at the Kuwait Petroleum Aviation Terminal Facility located in Laem Chabang Thailand. The buried pipework is equipped with a sacrificial anode cathodic protection system. The purpose of the survey is to report on the installed cathodic protection system operational status and provided protection levels so to ensure the pipeline(s) are receiving full protection from in conjunction with the pipeline coating systems from external corrosion.

2.0 REFERENCE CODES, STANDARDS AND SPECIFICATION

The following codes, standards and references, were utilized in the performance of the investigation:

NACE International SP0169:	Standard Practice "Control of External Corrosion on Underground of Submerged Metallic Piping Systems"
NACE International SP0177:	Standard Practice "Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems"

3.0 SYSTEM DESCRIPTION

The system comprises a total of four (4) test stations installed along and above the pipeline. The four (4) test stations are utilised to connect banks of five (5) sacrificial anodes to the pipeline. Of the four test stations, 1 No, CBT-BB1 also acts as an electrical bonding facility onto the PTT pipelines at the mutual pipelines crossing point.

The anodes are connected to the pipelines by terminating the anode cables directly to the pipe cable, (which is exothermically welded to the outside of the pipeline(s)), within their respective aboveground test box. Sacrificial anodes are all pre-packaged 9.1 kg high potential magnesium anodes with 10mm² XLPE/PVC anode cable. Anodes are buried adjacent to the pipeline below the centre-line of the pipe.

4.0 ACCEPTANCE CRITERIA

The following internationally recognized acceptance criteria are applied for the performance of cathodic protection system:

- A minimum 'Off' pipe to soil potential of -850 mVDC with respect to a portable copper/copper sulphate reference electrode (CSE) reference electrode
- The AC pipe to soil potential shall be less than 15VAC

5.0 SURVEY PROCEDURE – PIPELINES

5.1 APPLIED PIPE TO SOIL POTENTIAL

Applied pipe to soil potentials, shall be recorded at all test points, using a high input impedance volt / multi-meter, connected to the 'pipe' test lead within the test post and portable CSE reference electrode placed in contact with the ground immediately over/above the pipeline under test.

To allow for IR drop error induced in the soil, applied potentials shall also recorded with the reference electrode placed a minimum of 30m perpendicular and remote.

5.2 ANODE CURRENT OUTPUT

The anode current output shall be measured utilizing a known shunt resistor rated at 0.01 Ohm. The shunt resistor is introduced in series between the anode cables and pipe test lead. The voltage drop across the shunt is then measured using a high input impedance multi-meter set to the mV DC volt range. From the observed voltage drop and shunt resistance rating and applying Ohm's law the corresponding DC current flow may be obtained.

5.3 ESTIMATION OF ANODE REMAINING LIFE

Based upon the anode current output at time of commissioning and subsequent testing, the remaining useful operating life of the cathodic protection system may be estimated, (note estimation does not take into account continued degradation of the pipeline coating system and increase in current demand), as follows:

The estimated working year life is calculated from the following formula:

$$\text{Estimated Working Year Life (Y)} = \frac{W \times U}{C \times I}$$

Where:

W = Nominal weight of Anode(kg)

C = Anode consumption rate which for magnesium alloy = 7.8 kg/A-yr

I = Anode output current (A DC)

U = Utilisation factor = 0.8 (80%)

6.0 TEST RESULT

6.1 PROTECTION LEVELS

The pipe to soil potential survey conducted on the pipelines shows that the 'On' potentials measured at the (4) four test stations CBT-B2, CBT-B3, CBT-B4 and CBT-BB1 achieve the minimum acceptance criteria of -850mV (CSE) as shown in Table 1 and Table 2.

It was observed that all points on the pipeline tested achieved the minimum acceptance criteria of -850mV. However, when Q8 pipelines were boned (connected) with the PTT pipeline at bond box (CBT-BB1) affected the 'On' potential decreased as shown in Table 1

Test Box	Pipeline	Test Cable	Estimated Off Potential	On Potential		Remark
				mVDC	mVAC	
CBT-2	10"	P1	-1110	-1284	41.5	
	24"	P2	-1109	-1283	41.0	
CBT-3	10"	P1	-1161	-1335	33.6	
	24"	P2	-1162	-1336	31.7	
CBT-4	10"	P1	-1125	-1299	21.3	
	24"	P2	-1125	-1299	36.7	

Test Box	Pipeline	Test Cable	Estimated 'Off' Potential	'On' Potential		Remark
				(mVDC)	mVAC	
CBT-BB1	10"	P1	-1331	-1505	18.1	Connected to PTT Pipeline
	24"	P2	-1324	-1498	17.5	
	-	PTT1	-1070	-1244	50.5	
	-	PTT2	-1087	-1261	42.8	
	10"	P1	-1560	-1734	1.3	Disconnected from PTT Pipeline
	24"	P2	-1560	-1734	1.9	
	-	PTT1	No Connection	-914	83.4	
	-	PTT2	No Connection	-914	81.7	

Table 1: Pipe to Soil Potential Survey Results

The protection level reported on the PTT's pipeline were found to exceed the acceptance criteria. Normally, Q8's pipeline and PTT's pipeline are bonded, and this has been done to stop mutual interference between the two sets of pipeline and quite correctly so.

When the pipes are bonded, some CP current is being provided from the Q8 CP system to the PTT pipes, and the Q8 lines are protected. When the inter-pipeline bonds are disconnected the Q8 levels of protection increase (become more negative) as the extra load on the system is removed and more CP current is provided to the Q8 pipework, whilst the PTT pipelines lose this extra CP current protection and potentials become more positive.

CP current flows from the Q8 system onto PTT pipelines providing some protection total PTT pipelines. This CP current then flows along the PTT pipe to the bond connection, through the bond cable to the Q8 pipes then along that pipe and back to the sacrificial anodes complete the circuit. In doing so no pipes either PTT or Q8 are being damaged.

When the pipes are not bonded, interference from the PTT CP system is possible and this has the potential to damage the Q8 pipes.

Summary, provided that the bonds to the PTT pipeline are maintained and connected, there should be no interference problem on the Q8 pipelines.

It should be noted also that all testing was conducted without being able to switch 'Off' and 'On' the impressed current cathodic protection system installed upon the PTT and Q8 Pipelines.

6.2 ESTIMATED REMAINING SYSTEM LIFE

Test Box	Anode Potential (VDC)					Total Current (A)	* Estimated Remaining Life (Yrs)
	A-1	A-2	A-3	A-4	A-5		
CBT-2	-1.736	-1.763	-1.470	-1.604	-1.559	0.040	108
CBT-3	-1.874	-1.637	-1.671	-1.621	-1.671	0.074	55
CBT-4	-1.679	-1.680	-1.660	-1.646	-1.678	0.055	76
CBT-BB1	-1.680	-1.624	-1.667	-1.623	-1.782	0.210	14

Table 3: Anode Current Output

Example Calculation: Table 3 shows the total output current at test box CBT-BB1 is 0.21 A.

The theoretical remaining system life was calculated for the present current output from test station boxes as follows:

$$\text{Working Year Life (Y)} = \frac{(9.1 \text{ kg} \times 5 \text{ Anodes}) \times 0.8}{7.9 \times (\text{total current } 0.21 \text{ A})}$$

Where:

W = Nominal weight of Anode (kg)

C = Anode consumption rate which for magnesium alloy = 7.9 kg/A-yr

I = Anode output current (A DC)

U = Utilization factor = 0.8 (80%)

Theoretical Working Year Life (new anodes) = 21 Years

This system has been operated for almost 7 years (start of operation November 2014), therefore, theoretical working year life remaining at 0.21 A = 14 Years (21 minus 7)

6.3 AC VOLTAGE

The presence of induced AC current / voltage on the pipeline was investigated by recording the AC pipe to soil potential at all test station ins. All recorded AC pipe to soil potentials were found to be beneath the maximum acceptance criteria of 15VAC.

7.0 SURVEY PROCEDURE – BURIED TANKS

7.1 APPLIED TANK TO SOIL POTENTIAL

Applied tank to soil potentials, shall be recorded at all test points, using a high input impedance volt / multi-meter, connected to the 'pipe' test lead within the test post and portable CSE reference electrode placed in contact with the ground immediately over/above the buried tank under test.

7.2 ANODE CURRENT OUTPUT

The anode current output shall be measured utilizing a known shunt resistor. The shunt resistor is introduced in series between the anode cables and pipe test lead. The voltage drop across the shunt is then measured using a high input impedance multi-meter set to the mV DC volt range. From the observed voltage drop and shunt resistance rating and applying Ohm's law the corresponding DC current flow may be obtained.

8.0 TEST RESULT – BURIED TANKS

8.1 PROTECTION LEVELS

The pipe to soil potential survey conducted on the buried tanks CB-15 and CB-16 shows that the 'On' potentials measured do not achieve the minimum acceptance criteria for an 'Off' potential -850mV (CSE) as shown in Table 4.

Test Box	Pipeline	Test Cable	On Potential		Remark
			(mVDC)	mVAC	
CB-15	IF-1	Tank Side	-494	2.1	Below minimum protection criteria
		Unprotected	-281	2.3	
CB-16	IF-1	Tank Side	-552	11.1	Below minimum protection criteria
		Unprotected	-303	3.8	
	IF-2	Tank Side	-365	6.1	Below minimum protection criteria
		Unprotected	-364	8.1	No Insulation kit installed

Table 4: Tank to Soil Potential Survey Results

8.2 ANODE POTENTIAL AND CURRENT

Test Box	Anode Potential (VDC)		Total Current (A)	Remarks
	A-1	A-2		
CB-15	No Test Point Found		-	-
CB-16	-0.716		0.0012	Indication anodes are depleted

Table 5: Anode Current Output

9.0 RECOMMENDATIONS

9.1 UNDERGROUND PIPELINES

The following recommendations are made concerning the current status of Q8 pipelines:

- Q8 pipeline and PTT pipeline are bonded and this has been done to stop mutual interference between the two sets of pipelines. The bonds should not be removed and need to be checked on a regular basis to ensure the integrity.
- Consideration should be given to adding another bank of 5 high potential magnesium anodes in the vicinity of the PTT and Q8 pipeline crossing to provide additional current in order to compensate for the current drain from Q8 sacrificial system onto the PTT pipelines. As a result, the potentials of the PTT pipelines will rise, however, given a very complex interactions occurring at site with the PTT pipelines, its CP system functioning status and extent of the PTT pipelines increase loading on the Q8 CP system. It is not possible to guarantee that the accepted minimum CP criteria will be achieved.
- CBT-2, CBT-3 and CBT-4 have a damage head station board which shall be replaced.

9.2 UNDERGROUND TANKS CB-15 AND CB-16

The following recommendations are made concerning the current status of the underground tanks:

- Given the results of testing on CB15 and 16 it is evident that insufficient cathodic protection is being applied. Measurement of the anode potential and current indicates that the anodes are depleted.

- The recommendation to apply cathodic protection and to aid the design process would require conducting a current drain test to establish the required current and associated equipment to achieve protection.

10.0 ATTACHEMENT

Attachment A: Pipe to Soil Potential and Tank to Soil Potential Survey Results

Attachment B: Pipe to Soil Potential Graph

Attachment C: Pipeline Drawing

TANK TO SOIL POTENTIAL SURVEY RESULTS

Test Box	Pipeline	Test Cable	On Potential mVAC	Anode Potential (VDC)	Total Current (A)	Remark
CBT-15	IF-1	Tank Side	-494	2.1	-	
		Unprotected	-281	2.3	-	
CBT-16	IF-1	Tank Side	-552	11.1	-	
		Unprotected	-303	3.8	-	
	IF-2	Tank Side	-385	5.1	-	
		Unprotected	-364	8.1	0.012	

Table A2: Tank to Soil Potential Survey Results

*Shunt rating = 1A/500mV

Note:

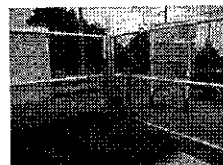
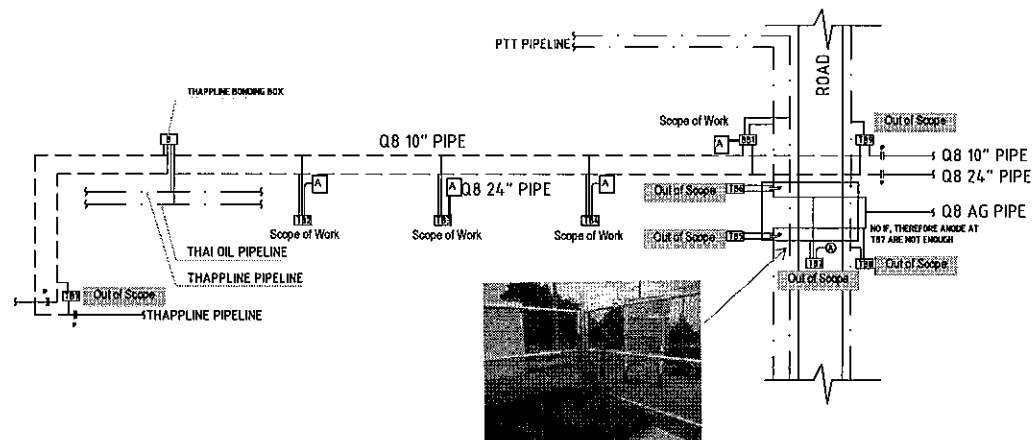
- Anode potentials were measured when disconnected to the pipeline.

PIPE TO SOIL POTENTIAL SURVEY RESULTS

Test Box	Pipeline	Test Cable	On Potential VDC	mVAC	Anode Potential (VDC)					Total Current (A)	Remark
					A-1	A-2	A-3	A-4	A-5		
CBT-2	10"	P1	-1284	41.5	-1.738	-1.763	-1.470	-1.804	-1.559	0.04	
		P2	-1283	41							
CBT-3	10"	P1	-1335	33.6	-1.674	-1.637	-1.571	-1.621	-1.671	0.074	
		P2	-1336	31.7							
CBT-4	10"	P1	-1299	21.3	-1.679	-1.680	-1.560	-1.646	-1.678	0.055	
		P2	-1296	36.7							
CBT-BB1	10"	P1	-1505	18.1							Connected to PTT Pipeline
		P2	-1498	17.5							
	24"	PTT1	-1244	50.5							Disconnect to PTT Pipelines
		PTT2	-1251	42.8							
	10"	P1	-1734	1.3	-1.680	-1.624	-1.657	-1.623	-1.782	0.21	
		P2	-1724	1.9							
	24"	PTT1	-914	83.4							
	-	PTT2	-914	81.7							

Table A1: Pipe to Soil Potential Survey Results

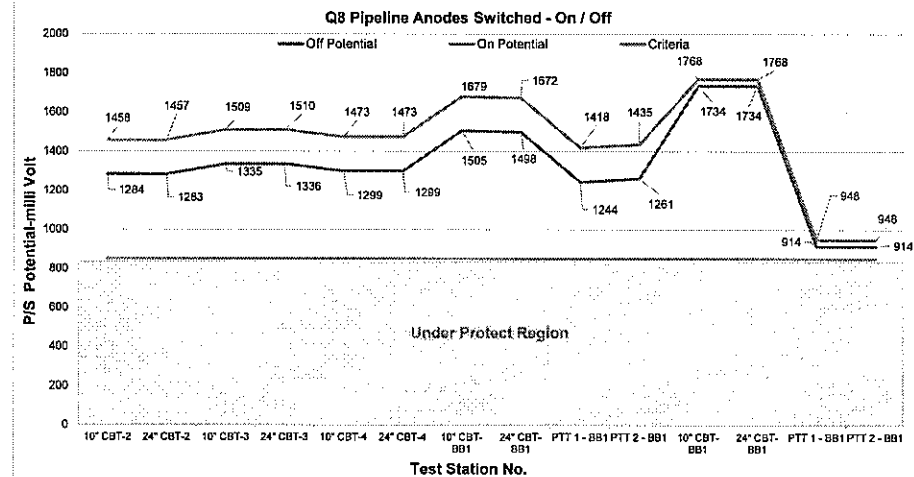
ATTACHMENT B:
PIPE TO SOIL POTENTIAL GRAPH



CATHODIC PROTECTION SYMBOL
 [Symbol] BOND BOX
 [Symbol] TEST BOX
 [Symbol] ANODE
 [Symbol] INSULATION FLANGE

JST
J.S. TECHNICAL SERVICES CO., LTD.
 29/3 Soi Charoenmitr 11 (Kamai 10), Sukhumvit 63 Road, Klongton Nua, Wattana,
 Bangkok 10110, THAILAND
 Tel.: (66-2) 391-4580, 391-9582 Fax: (66-2) 391-3371, 391-4330

PIPE TO SOIL POTENTIAL GRAPH



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การทดสอบและตรวจสอบก่อนการใช้งาน

รายงานผลการทดสอบและตรวจสอบ

ระบบท่อส่งน้ำมันเชื้อเพลิง

คลังน้ำมันเชื้อเพลิง

บริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด

เจ้าของ : บริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด
สถานที่ทดสอบ : 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขดา
อำเภอศรีราชา จังหวัดชลบุรี
ทดสอบโดย : บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด (มหาชน)



Ref : PAB-รายงานเลขที่ 2018-010

รายงานผลการทดสอบและตรวจสอบ

ระบบท่อส่งน้ำมันเชื้อเพลิง บริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด

ตามที่ทาง บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด (มหาชน) ได้ดำเนินการทดสอบและตรวจสอบ ระบบท่อส่งน้ำมันเชื้อเพลิง ของบริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด โดยทำการทดสอบที่ บริษัท คูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด เลขที่คัง 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขดา อำเภอศรีราชา จังหวัดชลบุรี เมื่อวันที่ 25 เมษายน 2561 นั้น ได้เสร็จสมบูรณ์แล้วโดยบริษัทที่กรมธุรกิจพลังงานจังหวัด และวิศวกรเครื่องกลประจำบริษัทฯ ไปร่วมทำการทดสอบซึ่งผลปรากฏว่าท่อส่งน้ำมันอยู่ในสภาพดีสามารถทนต่อการทดสอบได้

จึงแจ้งมาเพื่อทราบและโปรดปฏิบัติตามที่กรมธุรกิจพลังงานเห็นชอบต่อไป

ขอแสดงความนับถือ

บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด



(นายนิตติชัย สุราษฎร์กุล)

ผู้มีอำนาจลงนามแทนกรรมการผู้จัดการ

รายงานผลการทดสอบและตรวจสอบ

ทดสอบและตรวจสอบโดย

เจ้าของงาน

ผู้ครอบครอง

แบบก่อสร้าง

สถานที่ทำการทดสอบ

หมายเหตุ

ประเภทการติดตั้ง

ขนาดความจุ

มาตรฐานที่ใช้

ความดันที่ใช้ทดสอบ

เวลาที่กำหนดไว้ในการทดสอบ

ของเหลวที่ใช้ในการทดสอบ

จำนวนมาตรวัดที่ใช้ในการทดสอบ

บริษัท ทีเอส เทคโนโลยี จำกัด (มหาชน)
บริษัท อูเวค บีโตร์เลียม เอวิเอชั่น (ประเทศไทย) จำกัด
บริษัท อูเวค บีโตร์เลียม เอวิเอชั่น (ประเทศไทย) จำกัด
-
129-129/1 หมู่ที่ 2 ตำบลทุ่งหญ้า
อำเภอศรีราชา จังหวัดชลบุรี
N/A
N/A
N/A จำนวน N/A มี
ASME 31.3
27.5 บาร์ (BAR)
2.0 ชั่วโมง
น้ำ
2 ตัว

สรุปผลการทดสอบและตรวจสอบ

- ขณะทดสอบไม่พบการรั่วซึมใด ๆ ของท่อและอุปกรณ์ประกอบ

- หลังลดความดันลง ไม่พบการรวมหรือการบิดเบี้ยวของท่อและอุปกรณ์ประกอบ

สรุป : ผลการตรวจสอบผ่านเกณฑ์มาตรฐานการทดสอบตามมาตรฐานของ ASME 31.3

วัน เดือน ปี ที่ทำการทดสอบและตรวจสอบ

วัน เดือน ปี ที่ต้องทำการทดสอบและตรวจสอบครั้งต่อไป

25 เมษายน 2561

ตามข้อกำหนดของกรมธุรกิจพลังงาน

ผู้ปฏิบัติงานทดสอบและตรวจสอบ

วันที่ 25 เมษายน 2561

(นายชัชวาลย์ จิตต์นิล) เลขทะเบียน ๓๓. 4154

วิศวกรควบคุมงานทดสอบและตรวจสอบ

(นายวิชา พิมพ์ศรี) 25 เมษายน 2561 เลขทะเบียน ๓๓. 3085

PAE Technical Service Public Company Limited

Registration No. (5)1571/2542

69 Soi On-nuch 64, Srinakarin Rd., Suanluang, Bangkok 10250 Thailand, Tel : (662) 721-2742, Fax : (662) 721-2577

PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED.

69 Soi On-nuch 64, Srinakarin Road, Suanluang, Suanluang, Bangkok 10250

Tel : (662) 721-2742 Fax : (662) 721-2577, Email : info@paetechnical.com

PRESSURE TEST REPORT		Report no. : PAE-2018-010 Page 1 of 2
Client : บริษัท อูเวค บีโตร์เลียม เอวิเอชั่น (ประเทศไทย) จำกัด		Test Date : 25 Apr 18
Project : AMBER-THE KPAT JPS OPERATIONS CONVERSION PROJECT		Place of Work : Chonburi Province
Name of Product : ระบบท่อส่งน้ำมันเชื่อมเหล็ก		Test Product : <input type="checkbox"/> Tank <input checked="" type="checkbox"/> HEADER & PIPE <input type="checkbox"/> Others / Vessel
Name of Part : HEADER & PIPE		
Test Package :	TP-P-01-062,064	
Test Method :	<input checked="" type="checkbox"/> Hydrostatic Test <input type="checkbox"/> Pneumatic Test <input type="checkbox"/> Others	
Test Medium :	<input checked="" type="checkbox"/> Water <input type="checkbox"/> Air <input type="checkbox"/> CO ₂ <input type="checkbox"/> N ₂ <input type="checkbox"/> Others	
Pressure Indicator :	Cert. Number : CKC-PG-60-004	Range : 0 - 60 Bar
Pressure Indicator :	Cert. Number : CKC-PG-60-F	Range : 0 - 60 Bar
Temperature Indicator :	Cert. Number : N/A	Range : N/A
Pressure Recorder :	Cert. Number : ACT2561-00107	Range : 0 - 2500 PSI
STANDARD INFORMATION		
Design Pressure :	18.3 Bar	Start - Stop : 09.40 - 12.19
Design Temperature :	80 C	Testing Temperature : 42-48 C
Testing Pressure :	27.5 Bars	Testing Pressure : 37.5 Bars
Holding Time :	2.0 Hrs.	Holding Time : 2.0 Hrs.
Applicable Standard :	ASME B31.3	
Remarks		
<p align="center">PRESSURIZING CHART</p>		
Result : NEITHER LEAKAGE NOR DEFORMATION WAS OBSERVED		
Judgement <input checked="" type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable <input type="checkbox"/> Attached Sheets = 2 Page		
SIGNED :	TEST BY	INSPECTION BY
NAME :	Mr. Chaiphapruk J.	Mr. Wichai P.
COMPANY :	CKC CO.,LTD.	PAE PUBLIC CO.,LTD.
TESTED DATE :	25 April 2018	25 April 2018

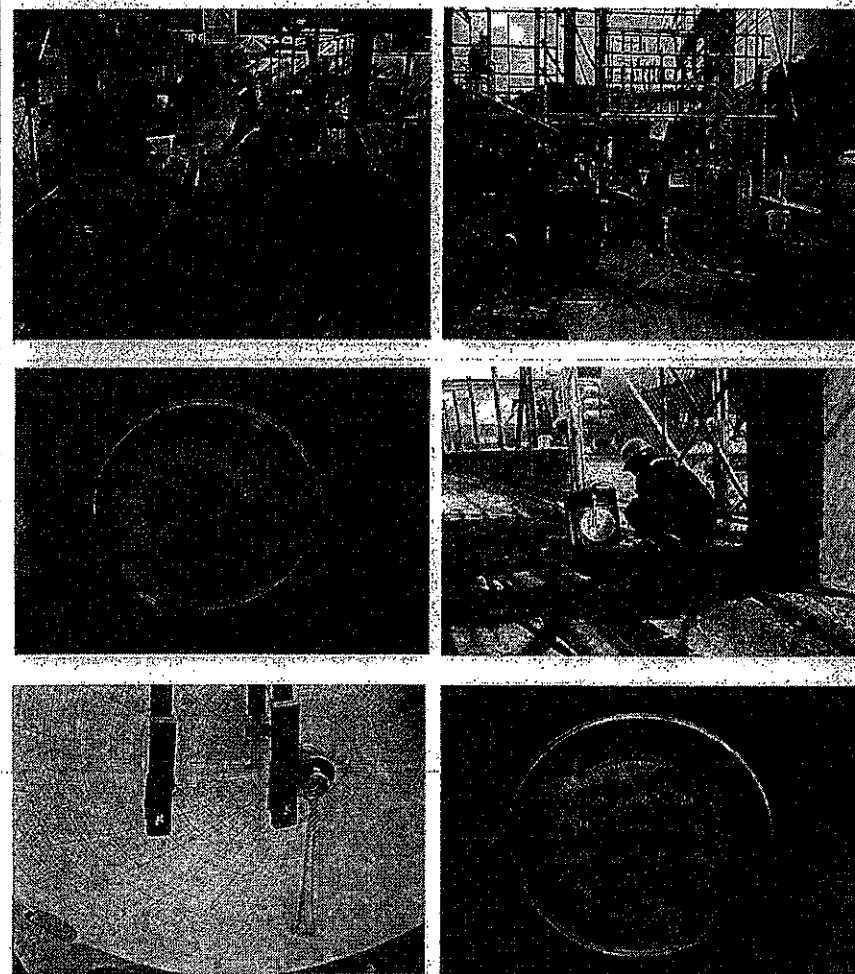
PRESSURE TEST RECORD

Client : บริษัท ดูนค บีโชนเคม เวนิชชั่น (ประเทศไทย) จำกัด Page No. 2 of 2
Contractor : บริษัท นวัตกรรมแห่งเทคโนโลยี จำกัด Report No. PAE/2018-010
Project Name : AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT Test Date 25 Apr 18
Name of Part : HEADER & PIPE Holding Time : 2 Hrs.
Location : Chonburi Province
Design Pressure : 18.3 Bars. Test Pressure : 27.5 Bars. Test Medium : Water

Test Instrument Detail	Pressure Indicator		Pressure Indicator		Pressure Recorder	
	No. 1	No. 2	No. 3	No. 4	No. 1	No. 2
Brand Name	Ashcroft	Ashcroft	-	-	CLIPMCK COMPANY	-
Serial No.	CKC-PG-60-004	CKC-PG-60-F	-	-	1559	-
Certificate No.	SB/CKC/2018/06/11	SB/CKC/2018/06/13	-	-	ACT2561-00107	-
Operating Range	0-60 BAR	0-60 BAR	-	-	0-2500 PSI	-

Time From	Pressure Gauge No. 1 (BAR)	Pressure Gauge No. 2 (BAR)	Pressure Gauge No. 3 (BAR)	Temp (Amb) T1 °C	Remark
9.40	0	0	-	42.0	
9.44	10.8	10	-	42.0	
9.54	11.8	11	-	43.0	
9.52	11.5	11	-	43.0	Holding Time
10.09	11.5	11	-	43.0	
10.19	11.5	11	-	43.0	
10.29	11.5	11	-	42.0	
10.39	11.5	11	-	42.0	
10.49	11.5	11	-	43.0	
10.59	11.5	11	-	44.0	
11.09	11.5	11	-	44.0	
11.19	11.5	11	-	47.0	
11.29	11.5	11	-	47.0	
11.39	11.5	11	-	48.0	
11.49	11.5	11	-	44.0	
11.59	11.5	11	-	44.0	
12.05	11.5	11	-	44.0	
12.07	19	19	-	44.0	
12.17	19.2	19	-	43.0	
12.19	0	0	-	42.0	

	Test By	Witness By	Witness By	Witness By	Approved By
SIGNED :					
NAME :	Mr. Chaiyaphruk J.	Mr. Wicha P.	Mr. Wicha P.	Mr. Wicha P.	Mr. Wicha P.
COMPANY :	CKC	PAE Public Co., Ltd	Amec Foster Wheeler	PAE Public Co., Ltd	PAE Public Co., Ltd
DATE :	25 Apr 18	25 Apr 18	25 Apr 18	25 Apr 18	25 Apr 18



HYDROSTATIC TEST

HEADER & PIPE

0100011497-254111111-2561



WYŻY SZKŁA

กรมธุรกิจพลังงาน
พาณิชย์รับของมีให้ไว้ที่แสดงว่า

អ្នកបង្កើត ពី ចេ ចី អេតិវិច្ឆត ចេតិវិច្ឆត ទាំង៣ (អោយឃើញ)

4. ប្រើប្រាស់ប្រភេទផ្សេងៗនៃឧបករណ៍ ។

ตามหลักฐานการค้นพบกระดูกมนุษย์ที่เมืองบ้านดอนเมืองเวียงจันทน์ จังหวัดบึงกาฬ มีอายุประมาณ ๒๕,๐๐๐ ปีมาแล้ว ซึ่งตรงกับสมัยก่อนประวัติศาสตร์ตอนต้น การขุดค้นพบกระดูกของมนุษย์ที่เมืองบ้านดอนเมืองเวียงจันทน์ จังหวัดบึงกาฬ มีอายุประมาณ ๒๕,๐๐๐ ปีมาแล้ว ซึ่งตรงกับสมัยก่อนประวัติศาสตร์ตอนต้น การขุดค้นพบกระดูกของมนุษย์ที่เมืองบ้านดอนเมืองเวียงจันทน์ จังหวัดบึงกาฬ มีอายุประมาณ ๒๕,๐๐๐ ปีมาแล้ว ซึ่งตรงกับสมัยก่อนประวัติศาสตร์ตอนต้น

អំពីការងារនេះ ត្រូវបានដាក់ចេញ, ៥ ឡើយ, ចុះក្រោយ: ៣.៧. ២០០៧

ପ୍ରକାଶକ: ଶ୍ରୀ ପ୍ରମୋଦ, ଲେଖକ: ଶ୍ରୀ ପ୍ରମୋଦ

ในระหว่างที่ พอล วอร์เรน
ผู้ซึ่งดำรงตำแหน่งเป็นทนายความ
อธิบดีกรมสุขภาพจิต

[illegible]

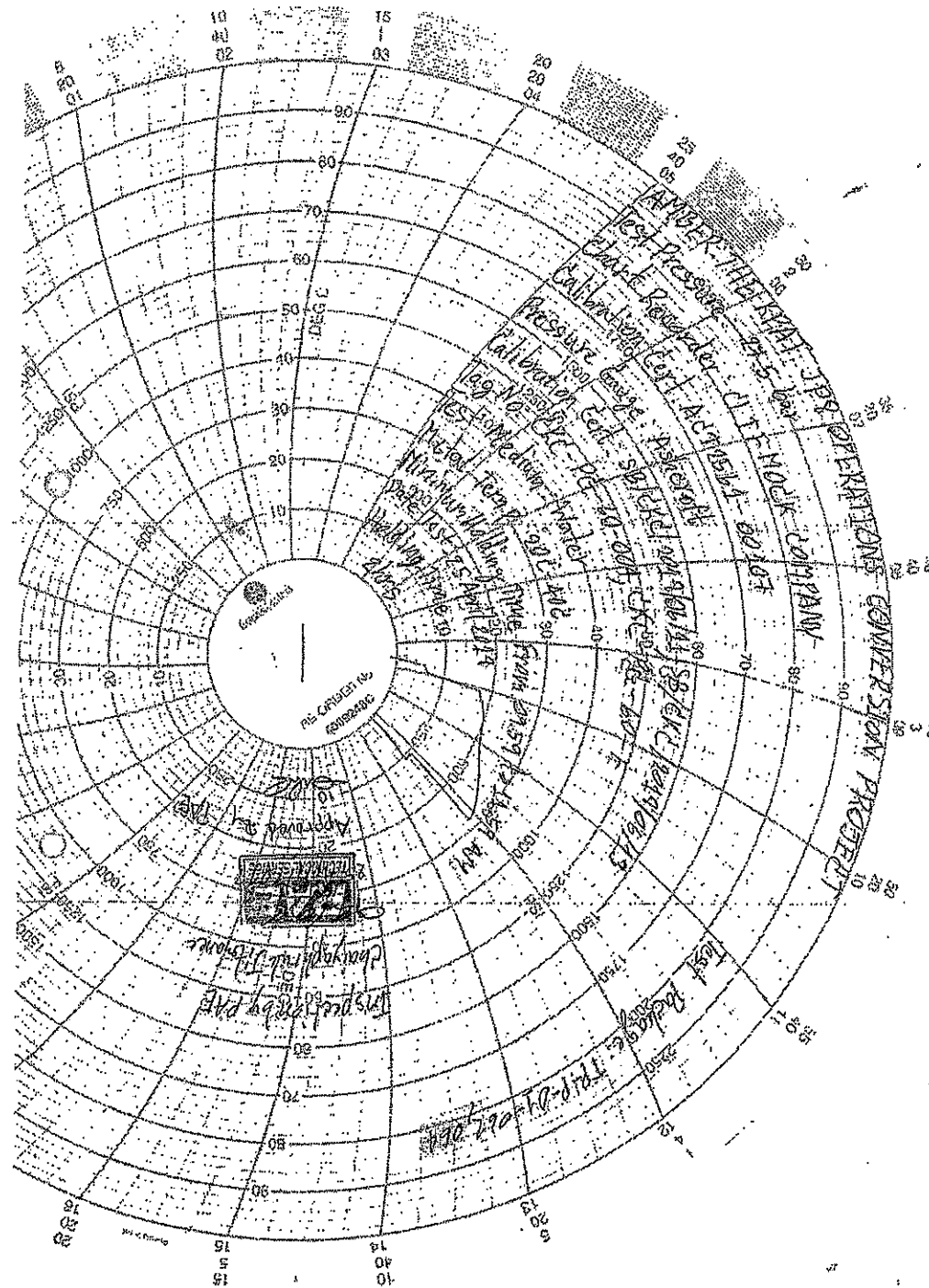
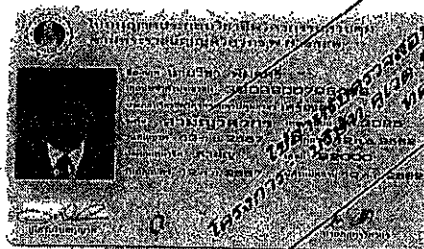
KEYWORDS

กรมธุรกิจพลังงาน

ਅਧਿਕਾਰੀਆਂ ਨੂੰ ਭਾਗੀਦਾਰਾਂ ਨੂੰ ਭਰੋਸੇ ਦਿਵਾਉਣਾ

[illegible]

កម្ពុជាខ្មែរ ឯកភាព ៥ ឆ្នាំ ក្រោយ ក.ខ. ២០០២

[illegible][illegible]



S.B. MAINTENANCE SERVICE CO., LTD.
PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CKC Engineering And Construction(1998) Co., Ltd.

RECORD No. : SB / CKC / 2018 / 06 / 11

TAG No. : CKC - PG - 60 - 004

DESCRIPTION :
MFGR. : ASHCROFT MODEL / TYPE :
S/R No. :

CALIBRATION RANGE : 0 - 60 Kg/cm² STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Kg/cm ²)	DESIRED OUTPUT (Kg/cm ²)	OUTPUT (Kg/cm ²)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50*	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

MFGR. : HAND PUMP
ENERPAC

RANGE : 0 - 10,000 PSI

MODEL : P39 H3596M

S/R No. :
CERT. No. :

<< STANDARD TEST GAUGE >>

MFGR. : Addiel

RANGE : 0 - 140 Kg/cm² / Bar

MODEL : 681

S/R No. : 211H16590012

CERT. No. : P180184

COMMENTS :



TESTED BY : S.Chit DATE : March 27, 2018 CHECKED BY : P.Sudhanom DATE : March 27, 2018
ACCEPTED BY : DATE : 27-March-2018 WITNESSED BY : DATE : 27-03-18

QA/QC DEPARTMENT

MT-P-003-18/01405



S.B. MAINTENANCE SERVICE CO., LTD.
PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CKC Engineering And Construction(1998) Co., Ltd.

RECORD No. : SB / CKC / 2018 / 06 / 13

TAG No. : CKC - PG - 60 - F

DESCRIPTION :
MFGR. : ASHCROFT MODEL / TYPE :
S/R No. :

CALIBRATION RANGE : 0 - 60 Kg/cm² STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Kg/cm ²)	DESIRED OUTPUT (Kg/cm ²)	OUTPUT (Kg/cm ²)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

MFGR. : HAND PUMP
ENERPAC

RANGE : 0 - 10,000 PSI

MODEL : P39 H3596M

S/R No. :
CERT. No. :

<< STANDARD TEST GAUGE >>

MFGR. : Addiel

RANGE : 0 - 140 Kg/cm² / Bar

MODEL : 681

S/R No. : 211H16590012

CERT. No. : P180184

COMMENTS :



TESTED BY : S.Chit DATE : March 27, 2018 CHECKED BY : P.Sudhanom DATE : March 27, 2018
ACCEPTED BY : DATE : 27-March-2018 WITNESSED BY : DATE : 27-03-18

QA/QC DEPARTMENT

MT-P-003-18/01405

Certificate of Calibration

Report number ACT2561-00107



BARTON	242E(D-2500)	2562-032-2	1559	18 Jan 18	18 Jan 19
--------	--------------	------------	------	-----------	-----------

\pm ASME 1A of span (1%)

All instrument calibrations are verified for accuracy before they are shipped. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

As Received Condition: In tolerance As Left Condition: In tolerance passed calibration:

All calibrations are performed in a controlled environment by qualified personnel using instrumentation and methods which guarantee that specifications claimed are reliable. Calibrations conform to ANSI/NCSL Z540-1-1994, MIL-STD 45662A, 10CFR21 and 10CFR50 when specified by customer documentation.

Definitions:	Temperature	Measured temperature of test during data collection.
	Reference Reading	True value according to our reference standards.
	Gauge Reading	Displayed reading from test unit.
	Condition	Pass or Fail.
	Difference	Indicated reading minus reference reading.
	Relative Difference	(Difference / reference reading) x 100
	Allowable Tolerance	\pm according to manufacturer's specifications.
	Water column	Referenced at 20° C and 1 atmosphere.
	Test Accuracy Ratio	At least 4:1 unless otherwise stated.

Laboratory ambient conditions throughout this calibration were:

Temperature 20 to 24° C
Humidity 30 to 55% RH
Pressure 100 to 103 kPa

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States, through the following report numbers:

Crystal Engineering	NV-4AA-BNKLPT-700BAR	073435	782265	24 Mar 18
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This certificate shall not be reproduced except in full, without written approval.

[Signature]

Laboratory Representative

[Signature]

Quality Representative

Test Results

Report number ACT2561-00107



As Received Test Results

2500 PSI

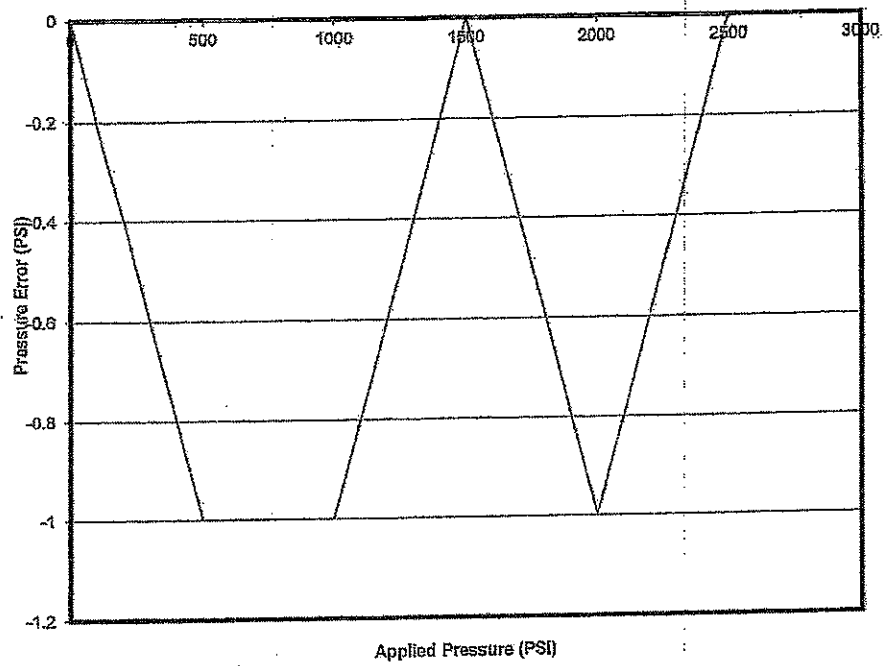
0	0	25	0		Pass
500	500	25	-1	-0.20%	Pass
1000	1000	25	-1	-0.10%	Pass
1500	1500	25	0	0.00%	Pass
2000	2000	25	-1	-0.05%	Pass
2500	2500	25	0	0.00%	Pass
2000	2000	25	0	0.00%	Pass
1500	1500	25	0	0.00%	Pass
1000	1000	25	0	0.00%	Pass
500	500	25	0	0.00%	Pass
0	0	25	0		Pass

As Left Test Results

2500 PSI

0	0	25	0		Pass
500	500	25	-1	-0.20%	Pass
1000	1000	25	-1	-0.10%	Pass
1500	1500	25	0	0.00%	Pass
2000	2000	25	-1	-0.05%	Pass
2500	2500	25	0	0.00%	Pass
2000	2000	25	0	0.00%	Pass
1500	1500	25	0	0.00%	Pass
1000	1000	25	0	0.00%	Pass
500	500	25	0	0.00%	Pass
0	0	25	0		Pass

Pressure Error Graph for Gauge # 2562-032-2, S/N 1559, Report # ACT2561-00107



— As Received Test Results
— As Left Test Results



รายงานผลการทดสอบและตรวจสอบ

ระบบท่อส่งน้ำมันเชื้อเพลิง

คลังน้ำมันเชื้อเพลิง

บริษัท กูเวต ปิโตรเลียม เอวี่เอชั่น (ประเทศไทย) จำกัด



Ref: PAE-รายงานเลขที่ 2018-004

รายงานผลการทดสอบและตรวจสอบ

ระบบท่อส่งน้ำมันเชื้อเพลิง บริษัท กูเวต ปิโตรเลียม เอวี่เอชั่น (ประเทศไทย) จำกัด

ตามที่ทาง บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด (มหาชน) ได้ดำเนินการทดสอบและตรวจสอบ ระบบท่อส่งน้ำมันเชื้อเพลิง ของบริษัท กูเวต ปิโตรเลียม เอวี่เอชั่น (ประเทศไทย) จำกัด โดยทำการทดสอบที่ บริษัท กูเวต ปิโตรเลียม เอวี่เอชั่น (ประเทศไทย) จำกัด เลขที่ 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขลา อำเภอศรีราชา จังหวัดชลบุรี เมื่อวันที่ 06 เมษายน 2561 นั้นได้เสร็จสมบูรณ์แล้วโดยมีเจ้าหน้าที่กรมธุรกิจพลังงานจังหวัด และวิศวกรเครื่องกลประจำบริษัทฯ ไปร่วมทำการทดสอบซึ่งผลปรากฏว่าท่อส่งน้ำมันอยู่ในสภาพดีสามารถทนต่อการทดสอบได้

จึงแจ้งมาเพื่อทราบและโปรดอนุวัติตามที่กรมธุรกิจพลังงานเห็นชอบต่อไป

ขอแสดงความนับถือ

บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด



(นายกิตติชัย สุมาณะกุล)

ผู้อำนวยการงานบำรุงรักษาระบบผู้จัดการ

เจ้าของ : บริษัท กูเวต ปิโตรเลียม เอวี่เอชั่น (ประเทศไทย) จำกัด

สถานที่ทดสอบ : 129-129/1 หมู่ที่ 2 ตำบลทุ่งสุขลา

อำเภอศรีราชา จังหวัดชลบุรี

ทดสอบโดย : บริษัท พีเออี เทคนิคอล เซอร์วิส จำกัด (มหาชน)



รายงานผลการทดสอบและตรวจรอบ

ทดสอบและตรวจรอบโดย	: บริษัท ทีเอบี เทคโนโลยี เซอร์วิส จำกัด (มหาชน)
เจ้าของถัง	: บริษัท อูเวค บีโกลิอิม เอจิเอัน (ประเทศไทย) จำกัด
ผู้ครอบครองถัง	: บริษัท อูเวค บีโกลิอิม เอจิเอัน (ประเทศไทย) จำกัด
แบบก่อสร้างถัง	: -
สถานที่ทำการทดสอบ	: 129-129/1 หมู่ที่ 2 ตำบลทุ่งขะลา อำเภอศรีราชา จังหวัดชลบุรี
หมายเลขถัง	: N/A
ประเภทการจัดเก็บ	: N/A
ขนาดความสูงถัง	: N/A จำนวน N/A ถึง
มาตรฐานที่ใช้	: ASME 31.3
ความดันที่ทำการทดสอบ	: 28.0 บาร์ (BAR)
เวลาที่กำหนดไว้ในใบการทดสอบให้ถึงที่	: 2.0 ชั่วโมง
ของเหลวที่ใช้ในการทดสอบ	: น้ำ
จำนวนผลการวัดที่ใช้ในการทดสอบ	: 2 ตัว

สรุปผลการทดสอบและตรวจรอบ

- ขณะลดความดัน ไม่พบการรั่วซึมใด ๆ ของท่อและอุปกรณ์ประกอบ
- หลังลดความดันลง ไม่พบการบวมหรือการบิดเบี้ยวของท่อและอุปกรณ์ประกอบ

สรุป : ผลการตรวจสอบผ่านเกณฑ์มาตรฐานการทดสอบความดันตามมาตรฐานของ ASME 31.3

วัน เดือน ปี ที่ทำการทดสอบและตรวจรอบ

06 เมษายน 2561

วัน เดือน ปี ที่ตั้งทำการทดสอบและตรวจรอบครั้งต่อไป

ตามข้อกำหนดของกรมอุตสาหกรรม

ผู้ปฏิบัติงานทดสอบและตรวจรอบ

[Signature]

วันที่

06 เมษายน 2561

(นายชัชวาลย์ จิตมณี)

สถ. 4154

ผู้ควบคุมงานจากสถานทดสอบ

[Signature]

(นายวิชา ทิมลวี)

วันที่

06 เมษายน 2561

เลขทะเบียน

สถ. 3085

PAE Technical Service Public Company Limited

Registration No. (5)1571/2542

69 Soi On-nuch 64, Srinakharin Rd., Suanluang, Bangkok 10250 Thailand. Tel : (662) 721-2742, Fax : (662) 721-2577



PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED
69 Soi On-nuch 64, Srinakharin Road, Suanluang, Suanluang, Bangkok 10250
Tel. : (662) 721-2742 Fax. : (662) 721-2577, Email : info@paetechnical.com

PRESSURE TEST REPORT		Report no. : PAE-2018-004 Page 1 of 2
Client : บริษัท อูเวค บีโกลิอิม เอจิเอัน (ประเทศไทย) จำกัด		Test Date : 6 Apr 18
Project : AMBER THE KPAT JF8 OPERATIONS CONVERSION PROJECT		Place of Work : Chonburi Province
Name of Product : ระบบท่อส่งน้ำมันเชื้อเพลิง	Test Product : <input type="checkbox"/> Tank <input checked="" type="checkbox"/> HEADER & PIPE <input type="checkbox"/> Others / Vessel	
Name of Parts : BRADER & PIPE		
Test Package : TP-P-01-001,002,003,004,005,013,014,015,024,030, TP-O-01-001,002,003,011, TP-TIRM-309		
Test Method : <input checked="" type="checkbox"/> Hydrostatic Test <input type="checkbox"/> Pneumatic Test <input type="checkbox"/> Others		
Test Medium : <input checked="" type="checkbox"/> Water <input type="checkbox"/> Air <input type="checkbox"/> CO ₂ <input type="checkbox"/> N ₂ <input type="checkbox"/> Others		
Pressure Indicator : Cert. Number : CKC-PG-60-F.R	Range	0 - 60 Bar
Pressure Indicator : Cert. Number : CKC-PG-60-001,002,004	Range	0 - 60 Bar
Temperature Indicator : Cert. Number : N/A	Range	N/A
Pressure Recorder : Cert. Number : ACT2561-00107	Range	0 - 2500 PSI
STANDARD INFORMATION		
Design Pressure	18.3 Bar	Start - Stop
Design Temperature	88 C	Testing Temperature
Testing Pressure	27.5 Bars	Testing Pressure
Holding Time	2.0 Hrs.	Holding Time
Applicable Standard	ASME B31.3	
ACTUAL RECORD		
Design Pressure	18.3 Bar	Start - Stop
Design Temperature	88 C	Testing Temperature
Testing Pressure	27.5 Bars	Testing Pressure
Holding Time	2.0 Hrs.	Holding Time
Applicable Standard	ASME B31.3	
Remark		
<p align="center">PRESSURIZING CHART</p>		
Result : NEITHER LEAKAGE NOR DEFORMATION WAS OBSERVED		
Judgement	<input checked="" type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable <input type="checkbox"/> Attached Sheets = 2 Page	
SIGNED :	TEST BY <i>[Signature]</i> INSPECTION BY <i>[Signature]</i> WITNESS BY <i>[Signature]</i> WITNESS BY <i>[Signature]</i> APPROVED BY <i>[Signature]</i>	
NAME :	Mr. Chalyaphrak J. Mr. Chalyaphrak J. Mr. Chalyaphrak J. Mr. Chalyaphrak J. Mr. Chalyaphrak J.	
COMPANY :	CKC CO., LTD. PAE PUBLIC CO., LTD. ANI-CRATER PUMPLER KRAT PAE PUBLIC CO., LTD.	
TESTED DATE :	6 April 2018 6 April 2018 6 April 2018 6 April 2018 6 April 2018	



PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED
69 On-nuch-B4, Srinakarin Rd., Suanluang, Bangkok 10250.
Tel.: (662) 721-2742 Fax.: (662) 721-2577, Email: info@paetechnical.com

PRESSURE TEST RECORD

Client : บริษัท อูราค นิโตรเคียม เอเซียซัน (ประเทศไทย) จำกัด Page No. 2 of 2
Contractor : บริษัท อีกรการช่างเทคนิค จำกัด Report No. PAE/2018-004
Project Name : AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT Test Date 6 Apr 18
Name of Part : HEADER & PIPE Holding Time : 2 Hrs.
Location : Chonburi Province
Design Pressure : 18.3 Bars. Test Pressure : 27.50 Bars. Test Medium : Water

Test Instrument Detail	Pressure Indicator					Pressure Recorder
	No. 1	No. 2	No. 3	No. 4	No. 5	
Brand Name	Ashcroft	Ashcroft	Ashcroft	Ashcroft	Ashcroft	CLIF BACK COMPANY
Serial No.	CKC-PG-60-F	CKC-PG-60-D	CKC-PG-60-001	CKC-PG-60-002	CKC-PG-60-004	1559
Certificate No.	SBCKC2018/0603	SBCKC2018/0602	SBCKC2018/0608	SBCKC2018/0609	SBCKC2018/0611	ACT2561-00107
Operating Range	0 - 60 BAR	0 - 60 BAR	0 - 60 BAR	0 - 60 BAR	0 - 60 BAR	0 - 2500 PSI

Time	Pressure Gauge No. 1 (BAR)	Pressure Gauge No. 2 (BAR)	Pressure Gauge No. 3 (BAR)	Pressure Gauge No. 4 (BAR)	Pressure Gauge No. 5 (BAR)	Temp (Amb) T1 - C	Remark
10.15	0	0	0	0	0	42.0	
10.25	9	9	10	10	10	42.0	
10.35	12	12	14	13	13	42.0	
10.45	14	14	15	14	14	42.0	
10.50	30	28	29	30	30	42.0	Holding Time
11.00	30	28	29	30	30	42.0	
11.10	30	28	29	30	30	42.0	
11.20	31	29	30	31	31	42.0	
11.30	31	29	30	31	31	42.0	
11.40	31	29	30	31	31	42.0	
11.50	32	30	31	32	32	42.0	
12.00	32	30	31	32	32	42.0	
12.10	32	30	31	32	32	42.0	
12.20	33	31	31	33	33	42.0	
12.30	33	31	31	33	33	42.0	
12.40	34	32	32	34	34	42.0	
12.50	34	32	32	34	34	42.0	
13.00	35	33	33	35	35	42.0	
13.10	20	19	20	19	19	40.0	
13.20	20	19	20	19	19	40.0	
13.35	2	1	2	1	1	40.0	
13.45	0	0	0	0	0	40.0	

	Test By	Inspect By	Witness By	Witness By	Approved By
SIGNED :					
NAME :	Mr. Chaiyaphan J.	Mr. Chaiyaphan J.	Mr. Chaiyaphan J.	Mr. Chaiyaphan J.	Mr. Wicha R.
COMPANY :	CKC	PAE Public Co., Ltd	Amee Foster Wheeler	EPAT	PAE Public Co., Ltd
DATE :	6 Apr 18	6 Apr 18	6 Apr 18	6 Apr 18	6 Apr 18



กรมการช่างเทคนิค

วันที่ 18/04/2018

กรมการช่างเทคนิค
หนังสือรับรองการปฏิบัติงาน

บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน)
(ในลักษณะการดำเนินงาน)

ตามที่ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ได้ขอรับการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ในการดำเนินงานโครงการ AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT ซึ่งได้ดำเนินการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) เมื่อวันที่ 6 เมษายน 2561

หนังสือรับรองการปฏิบัติงานฉบับนี้ มีผลใช้บังคับตั้งแต่วันที่ 6 เมษายน 2561

โดยมีผลใช้บังคับตั้งแต่วันที่ 6 เมษายน 2561

นางสาว อรุณรัตน์ นิลรัตน์
ผู้อำนวยการกองช่างเทคนิค
กรมการช่างเทคนิค

ขอสงวนสิทธิ์ในกรณีที่ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ได้ขอรับการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ในการดำเนินงานโครงการ AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT ซึ่งได้ดำเนินการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) เมื่อวันที่ 6 เมษายน 2561



กรมการช่างเทคนิค

วันที่ 18/04/2018

กรมการช่างเทคนิค
หนังสือรับรองการปฏิบัติงาน

ตามที่ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ได้ขอรับการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ในการดำเนินงานโครงการ AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT ซึ่งได้ดำเนินการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) เมื่อวันที่ 6 เมษายน 2561

หนังสือรับรองการปฏิบัติงานฉบับนี้ มีผลใช้บังคับตั้งแต่วันที่ 6 เมษายน 2561

โดยมีผลใช้บังคับตั้งแต่วันที่ 6 เมษายน 2561

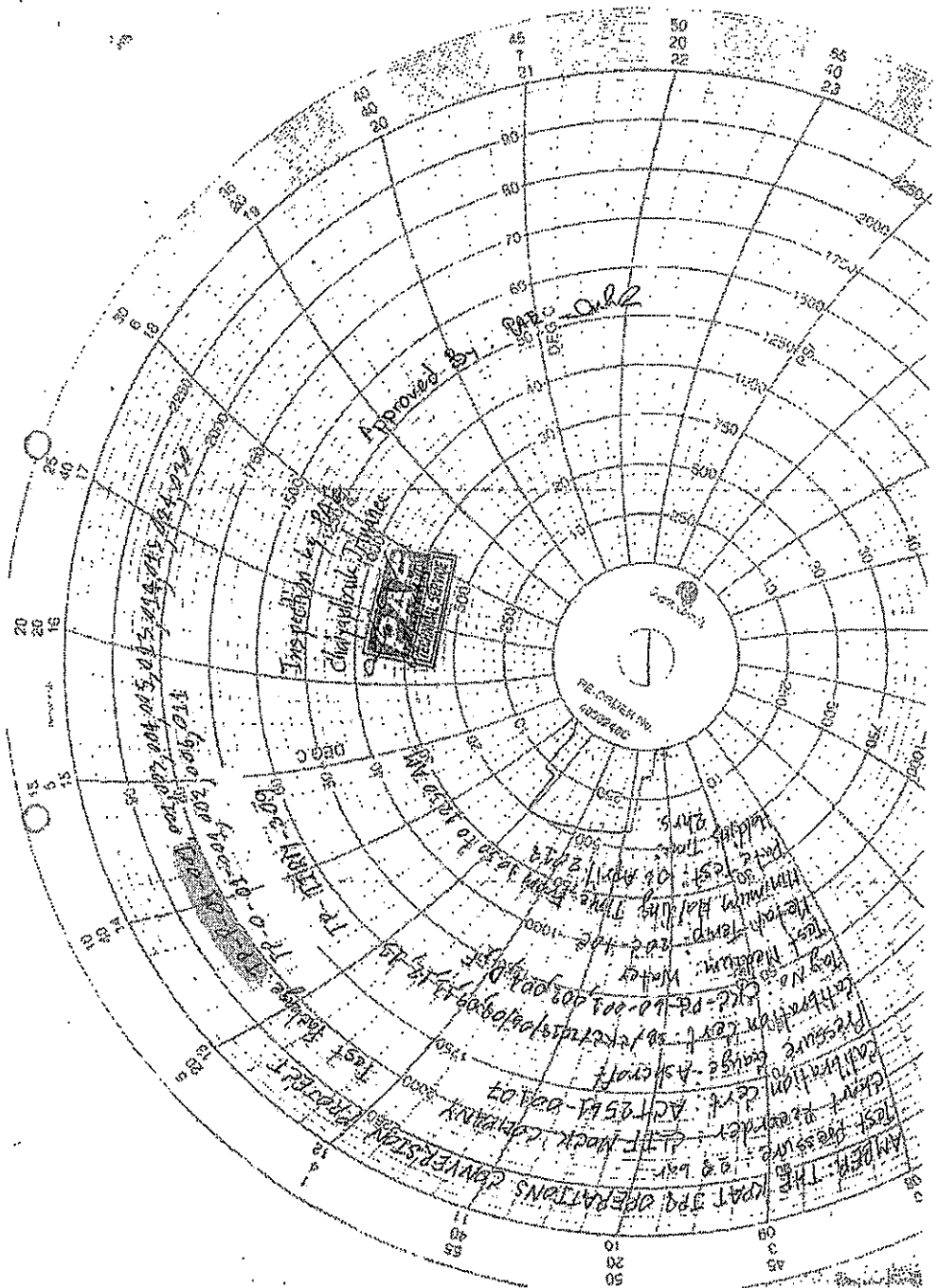


นางสาว อรุณรัตน์ นิลรัตน์
ผู้อำนวยการกองช่างเทคนิค
กรมการช่างเทคนิค

ขอสงวนสิทธิ์ในกรณีที่ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ได้ขอรับการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) ในการดำเนินงานโครงการ AMBER THE KPAT JPS OPERATIONS CONVERSION PROJECT ซึ่งได้ดำเนินการตรวจสอบการปฏิบัติงานของ บริษัท อูราค นิโตรเคียม เอเซียซัน จำกัด (มหาชน) เมื่อวันที่ 6 เมษายน 2561



116600



Certificate of Calibration

Report number ACT2561-00107



BARTON	242E(0-2500)	2562-032-2	1559	18 Jan 18	18 Jan 19
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± ASME 1A of span (1%)

All instrument calibrations are verified for accuracy before they are shipped. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

As Received Condition: in tolerance As Left Condition: in tolerance passed calibration.

All calibrations are performed in a controlled environment by qualified personnel using instrumentation and methods which guarantee that specifications claimed are reliable. Calibrations conform to ANSI/NCSL Z540-1-1994, MIL-STD 45662A, 10CFR21 and 10CFR50 when specified by customer documentation.

Definitions:	Temperature	Measured temperature of test during data collection.
	Reference Reading	True value according to our reference standards.
	Gauge Reading	Displayed reading from test unit.
	Condition	Pass or Fail.
	Difference	Indicated reading minus reference reading.
	Relative Difference	(Difference / reference reading) x 100
	Allowable Tolerance	± according to manufacturer's specifications.
	Water column	Referenced at 20° C and 1 atmosphere.
	Test Accuracy Ratio	At least 4:1 unless otherwise stated.

Laboratory ambient conditions throughout this calibration were:

Temperature	20 to 24° C
Humidity	30 to 38% RH
Pressure	100 to 103 kPa

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States, through the following report numbers:

Crystal Engineering	NV-4AA-BNKPLT-702BAR	073435	782265	24 Mar 18
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This certificate shall not be reproduced except in full, without written approval.

Laboratory Representative

Quality Representative

Test Results Report number ACT2561-00107



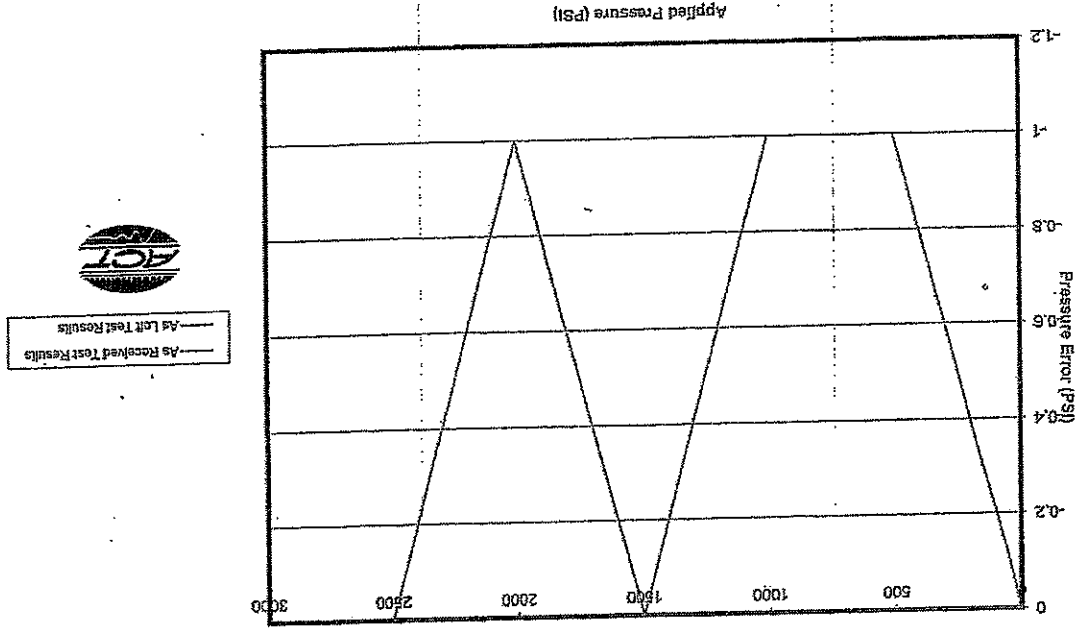
As Received Test Results

2500 PSI					
0	0	25	0	0	Pass
501	500	25	-1	-0.20%	Pass
1001	1000	25	-1	-0.10%	Pass
1500	1500	25	0	0.00%	Pass
2001	2000	25	-1	-0.05%	Pass
2500	2500	25	0	0.00%	Pass
2000	2000	25	0	0.00%	Pass
1500	1500	25	0	0.00%	Pass
1000	1000	25	0	0.00%	Pass
500	500	25	0	0.00%	Pass
0	0	25	0	0.00%	Pass

As Left Test Results

2500 PSI					
0	0	25	0	0.00%	Pass
501	500	25	0	0.00%	Pass
1001	1000	25	-1	-0.10%	Pass
1500	1500	25	0	0.00%	Pass
2001	2000	25	-1	-0.05%	Pass
2500	2500	25	0	0.00%	Pass
2000	2000	25	0	0.00%	Pass
1500	1500	25	0	0.00%	Pass
1000	1000	25	0	0.00%	Pass
500	500	25	0	0.00%	Pass
0	0	25	0	0.00%	Pass

Pressure Error Graph for Gauge # 2562-032-2, S/N-1559, Report# ACT2561-00107





S.B. MAINTENANCE SERVICE CO., LTD. PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CRC Engineering And Construction(1998) Co.,Ltd.
 RECORD No. : SB / CRC / 2018 / 06 / 11
 TAG No. : CRC-PG-60-004
 DESCRIPTION :
 MFR. : ASHCROFT MODEL / TYPE :
 S/R No. :
 CALIBRATION RANGE : 0-60 Kg/cm² STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Kg/cm ²)	DESIRED OUTPUT (Kg/cm ²)	OUTPUT (Kg/cm ²)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

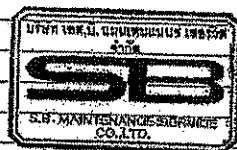
<< INPUT PRESSURE >>

MFR. : HAND PUMP
 ENERPAC
 RANGE : 0-10,000 PSI
 MODEL : P39H356M
 S/R No. :
 CERT No. :

<< STANDARD TEST GAUGE >>

MFR. : Addeid
 RANGE : 0-140 Kg/cm²/Bar
 MODEL : 681
 S/R No. : 211H16390012
 CERT No. : P180184

COMMENTS :



TESTED BY : S.Chit DATE : March 27, 2018
 ACCEPTED BY : DATE : 27-March-2018
 CHECKED BY : DATE : March 27, 2018
 WITNESSED BY : DATE : 27-03-18

QA/QC DEPARTMENT



S.B. MAINTENANCE SERVICE CO., LTD. PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CRC Engineering And Construction(1998) Co.,Ltd.
 RECORD No. : SB / CRC / 2018 / 06 / 09
 TAG No. : CRC-PG-60-002
 DESCRIPTION :
 MFR. : Baumer MODEL / TYPE :
 S/R No. :
 CALIBRATION RANGE : 0-60 Bar STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Bar)	DESIRED OUTPUT (Bar)	OUTPUT (Bar)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

MFR. : HAND PUMP
 ENERPAC
 RANGE : 0-10,000 PSI
 MODEL : P39H356M
 S/R No. :
 CERT No. :

<< STANDARD TEST GAUGE >>

MFR. : Addeid
 RANGE : 0-140 Kg/cm²/Bar
 MODEL : 681
 S/R No. : 211H16390012
 CERT No. : P180184

COMMENTS :



TESTED BY : S.Chit DATE : March 27, 2018
 ACCEPTED BY : DATE : 27-March-2018
 CHECKED BY : DATE : March 27, 2018
 WITNESSED BY : DATE : 27-03-18



S.B. MAINTENANCE SERVICE CO., LTD.

PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CKC Engineering And Construction(1996) Co.,Ltd.

RECORD No. : SB/CKC/2018/06/09

TAG No. : CKC-PG-60-001

DESCRIPTION :

MFGR. : Spinner

MODEL/TYPE :

S/R No. :

CALIBRATION RANGE : 0-60 Bar

STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Bar)	DESIRED OUTPUT (Bar)	OUTPUT (Bar)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

MFGR. : HAND PUMP

ENERPAC

RANGE : 0-10,000 PSI

MODEL : F39 H3596M

S/R No. :

CERT.No. :

<< STANDARD TEST GAUGE >>

MFGR. : Adidol

RANGE : 0-140 Kgf/cm²/Bar

MODEL : 681

S/R No. : 211H16590012

CERT.No. : P180184

COMMENTS :



TESTED BY : S.Chet DATE : March 27, 2018

CHECKED BY :

DATE : March 27, 2018

ACCEPTED BY : DATE : 27-March-2018

WITNESSED BY :

DATE : 27.03.18

QA/QC DEPARTMENT

SB-P-001-18/01/15



S.B. MAINTENANCE SERVICE CO., LTD.

PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CKC Engineering And Construction(1996) Co.,Ltd.

RECORD No. : SB/CKC/2018/06/12

TAG No. : CKC-PG-60-D

DESCRIPTION :

MFGR. : ASHCROFT

MODEL/TYPE :

S/R No. :

CALIBRATION RANGE : 0-60 Bar

STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Bar)	DESIRED OUTPUT (Bar)	OUTPUT (Bar)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

MFGR. : HAND PUMP

ENERPAC

RANGE : 0-10,000 PSI

MODEL : F39 H3596M

S/R No. :

CERT.No. :

<< STANDARD TEST GAUGE >>

MFGR. : Adidol

RANGE : 0-140 Kgf/cm²/Bar

MODEL : 681

S/R No. : 211H16590012

CERT.No. : P180184

COMMENTS :



TESTED BY : S.Chet DATE : March 27, 2018

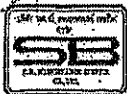
CHECKED BY :

DATE : March 27, 2018

ACCEPTED BY : DATE : 27-March-2018

WITNESSED BY :

DATE : 27.03.18



S.B. MAINTENANCE SERVICE CO., LTD.

PRESSURE GAUGE CALIBRATION REPORT

CUSTOMER : CEC Engineering And Construction(1998) Co., Ltd.
RECORD No. : SB / CEC / 2018 / 06 / 13
TAG No. : CEC - PG - 60 - F
DESCRIPTION :
MPGR : ASHCROFT MODEL / TYPE :
S/R No. :
CALIBRATION RANGE : 0 - 60 Kg/cm² STANDARD TEST GAUGE : Digital Test Gauge

%	INPUT (Kg/cm ²)	DESIRED OUTPUT (Kg/cm ²)	OUTPUT (Kg/cm ²)				Absolute Error		% Accuracy (%)	
			AS FOUND		AS LEFT					
			INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
0	0.00	0.00	0.00	0.00	-	-	-	-	-	-
25	15.00	15.00	15.00	15.00	-	-	-	-	-	-
50	30.00	30.00	30.00	30.00	-	-	-	-	-	-
75	45.00	45.00	45.00	45.00	-	-	-	-	-	-
100	60.00	60.00	60.00	60.00	-	-	-	-	-	-

TEST EQUIPMENT

<< INPUT PRESSURE >>

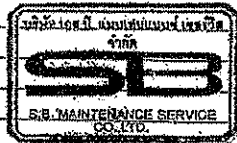
MPGR : HAND PUMP
BNERPAC
RANGE : 0 - 10,000 PSI
MODEL : F39 H390M
S/R No. :
CERT No. :

<< STANDARD TEST GAUGE >>

MPGR : Additel
RANGE : 0 - 140 Kg/cm² / Bar
MODEL : 681
S/R No. : 211HJ6390012
CERT No. : P180184

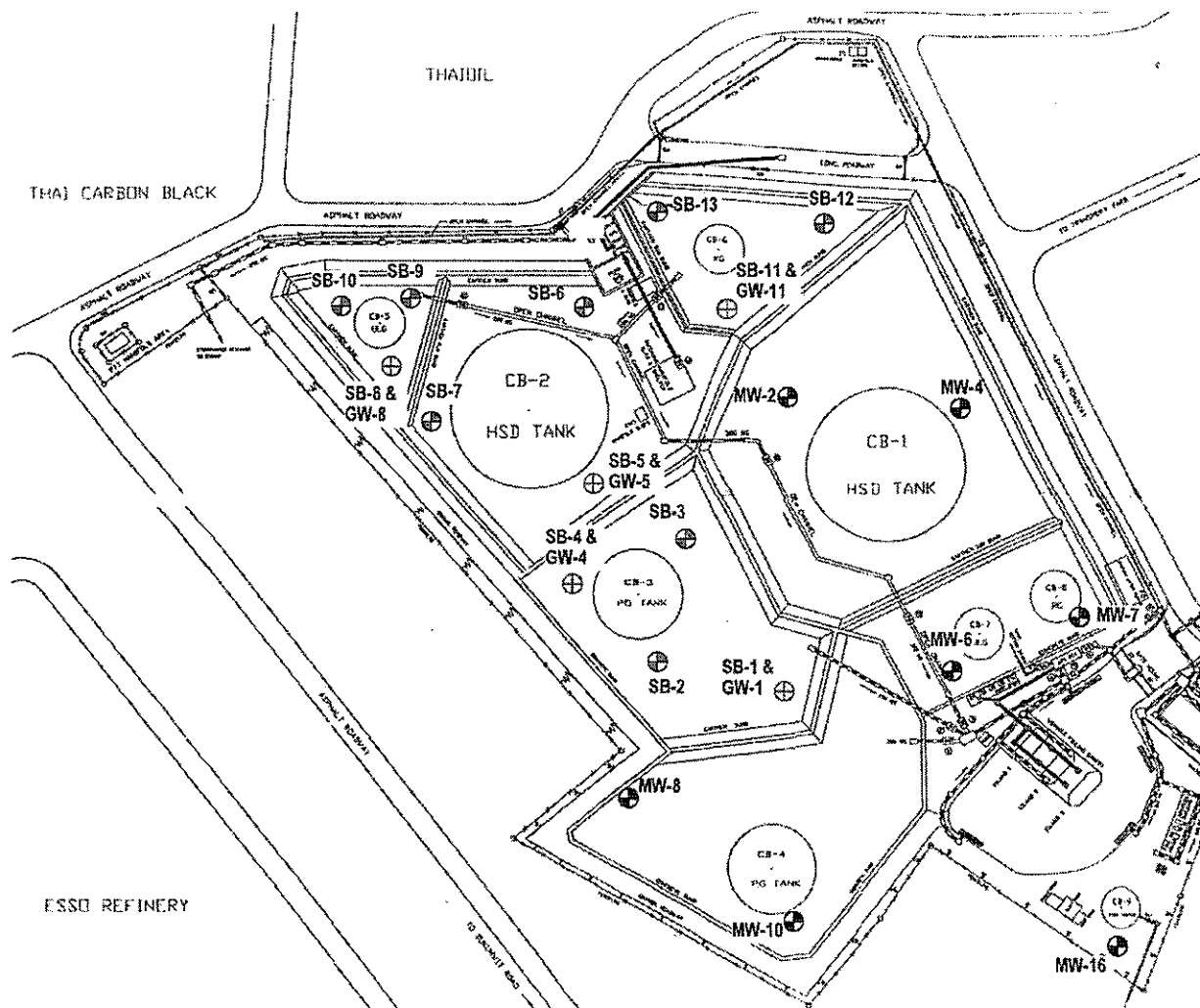
COMMENTS :

TESTED BY : S.Chet DATE : March 27, 2018 CHECKED BY : P. Subramaniam DATE : March 27, 2018
ACCEPTED BY : DATE : 27-March-2018 WITNESSED BY : DATE : 27-03-18



ภาคผนวก ข.4

แผนผังแสดงตำแหน่งบ่อตรวจสอบคุณภาพน้ำใต้ดินภายในบริษัท



ตำแหน่งตรวจวัดคุณภาพน้ำใต้ดิน
โครงการท่อส่งน้ำมัน บริษัท กูเวต ปิโตรเลียม เอวิเอชั่น (ประเทศไทย) จำกัด