

ภาคผนวก ง

มาตรฐาน



## ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๒๑ (พ.ศ. ๒๕๕๔)

ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ

พ.ศ. ๒๕๓๕

เรื่อง กำหนดมาตรฐานค่าก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไป  
ในเวลา ๑ ชั่วโมง

อาศัยอำนาจตามความในมาตรา ๓๒ และมาตรา ๓๕ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ คณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงปรับปรุงแก้ไขมาตรฐานค่าก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไปในเวลา ๑ ชั่วโมงไว้ดังต่อไปนี้

(๑) ให้ยกเลิกข้อ ๒ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๒ (พ.ศ. ๒๕๓๘) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานค่าก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไปในเวลา ๑ ชั่วโมง

(๒) ให้ยกเลิกความในข้อ ๓ และข้อ ๕ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๒ (พ.ศ. ๒๕๓๘) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานค่าก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไปในเวลา ๑ ชั่วโมง และให้ใช้ความต่อไปนี้แทน

“ข้อ ๓ ค่าเฉลี่ยความเข้มข้นของก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไปในเวลา ๑ ชั่วโมง จะต้องไม่เกิน ๐.๓๐ ส่วนในล้านส่วน (ppm) หรือไม่เกิน ๑๘๐ ไมโครกรัมต่อลูกบาศก์เมตร”

๒๖๘

“ข้อ ๕ การวัดค่าเฉลี่ยความเข้มข้นของก๊าซซัลเฟอร์ไดออกไซด์ในบรรยากาศโดยทั่วไปในเวลา ๑ ชั่วโมง ตามข้อ ๓ ให้ใช้เครื่องมือระบบ ยูวี ฟลูออเรสเซน หรือระบบอื่นที่กรมควบคุมมลพิษประกาศในราชกิจจานุเบกษา”

ประกาศ ณ วันที่ ๘ เมษายน พ.ศ. ๒๕๕๔

(นายเดช บุญ-หลง)

รองนายกรัฐมนตรี ปฏิบัติหน้าที่

ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

(ประกาศในราชกิจจานุเบกษา เล่ม ๑๑๘ ตอนที่ ๓๕ ง ลงวันที่ ๓๐ เมษายน ๒๕๕๔)

๒๖๙



## ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๒๔ (พ.ศ. ๒๕๕๗)

เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป

อาศัยอำนาจตามความในมาตรา ๓๒ และมาตรา ๓๕ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจำกัดสิทธิและเสรีภาพของบุคคล ซึ่งมาตรา ๒๙ ประกอบกับมาตรา ๓๕ มาตรา ๔๔ มาตรา ๕๐ และมาตรา ๕๑ ของรัฐธรรมนูญแห่งราชอาณาจักรไทยบัญญัติให้กระทำได้โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย คณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงได้มีมติในคราวการประชุมครั้งที่ ๒/๒๕๕๗ เมื่อวันที่ ๒๔ กุมภาพันธ์ ๒๕๕๗ ให้ปรับปรุงแก้ไขมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป ดังต่อไปนี้

ข้อ ๑ ให้ยกเลิกความใน (๔) ของข้อ ๒ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๐ (พ.ศ. ๒๕๓๘) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป และให้ใช้ความต่อไปนี้แทน

“(๔) ค่าเฉลี่ยของก๊าซซัลเฟอร์ไดออกไซด์ ในเวลา ๒๔ ชั่วโมง จะต้องไม่เกิน ๐.๑๒ ส่วนในล้านส่วน หรือไม่เกิน ๐.๑๐ มิลลิกรัมต่อลูกบาศก์เมตร และค่ามัธยฐานเลขคณิต (Arithmetic Mean) ในเวลา ๑ ปี จะต้องไม่เกิน ๐.๐๕ ส่วนในล้านส่วน หรือไม่เกิน ๐.๑๐ มิลลิกรัมต่อลูกบาศก์เมตร”

ข้อ ๒ ให้ยกเลิกความใน (๒) และ (๓) ของข้อ ๔ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๐ (พ.ศ. ๒๕๓๘) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป และให้ใช้ความต่อไปนี้แทน

“(๒) ค่าเฉลี่ยของฝุ่นละอองขนาดไม่เกิน ๑๐ ไมครอน ในเวลา ๒๔ ชั่วโมง จะต้องไม่เกิน ๐.๑๒ มิลลิกรัมต่อลูกบาศก์เมตร และค่ามัธยฐานเลขคณิต (Arithmetic Mean) ในเวลา ๑ ปี จะต้องไม่เกิน ๐.๐๕ มิลลิกรัมต่อลูกบาศก์เมตร

(๓) ค่าเฉลี่ยของฝุ่นละอองรวมฝุ่นละอองขนาดไม่เกิน ๑๐๐ ไมครอน ในเวลา ๒๔ ชั่วโมง จะต้องไม่เกิน ๐.๑๕ มิลลิกรัมต่อลูกบาศก์เมตร และค่ามัธยฐานเลขคณิต (Arithmetic Mean) ในเวลา ๑ ปี จะต้องไม่เกิน ๐.๑๐ มิลลิกรัมต่อลูกบาศก์เมตร”

ประกาศ ณ วันที่ ๔ สิงหาคม พ.ศ. ๒๕๕๗

(ลงนาม) จาตุรนต์ ฉายแสง

(นายจาตุรนต์ ฉายแสง)

รองนายกรัฐมนตรี

ปฏิบัติหน้าที่ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ราชกิจจานุเบกษา ฉบับประกาศทั่วไป เล่ม ๑๒๑ ตอนที่ ๑๐๔ ง วันที่ ๒๒ กันยายน ๒๕๕๗



ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๑๓ (พ.ศ. ๒๕๕๒)  
เรื่อง กำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป

โดยที่เป็นการสมควรกำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป เพื่อเป็นเกณฑ์ทั่วไปสำหรับการส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมตามพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕

อาศัยอำนาจตามความในมาตรา ๑๒ (๔) และมาตรา ๑๔ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจัดตั้งและอำนาจของบุคคล ซึ่งมาตรา ๒๕ ประกอบกับมาตรา ๑๓ มาตรา ๑๔ มาตรา ๔๑ และมาตรา ๔๓ ของรัฐธรรมนูญแห่งราชอาณาจักรไทย บัญญัติให้กระทำได้โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย คณะกรรมการสิ่งแวดล้อมแห่งชาติจึงออกประกาศกำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป ดังต่อไปนี้

ข้อ ๑ ในประกาศนี้

“เครื่องมือระบบเคมีลูมิเนสเซนซ์” (Chemiluminescence) หมายความว่า เครื่องมือวัดก๊าซไนโตรเจนไดออกไซด์ที่ใช้ก๊าซไอโซนทำปฏิกิริยากับก๊าซไนโตรเจนไดออกไซด์ซึ่งถูกเปลี่ยนมาจากก๊าซไนโตรเจนไดออกไซด์แล้ววัดความเข้มของแสงที่เกิดจากปฏิกิริยานั้น ณ ความยาวคลื่นที่สูงกว่า ๖๐๐ นาโนเมตร (Nanometer)

ข้อ ๒ ให้ยกเลิก

(๑) ความใน (๒) ของข้อ ๒ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๐ (พ.ศ. ๒๕๓๕) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป

(๒) ความใน (๑) ของข้อ ๖ แห่งประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๐ (พ.ศ. ๒๕๓๕) ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป แก้ไขเพิ่มเติมโดยประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๒๔ (พ.ศ. ๒๕๕๐) เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป

ข้อ ๓ ให้กำหนดมาตรฐานค่าก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไปไว้ดังต่อไปนี้

(๑) ค่าเฉลี่ยของก๊าซไนโตรเจนไดออกไซด์ในเวลากลางวัน ๑ ชั่วโมง จะต้องไม่เกิน ๐.๑๕ ส่วนในล้านส่วนหรือไม่เกิน ๐.๑๒ มิลลิกรัมต่อลูกบาศก์เมตร

(๒) ค่ามัธยเทศคณิต (Arithmetic Mean) ของก๊าซไนโตรเจนไดออกไซด์ในเวลากลางวัน ๑ ปี จะต้องไม่เกิน ๐.๐๘ ส่วนในล้านส่วน หรือไม่เกิน ๐.๐๘๓ มิลลิกรัมต่อลูกบาศก์เมตร

ข้อ ๔ การคำนวณค่าความเข้มข้นของก๊าซไนโตรเจนไดออกไซด์ในบรรยากาศโดยทั่วไป ให้คำนวณเทียบที่ความดัน ๑ บรรยากาศ และอุณหภูมิ ๒๕ องศาเซลเซียส

ข้อ ๕ การวัดค่าเฉลี่ยของก๊าซไนโตรเจนไดออกไซด์ในเวลากลางวัน หรือค่ามัธยเทศคณิต (Arithmetic Mean) ในเวลา ๑ ปี ให้ใช้เครื่องมือระบบเคมีลูมิเนสเซนซ์ หรือระบบอื่นที่กรมควบคุมมลพิษให้ความเห็นชอบ

ประกาศ ณ วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๕๒

อภิสิทธิ์ เวชชาชีวะ

นายกรัฐมนตรี

ประธานกรรมการสิ่งแวดล้อมแห่งชาติ

ประกาศกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

เรื่อง กำหนดมาตรฐานควบคุมการปล่อยทิ้งอากาศเสียจากโรงไฟฟ้าใหม่

โดยที่เป็นการสมควรปรับปรุงการกำหนดมาตรฐานควบคุมการปล่อยทิ้งอากาศเสียจากโรงไฟฟ้าให้มีความเหมาะสมกับการพัฒนาเทคโนโลยี และสถานการณ์มลพิษในปัจจุบัน

อาศัยอำนาจตามความในมาตรา ๕๕ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจัดตั้งและอำนาจของบุคคล ซึ่งมาตรา ๒๕ ประกอบกับมาตรา ๑๓ มาตรา ๑๔ มาตรา ๔๑ และมาตรา ๔๓ ของรัฐธรรมนูญแห่งราชอาณาจักรไทยบัญญัติให้กระทำได้โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย รัฐมนตรีว่าการกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อมได้โดยคำแนะนำของคณะกรรมการควบคุมมลพิษ และโดยความเห็นชอบของคณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงออกประกาศไว้ ดังต่อไปนี้

ข้อ ๑ ในประกาศนี้

“โรงไฟฟ้าใหม่” หมายความว่า โรงงานผลิตพลังงานไฟฟ้าตามกฎหมายว่าด้วยโรงงานซึ่งใช้ถ่านหิน น้ำมัน ก๊าซธรรมชาติหรือเชื้อเพลิงชีวภาพเป็นเชื้อเพลิง ที่ได้รับอนุญาตให้ประกอบกิจการหลังการขึ้นทะเบียนครั้งแรก

“เชื้อเพลิงชีวภาพ” หมายความว่า เชื้อเพลิงที่ได้มาจากอินทรีย์สารหรือสิ่งมีชีวิต รวมทั้งผลิตภัณฑ์จากกระบวนการแปรรูป และกระบวนการอื่นใด เช่น ไม้ปื้น เศษไม้ แกลบ ฟาง ชานอ้อย มัน และใบอ้อย ใบปาล์ม ทะเลปาล์ม ทะเลสาบปาล์ม ทะเลสาบข้าว โสมะพร้าว เศษพืช มูลสัตว์ ก๊าซชีวภาพ ภาคเกษตรหรือของเสียจากโรงงานแปรรูปผลิตภัณฑ์ทางการเกษตร เป็นต้น

“สภาวะแห้ง” หมายความว่า สภาวะที่ความชื้นของตัวตัวอย่างอากาศเป็นศูนย์

ข้อ ๒ กำหนดมาตรฐานควบคุมการปล่อยทิ้งอากาศเสียจากโรงไฟฟ้าใหม่ และโรงไฟฟ้าตามกฎหมายว่าด้วยการส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติไว้รับในอนุญาตประกอบกิจการโรงงานก่อนและในวันที่ประกาศนี้มีผลใช้บังคับแล้วแต่ยังได้รับอนุญาตให้ขยายโรงงานไว้ดังต่อไปนี้

ชนิดของโรงไฟฟ้า	ฝุ่นละออง (มิลลิกรัมต่อลูกบาศก์เมตร)	ก๊าซซัลเฟอร์ไดออกไซด์ (ส่วนในล้านส่วน)	ก๊าซไนโตรเจนไดออกไซด์ (ส่วนในล้านส่วน)
๑. โรงไฟฟ้าที่ใช้ถ่านหินเป็นเชื้อเพลิง			
(๑) ที่มีกำลังการผลิตไฟฟ้าไม่เกิน ๕๐ เมกะวัตต์	ไม่เกิน ๕๐	ไม่เกิน ๓๖๐	ไม่เกิน ๒๐๐
(๒) ที่มีกำลังการผลิตไฟฟ้าเกิน ๕๐ เมกะวัตต์	ไม่เกิน ๕๐	ไม่เกิน ๔๕๐	ไม่เกิน ๒๐๐
๒. โรงไฟฟ้าที่ใช้ถ่านหินเป็นเชื้อเพลิง	ไม่เกิน ๑๒๐	ไม่เกิน ๒๖๐	ไม่เกิน ๔๕๐
๓. โรงไฟฟ้าที่ใช้ก๊าซธรรมชาติเป็นเชื้อเพลิง	ไม่เกิน ๖๐	ไม่เกิน ๒๐	ไม่เกิน ๑๒๐
๔. โรงไฟฟ้าที่ใช้เชื้อเพลิงชีวภาพเป็นเชื้อเพลิง	ไม่เกิน ๑๒๐	ไม่เกิน ๖๐	ไม่เกิน ๒๐๐

ข้อ ๓ การคำนวณค่าอากาศเสียแต่ละชนิดที่ปล่อยทิ้งจากปล่องโรงไฟฟ้าตามข้อ ๒ ให้คำนวณที่ความดัน ๑ บรรยากาศหรือที่ ๑๐๖ มิลลิเมตรปรอท อุณหภูมิ ๒๕ องศาเซลเซียส ที่สภาวะแห้ง (Dry Basis) โดยมีปริมาณอากาศส่วนเกินในกระแสไอ (Excess Air) ร้อยละ ๕๐ หรือที่ปริมาณออกซิเจนส่วนเกิน (Excess Oxygen) ในกระแสไอร้อยละ ๘

ข้อ ๔ กรณีโรงไฟฟ้าตามข้อ ๒ ใช้ทั้งถ่านหิน น้ำมัน ก๊าซธรรมชาติหรือเชื้อเพลิงชีวภาพเป็นเชื้อเพลิงรวมกันตั้งแต่ ๒ ประเภทขึ้นไป ให้คำนวณมาตรฐานควบคุมการปล่อยทิ้งอากาศเสียตามสัดส่วนของเชื้อเพลิงที่ใช้แต่ละประเภทดังต่อไปนี้

คำนวณมาตรฐานควบคุมการปล่อยทิ้งอากาศเสีย = AW + BX + CY + DZ

เมื่อ A = ค่ามาตรฐานอากาศเสียที่ปล่อยทิ้งเมื่อใช้ถ่านหินเป็นเชื้อเพลิงอย่างเดียว

B = ค่ามาตรฐานอากาศเสียที่ปล่อยทิ้งเมื่อใช้น้ำมันเป็นเชื้อเพลิงอย่างเดียว

C = ค่ามาตรฐานอากาศเสียที่ปล่อยทิ้งเมื่อใช้ก๊าซธรรมชาติเป็นเชื้อเพลิงอย่างเดียว

D = ค่ามาตรฐานอากาศเสียที่ปล่อยทิ้งเมื่อใช้เชื้อเพลิงชีวภาพเป็นเชื้อเพลิงอย่างเดียว

W = สัดส่วนของความร้อน (Heat Input) ที่ได้จากเชื้อเพลิงประเภทถ่านหิน

X = สัดส่วนของความร้อน (Heat Input) ที่ได้จากเชื้อเพลิงประเภทน้ำมัน

Y = สัดส่วนของความร้อน (Heat Input) ที่ได้จากเชื้อเพลิงประเภทก๊าซธรรมชาติ

Z = สัดส่วนของความร้อน (Heat Input) ที่ได้จากเชื้อเพลิงประเภทเชื้อเพลิงชีวภาพ



การควบคุมปริมาณอากาศและสภาวะแวดล้อมในการเผาไหม้ เช่น หม้อเผาปูนซีเมนต์ หม้อน้ำ เป็นต้น

ชนิดของสารเจือปน (หน่วยวัด)	แหล่งที่มาของสารเจือปน	ค่าปริมาณของสารเจือปน ในอากาศ	
		ไม่มีการเผาไหม้ เชื้อเพลิง	มีการเผาไหม้ เชื้อเพลิง
๓. ฝุ่นละออง (Total Suspended Particulate) (มิลลิกรัมต่อลูกบาศก์เมตร)	ก. แหล่งกำเนิดจากธรรมชาติ - ป่าไม้หรือบริเวณภูเขา - ถ่านหิน - เชื้อเพลิงชีวมวล - เชื้อเพลิงอื่น ๆ ข. การจราจร แหล่งถนน วัสดุ และ ผลิตภัณฑ์ อลูมิเนียม ค. การผลิตทั่วไป	- - - -	๒๕๐ ๓๒๐ ๓๒๐ ๓๒๐
๒. ฟอสฟอรัส (Arsimony) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๒๐	๑๖
๓. อาร์เซนิก (Arsenic) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๒๐	๑๖
๔. ทองแดง (Copper) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๓๐	๒๔
๕. ตะกั่ว (Lead) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๓๐	๒๔
๖. ปฏิกิริยา (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๓	๒.๔
๗. คลอรีน (Chlorine) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๓๐	๒๔
๘. ไฮโดรเจนคลอไรด์ (Hydrogen chloride) (มิลลิกรัมต่อลูกบาศก์เมตร)	การผลิตทั่วไป	๒๐๐	๑๖๐

ชนิดของสารเคมี (หน่วยวัด)	แหล่งที่มาของสารเคมี	ปริมาณของสารเคมี ในเกณฑ์	
		ไม่มีกรรมสิทธิ์ เฉพาะ	มีกรรมสิทธิ์ เฉพาะ
5. กรดซัลฟูริก (Sulfuric acid) (ส่วนในถังส่วน)	การผลิตทั่วไป	๒๕	-
๑๐. ไฮโดรเจนซัลไฟด์ (Hydrogen sulfide) (ส่วนในถังส่วน)	การผลิตทั่วไป	๑๐๐	๘๐
๑๑. คาร์บอนมอนอกไซด์ (Carbon monoxide) (ส่วนในถังส่วน)	การผลิตทั่วไป	๘๕๐	๖๕๐
๑๒. ซัลเฟอร์ไดออกไซด์ (Sulfur dioxide) (ส่วนในถังส่วน)	ก. แหล่งกำเนิดตามบริเวณที่ ๕ - น้ำมันเชื้อเพลิงดิบ - ถ่านหิน - เชื้อเพลิงชีวภาพ - เชื้อเพลิงอื่น ๆ ข. การผลิตทั่วไป	- - - - - ๕๐๐	๕๕๐ ๕๐๐ ๖๐ ๖๐ -
๑๓. ออกไซด์ของไนโตรเจน (Oxides of nitrogen) (ส่วนในถังส่วน)	ก. แหล่งกำเนิดตามบริเวณที่ ๕ - น้ำมันเชื้อเพลิงดิบ - ถ่านหิน - เชื้อเพลิงชีวภาพ - เชื้อเพลิงอื่น ๆ	- - + -	๓๐๐ ๔๐๐ ๓๐๐ ๒๐๐
๑๔. ไซลีน (Xylene) (ส่วนในถังส่วน)	การผลิตทั่วไป	๒๐๐	-
๑๕. ครีซอล (Cresol) (ส่วนในถังส่วน)	การผลิตทั่วไป	๕	-

ข้อ ๕ การตรวจวัดค่าปริมาณของสารเจือปนในอากาศที่ระบอบออกจากโรงงาน แต่ละชนิด ให้ใช้วิธีดังต่อไปนี้



(๑) การตรวจวัดค่าปริมาณฝุ่นละออง ให้ใช้วิธี Determination of Particulate Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๒) การตรวจวัดค่าปริมาณพลวง สารหนู ทองแดง ตะกั่ว และสารปรอท ให้ใช้วิธี Determination of Metals Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๓) การตรวจวัดค่าปริมาณคลอรีน และไฮโดรเจนคลอไรด์ ให้ใช้วิธี Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic หรือวิธี Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๔) การตรวจวัดค่าปริมาณกรดกำมะถัน ให้ใช้วิธี Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๕) การตรวจวัดค่าปริมาณไฮโดรเจนซัลไฟด์ ให้ใช้วิธี Determination of Hydrogen Sulfide, Carbonyl Sulfide and Carbon Disulfide Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๖) การตรวจวัดค่าปริมาณคาร์บอนมอนอกไซด์ ให้ใช้วิธี Determination of Carbon Monoxide Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๗) การตรวจวัดค่าปริมาณซัลเฟอร์ไดออกไซด์ ให้ใช้วิธี Determination of Sulfur Dioxide Emissions from Stationary Sources หรือวิธี Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๘) การตรวจวัดค่าปริมาณออกไซด์ของไนโตรเจนในรูปไนโตรเจนไดออกไซด์ ให้ใช้วิธี Determination of Nitrogen Oxide Emissions from Stationary Sources ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

(๙) การตรวจวัดค่าปริมาณไฮโดรคาร์บอน ให้ใช้วิธี Measurement of Gaseous Organic Compound Emissions by Gas Chromatography ที่องค์การพิทักษ์สิ่งแวดล้อมแห่งประเทศสหรัฐอเมริกา (United States Environmental Protection Agency : U.S. EPA) กำหนดไว้ หรือใช้วิธีตามมาตรฐานอื่นที่เทียบเท่า

ข้อ ๖ การรายงานผลการตรวจวัดปริมาณของสารเจือปนในอากาศ ให้รายงานผลดังต่อไปนี้

(๑) ในกรณีที่ไม่มีสารเจือปนอื่นที่ตรวจพบ ให้คำนวณผลที่ความดัน ๑ บรรยากาศ หรือที่ ๗๖๐ มิลลิเมตรปรอท อุณหภูมิ ๒๕ องศาเซลเซียส ที่สภาวะแห้ง (Dry Basis) โดยมีปริมาณคาร์บอนเจือปนในอากาศเลือกภาวะจริงในขณะตรวจวัด

(๒) ในกรณีที่มีการเผาไหม้เชื้อเพลิง

(ก) ระบบป้อนให้คำนวณผลที่ความดัน ๑ บรรยากาศ หรือที่ ๗๖๐ มิลลิเมตรปรอท อุณหภูมิ ๒๕ องศาเซลเซียส ที่สภาวะแห้ง (Dry Basis) โดยมีปริมาณคาร์บอนส่วนเกินในการเผาไหม้ (Excess Air) ร้อยละ ๕๐ หรือ มีปริมาณคาร์บอนเจือปนในอากาศเหลือ ร้อยละ ๕

(ข) ระบบป้อนให้คำนวณผลที่ความดัน ๑ บรรยากาศ หรือที่ ๗๖๐ มิลลิเมตรปรอท อุณหภูมิ ๒๕ องศาเซลเซียส ที่สภาวะแห้ง (Dry Basis) โดยมีปริมาณคาร์บอนเจือปนในอากาศเหลือ ๗๕ เปอร์เซ็นต์ของผลตรวจวัด

ข้อ ๗ ประกาศฉบับนี้ใช้บังคับสำหรับประกาศโรงงานใด ๆ ที่เป็นแหล่งกำเนิดสารเจือปนในอากาศที่ไม่ได้กำหนดค่าการระบายปริมาณสารเจือปนในอากาศไว้เป็นการเฉพาะ ทั้งนี้ ให้ใช้บังคับตั้งแต่วันถัดจากวันประกาศในราชกิจจานุเบกษาเป็นต้นไป

ประกาศ ณ วันที่ ๑๑ ตุลาคม พ.ศ. ๒๕๕๕

โฆสิต ปั้นเปี่ยมรัษฎ์

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม



## ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๑๕ (พ.ศ. ๒๕๕๐)

### เรื่อง กำหนดมาตรฐานระดับเสียงโดยทั่วไป

อาศัยอำนาจตามความในมาตรา ๓๒ (๕) แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ คณะกรรมการสิ่งแวดล้อมแห่งชาติกำหนดมาตรฐานระดับเสียงโดยทั่วไปไว้ดังต่อไปนี้

ข้อ ๑ ในประกาศนี้

“ระดับเสียงโดยทั่วไป” หมายความว่า ระดับเสียงที่เกิดขึ้นในสิ่งแวดล้อม

“ค่าระดับเสียงสูงสุด” หมายความว่า ค่าระดับเสียงสูงสุดที่เกิดขึ้นในขณะใดขณะหนึ่งระหว่างการตรวจวัดระดับเสียง โดยมีหน่วยเป็นเดซิเบล หรือ dB (A)

“ค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง” หมายความว่า ค่าระดับเสียงเฉลี่ยที่มีพลังงานเทียบเท่าระดับเสียงที่เกิดขึ้นจริง ซึ่งมีระดับเสียงเปลี่ยนแปลงตามเวลาในช่วง ๒๔ ชั่วโมง (๒๔ hours A-weighted Equivalent Continuous Sound Level) ซึ่งเรียกโดยย่อว่า Leq ๒๔ hr โดยมีหน่วยเป็นเดซิเบล หรือ dB (A)

“มาตรฐานระดับเสียง” หมายความว่า เครื่องวัดระดับเสียงตามมาตรฐาน IEC ๖๕๑ หรือ IEC ๘๐๔ ของคณะกรรมการการระหว่างประเทศว่าด้วยเทคนิคไฟฟ้า (International Electrotechnical Commission, IEC)

ข้อ ๒ ให้กำหนดมาตรฐานระดับเสียงโดยทั่วไปไว้ดังต่อไปนี้

(๑) ค่าระดับเสียงสูงสุด ไม่เกิน ๑๑๕ เดซิเบล

(๒) ค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง ไม่เกิน ๗๐ เดซิเบล

ข้อ ๓ การตรวจวัดระดับเสียงโดยทั่วไป ให้ดำเนินการดังต่อไปนี้

(๑) การตรวจวัดค่าระดับเสียงสูงสุด ให้ใช้มาตรฐานระดับเสียงตรวจวัดระดับเสียงในบริเวณที่มีคนอยู่หรืออาศัยอยู่

(๒) การตรวจวัดค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง ให้ใช้มาตรฐานระดับเสียงตรวจวัดระดับเสียงอย่างต่อเนื่องตลอดเวลา ๒๔ ชั่วโมงใดๆ

(๓) การตั้งไมโครโฟนของมาตรฐานระดับเสียงที่บริเวณภายนอกอาคารให้ตั้งสูงจากพื้นไม่น้อยกว่า ๑.๒๐ เมตร โดยในรัศมี ๓.๕๐ เมตร ตามแนวราบรอบไมโครโฟนต้องไม่มีกำแพงหรือสิ่งใดที่มีคุณสมบัติในการสะท้อนเสียงกีดขวางอยู่

(๔) การตั้งไมโครโฟนของมาตรฐานระดับเสียงที่บริเวณภายในอาคารให้ตั้งสูงจากพื้นไม่น้อยกว่า ๑.๒๐ เมตร โดยในรัศมี ๑.๐๐ เมตร ตามแนวราบรอบไมโครโฟนต้องไม่มีกำแพงหรือสิ่งใดที่มีคุณสมบัติในการสะท้อนเสียงกีดขวางอยู่และต้องห่างจากช่องหน้าต่างหรือช่องทางที่เปิดออกนอกอาคารอย่างน้อย ๑.๕๐ เมตร

ข้อ ๔ การคำนวณค่าระดับเสียงจะต้องเป็นไปตามวิธีการที่องค์การระหว่างประเทศว่าด้วยมาตรฐาน (International Organization for Standardization, ISO) กำหนด ซึ่งกรมควบคุมมลพิษจะประกาศในราชกิจจานุเบกษา

ประกาศ ณ วันที่ ๑๒ มีนาคม พ.ศ. ๒๕๕๐

พลเอก ชวลิต ยงใจยุทธ

นายกรัฐมนตรี

ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

(ประกาศในราชกิจจานุเบกษา เล่ม ๑๑๔ ตอนที่ ๒๗ ง วันที่ ๓ เมษายน ๒๕๕๐)











หมวด ๒

ประเภทและมาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน

- ข้อ ๒ ให้แบ่งแหล่งน้ำผิวดินออกเป็น ๕ ประเภทคือ แหล่งน้ำประเภทที่ ๑ แหล่งน้ำประเภทที่ ๒ แหล่งน้ำประเภทที่ ๓ แหล่งน้ำประเภทที่ ๔ และแหล่งน้ำประเภทที่ ๕
- (๑) แหล่งน้ำประเภทที่ ๑ ได้แก่ แหล่งน้ำที่คุณภาพน้ำมีสภาพตามธรรมชาติโดยปราศจากน้ำทิ้งจากกิจกรรมทุกประเภทและสามารถเป็นประโยชน์เพื่อ
- (ก) การอุปโภคและบริโภคโดยตรงผ่านการฆ่าเชื้อโรคตามปกติก่อน
- (ข) การขยายพันธุ์ตามธรรมชาติของสิ่งมีชีวิตระดับพื้นฐาน
- (ค) การอนุรักษ์ระบบนิเวศของแหล่งน้ำ
- (๒) แหล่งน้ำประเภทที่ ๒ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ
- (ก) การอุปโภคและบริโภคโดยตรงผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำทั่วไปก่อน
- (ข) การอนุรักษ์สัตว์น้ำ
- (ค) การประมง
- (ง) การว่ายน้ำและกีฬาทางน้ำ
- (๓) แหล่งน้ำประเภทที่ ๓ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ
- (ก) การอุปโภคและบริโภคโดยตรงผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำทั่วไปก่อน
- (ข) การเกษตร
- (๔) แหล่งน้ำประเภทที่ ๔ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ
- (ก) การอุปโภคและบริโภคโดยตรงผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำเป็นพิษก่อน
- (ข) การอุตสาหกรรม

๒๓๕

- (๕) แหล่งน้ำประเภทที่ ๕ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภท และสามารถเป็นประโยชน์เพื่อการคมนาคม
- ข้อ ๓ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๑ ต้องมีสภาพตามธรรมชาติ และสามารถใช้อุปโภคบริโภคได้ตามข้อ ๒ (๑)
- ข้อ ๔ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๒ ต้องมีมาตรฐานดังต่อไปนี้
- (๑) ไม่มีวัตถุหรือสิ่งของที่เกิดจากการกระทำของมนุษย์ซึ่งจะทำให้ สึก ถิ่น และรสชาติของน้ำเปลี่ยนไปตามธรรมชาติ
- (๒) อุณหภูมิ (Temperature) ไม่สูงกว่าอุณหภูมิมาตรฐานชาติเกิน ๓ องศาเซลเซียส
- (๓) ความเป็นกรดและด่าง (pH) มีค่าระหว่าง ๕.๐-๘.๐
- (๔) ออกซิเจนละลาย (DO) มีค่าไม่น้อยกว่า ๖.๐ มิลลิกรัมต่อลิตร
- (๕) บีโอดี (BOD) มีค่าไม่เกินกว่า ๑.๕ มิลลิกรัมต่อลิตร
- (๖) แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria) มีค่าไม่เกินกว่า ๕,๐๐๐ เอ็ม.พี.เอ็น. ต่อ ๑๐๐ มิลลิลิตร
- (๗) แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม (Fecal Coliform Bacteria) มีค่าไม่เกินกว่า ๑,๐๐๐ เอ็ม.พี.เอ็น. ต่อ ๑๐๐ มิลลิลิตร
- (๘) ไนเตรต ( $\text{NO}_3$ ) ในหน่วยไนโตรเจน มีค่าไม่เกินกว่า ๕.๐ มิลลิกรัมต่อลิตร
- (๙) แอมโมเนีย ( $\text{NH}_3$ ) ในหน่วยไนโตรเจน มีค่าไม่เกินกว่า ๐.๕ มิลลิกรัมต่อลิตร
- (๑๐) ฟีนอล (Phenols) มีค่าไม่เกินกว่า ๐.๐๐๕ มิลลิกรัมต่อลิตร
- (๑๑) ทองแดง (Cu) มีค่าไม่เกินกว่า ๐.๑ มิลลิกรัมต่อลิตร
- (๑๒) นิกเกิล (Ni) มีค่าไม่เกินกว่า ๐.๑ มิลลิกรัมต่อลิตร
- (๑๓) แมงกานีส (Mn) มีค่าไม่เกินกว่า ๑.๐ มิลลิกรัมต่อลิตร
- (๑๔) สังกะสี (Zn) มีค่าไม่เกินกว่า ๑.๐ มิลลิกรัมต่อลิตร
- (๑๕) แคดเมียม (Cd) ในน้ำที่มีความกระด้างในรูปของ  $\text{CaCO}_3$  ไม่เกินกว่า ๑๐๐ มิลลิกรัมต่อลิตร มีค่าไม่เกินกว่า ๐.๐๐๕ มิลลิกรัมต่อลิตร และในน้ำที่มีความกระด้างในรูปของ  $\text{CaCO}_3$  เกินกว่า ๑๐๐ มิลลิกรัมต่อลิตร มีค่าไม่เกินกว่า ๐.๐๕ มิลลิกรัมต่อลิตร

๒๓๖

- (๑๖) โครเมียมชนิดเฮกซะวาเลนต์ (Cr Hexavalent) มีค่าไม่เกินกว่า ๐.๐๕ มิลลิกรัมต่อลิตร
- (๑๗) ตะกั่ว (Pb) มีค่าไม่เกิน ๐.๐๕ มิลลิกรัมต่อลิตร
- (๑๘)ปรอททั้งหมด (Total Hg) มีค่าไม่เกินกว่า ๐.๐๐๒ มิลลิกรัมต่อลิตร
- (๑๙) สารหนู (As) มีค่าไม่เกินกว่า ๐.๐๑ มิลลิกรัมต่อลิตร
- (๒๐) ไซยาไนด์ (Cyanide) มีค่าไม่เกินกว่า ๐.๐๐๕ มิลลิกรัมต่อลิตร
- (๒๑) กัมมันตภาพรังสี (Radioactivity) มีค่ารังสีแอลฟา (Alpha) ไม่เกินกว่า ๐.๑ เบคเคอเรลต่อลิตร และรังสีเบตา (Beta) ไม่เกินกว่า ๑.๐ เบคเคอเรลต่อลิตร
- (๒๒) สารฆ่าศัตรูพืชและสัตว์ชนิดที่มีคลอรีนทั้งหมด (Total Organochlorine Pesticides) มีค่าไม่เกินกว่า ๐.๐๕ มิลลิกรัมต่อลิตร
- (๒๓) ดีดีที (DDT) มีค่าไม่เกินกว่า ๐.๑ ไมโครกรัมต่อลิตร
- (๒๔) บีเอชซีแอลเอ (Alpha-BHC) มีค่าไม่เกินกว่า ๐.๐๒ ไมโครกรัมต่อลิตร
- (๒๕) ดีแอลดี (Dieldrin) มีค่าไม่เกินกว่า ๐.๑ ไมโครกรัมต่อลิตร
- (๒๖) อัลดริน (Aldrin) มีค่าไม่เกินกว่า ๐.๑ ไมโครกรัมต่อลิตร
- (๒๗) เฮปตาคลอร์ (Heptachlor) และเฮปตาคลอร์อีพอกไซด์ (Heptachlorepoxyde) มีค่าไม่เกินกว่า ๐.๒ ไมโครกรัมต่อลิตร
- (๒๘) เอนดริน (Endrin) ไม่สามารถตรวจพบได้ตามวิธีการตรวจสอบที่กำหนด
- ข้อ ๕ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๓ ต้องมีมาตรฐานตาม ข้อ ๔ (๑) ถึง (๕)
- (๑) ออกซิเจนละลาย มีค่าไม่น้อยกว่า ๔.๐ มิลลิกรัมต่อลิตร
- (๒) บีโอดี มีค่าไม่เกินกว่า ๒.๐ มิลลิกรัมต่อลิตร
- (๓) แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด มีค่าไม่เกินกว่า ๒๐,๐๐๐ เอ็ม.พี.เอ็น. ต่อ ๑๐๐ มิลลิลิตร
- (๔) แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม มีค่าไม่เกินกว่า ๔,๐๐๐ เอ็ม.พี.เอ็น. ต่อ ๑๐๐ มิลลิลิตร
- ข้อ ๖ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๔ ต้องมีมาตรฐานตามข้อ ๔ (๑) ถึง (๕) และ (๘) ถึง (๒๘) เว้นแต่
- (๑) ออกซิเจนละลาย มีค่าไม่น้อยกว่า ๒.๐ มิลลิกรัมต่อลิตร

๒๓๗

- (๒) บีโอดี มีค่าไม่เกินกว่า ๔.๐ มิลลิกรัมต่อลิตร
- ข้อ ๗ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๕ ต้องมีมาตรฐานต่ำกว่าคุณภาพน้ำ ในแหล่งน้ำประเภทที่ ๔
- ข้อ ๘ การกำหนดให้แหล่งน้ำผิวดินแหล่งใดแหล่งหนึ่งเป็นประเภทใดตามข้อ ๒ ให้เป็นไปตามที่กรมควบคุมมลพิษประกาศในราชกิจจานุเบกษา

หมวด ๓

วิธีการเก็บตัวอย่างและตรวจสอบคุณภาพน้ำในแหล่งน้ำผิวดิน

- ข้อ ๙ การเก็บตัวอย่างน้ำเพื่อตรวจสอบคุณภาพตามข้อ ๓ ถึง ข้อ ๗ ให้ใช้วิธีการดังต่อไปนี้
- (๑) แหล่งน้ำไหล ซึ่งได้แก่ แม่น้ำ ลำคลอง เป็นต้น ให้เก็บที่จุดกึ่งกลางความกว้างของแหล่งน้ำที่ระดับกึ่งกลางความลึก ณ จุดตรวจสอบ เว้นแต่แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมดและแบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม ให้เก็บที่ระดับความลึก ๓๐ เซนติเมตร ณ จุดตรวจสอบ
- (๒) แหล่งน้ำนิ่ง ซึ่งได้แก่ ทะเลสาบ หนอง บึง อ่างเก็บน้ำ เป็นต้น ให้เก็บที่ระดับความลึก ๑ เมตร ณ จุดตรวจสอบสำหรับแหล่งน้ำที่มีความลึกเกินกว่า ๒ เมตร และให้เก็บที่จุดกึ่งกลางความลึก ณ จุดตรวจสอบสำหรับแหล่งน้ำที่มีความลึกไม่เกิน ๒ เมตร เว้นแต่แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมดและแบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม ให้เก็บที่ระดับความลึก ๓๐ เซนติเมตร ณ จุดตรวจสอบ
- จุดตรวจสอบตาม (๑) และ (๒) ของแหล่งน้ำที่กำหนดตามข้อ ๘ ให้เป็นไปตามที่กรมควบคุมมลพิษกำหนด
- ข้อ ๑๐ การตรวจสอบคุณภาพน้ำตามข้อ ๓ ถึงข้อ ๗ ให้ใช้วิธีการดังต่อไปนี้
- (๑) การตรวจสอบอุณหภูมิ ให้ใช้เครื่องมืออุณหภูมิ (Thermometer) วัดขณะทำการเก็บตัวอย่างน้ำ
- (๒) การตรวจสอบค่าความเป็นกรดและด่าง ให้ใช้เครื่องวัดความเป็นกรดและด่างของน้ำ (pH meter) ตามวิธีการหาค่าแบบอิเล็กโตรเมตริก (Electrometric)
- (๓) การตรวจสอบค่าออกซิเจนละลาย ให้ใช้วิธีอะไซด์โมดิฟิเคชัน (Azide Modification)

๒๓๘



(๔) การตรวจสอบค่าบีโอดี ให้ใช้วิธีอะไซด์โมดิฟิเคชัน (Azide Modification) ที่อุณหภูมิ ๒๐ องศาเซลเซียส เป็นเวลา ๕ วันติดต่อกัน

(๕) การตรวจสอบค่าเบคทีเรียกลุ่มโคลิฟอร์มทั้งหมดและค่าเบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม ให้ใช้วิธีมัลติเทสต์ ทิวบ์ เฟอว์เมนเคชัน เทคนิค (Multiple Tube Fermentation Technique)

(๖) การตรวจสอบค่าไนเตรดในหน่วยไนโตรเจน ให้ใช้วิธีแคดเมียมรีดักชัน (Cadmium Reduction)

(๗) การตรวจสอบค่าแอมโมเนียในหน่วยไนโตรเจน ให้ใช้วิธีดิสทิลเลชัน-เนสเลอร์ไรเซชัน (Distillation Nesslerization)

(๘) การตรวจสอบค่าฟีนอล ให้ใช้วิธีดิสทิลเลชัน ๔ - อะมิโนแอนติไพรีน (Distillation, 4-Amino antipyrine)

(๙) การตรวจสอบค่าทองแดง นิกเกิล แมงกานีส สังกะสี แคดเมียม โครเมียมชนิดเฮกซะวาเลนต์ และตะกั่ว ให้ใช้วิธีอะตอมมิก แอซพอร์ชัน ไครเรก แอสไพเรชัน (Atomic Absorption - Direct Aspiration)

(๑๐) การตรวจสอบค่าปรอททั้งหมด ให้ใช้วิธีอะตอมมิก แอซพอร์ชัน ไกลด์ เวปอร์ เทคนิค (Atomic Absorption-Cold Vapour Technique)

(๑๑) การตรวจสอบค่าสารหนู ให้ใช้วิธีอะตอมมิก แอซพอร์ชัน แก๊สไฮไดรด์ (Atomic Absorption - Gaseous Hydride)

(๑๒) การตรวจสอบค่าไซยาไนด์ ให้ใช้วิธีไพริดีน บาร์บิบูริก แอซิด (Pyridine - Barbituric Acid)

(๑๓) การตรวจสอบค่ากัมมันตภาพรังสี ให้ใช้วิธีโลว์ แบ็กกราวด์ หรือพรอพอร์ชันนอล เคาน์เตอร์ (Low Background Proportional Counter)

(๑๔) การตรวจค่าสารฆ่าศัตรูพืชและศัตรูชนิดที่มีคลอรีนทั้งหมด ดีดีที บีโอซซิมิธแอลฟา ดีคลริน อัลดริน เฮปตาคลอร์อีพอกไซด์ และเอนดริน ให้ใช้วิธีแก๊ส-โครมาโตกราฟี (Gas - Chromatography)

ข้อ ๑๑ การตรวจสอบค่าออกซิเจนละลายให้ใช้ค่าเปอร์เซ็นต์ไทด์ที่ ๒๐ (20° Percentile Value) ส่วนการตรวจสอบค่าบีโอดี เบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด และเบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม ให้ใช้ค่าเปอร์เซ็นต์ไทด์ที่ ๙๐ โดยจำนวนและระยะเวลาสำหรับการเก็บตัวอย่างน้ำดังกล่าว ให้เป็นไปตามที่กรมควบคุมมลพิษกำหนด

๒๓๖

ข้อ ๑๒ การเก็บตัวอย่างน้ำตามข้อ ๘ และการตรวจสอบคุณภาพน้ำตามข้อ ๑๐ จะต้องเป็นไปตามวิธีการมาตรฐานสำหรับการวิเคราะห์น้ำและน้ำเสีย (Standard Methods for Examination of Water and Wastewater) ซึ่ง American Public Health Association และ American Water Works Association กับ Water Pollution Control Federation ของสหรัฐอเมริกา ร่วมกันกำหนดไว้ด้วย

ประกาศ ณ วันที่ ๒๐ มกราคม พ.ศ. ๒๕๓๖

ชวน หลีกภัย

นายกรัฐมนตรี

ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

(ประกาศในราชกิจจานุเบกษา เล่ม ๑๑๑ ตอนที่ ๑๖ ง วันที่ ๒๔ กุมภาพันธ์ ๒๕๓๖)

๒๔๐

หน้า ๑๓  
เล่ม ๑๓๕ ตอนที่ ๕๗ ง ราชกิจจานุเบกษา ๑๒ มีนาคม ๒๕๖๓

### ประกาศกรมสวัสดิการและคุ้มครองแรงงาน

เรื่อง หลักเกณฑ์ วิธีการตรวจวัด และการวิเคราะห์ผลการทำงานเกี่ยวกับระดับความร้อน แสงสว่าง หรือเสียง รวมทั้งระยะเวลาและประเภทกิจการที่ต้องดำเนินการ

โดยที่กฎกระทรวงกำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับความร้อน แสงสว่าง และเสียง พ.ศ. ๒๕๕๙ ข้อ ๑๔ วรรคสอง กำหนดให้อธิบดีกรมสวัสดิการและคุ้มครองแรงงานกำหนดหลักเกณฑ์ วิธีการ ตรวจวัด และการวิเคราะห์ผลการทำงานเกี่ยวกับระดับความร้อน แสงสว่าง หรือเสียง รวมทั้ง ระยะเวลาและประเภทกิจการที่ต้องดำเนินการเพื่อให้การบริหารจัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานได้อย่างปลอดภัย

อาศัยอำนาจตามความในข้อ ๑๔ วรรคสอง แห่งกฎกระทรวงกำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับ ความร้อน แสงสว่าง และเสียง พ.ศ. ๒๕๕๙ อธิบดีกรมสวัสดิการและคุ้มครองแรงงานจึงออกประกาศไว้ ดังต่อไปนี้

ข้อ ๓ ประกาศนี้ให้ใช้บังคับตั้งแต่วันถัดจากวันประกาศในราชกิจจานุเบกษาเป็นต้นไป

หมวด ๓  
บททั่วไป

ข้อ ๒ ให้นายจ้างจัดให้มีการตรวจวัดและวิเคราะห์ผลการทำงานเกี่ยวกับระดับความร้อน แสงสว่าง หรือเสียง ภายในสถานประกอบกิจการในลักษณะที่เป็นเชิงระบบสภาพการทำงานอย่างน้อย ปีละหนึ่งครั้ง

กรณีที่มีการปรับปรุงหรือเปลี่ยนแปลงเครื่องจักรอุปกรณ์ กระบวนการผลิต วิธีการทำงาน หรือการดำเนินการใด ๆ ที่อาจมีผลต่อการเปลี่ยนแปลงระดับความร้อน แสงสว่าง หรือเสียง ให้นายจ้างดำเนินการตามวรรคหนึ่งเพิ่มเติมโดยตรวจวัดและวิเคราะห์ผลการทำงานบริเวณพื้นที่ หรือบุคคลที่อาจได้รับผลกระทบภายในเก้าสิบวันนับจากวันที่มีการปรับปรุงหรือเปลี่ยนแปลง

หมวด ๒

การตรวจวัดระดับความร้อนและประเภทกิจการที่ต้องดำเนินการ

ข้อ ๓ ให้นายจ้างจัดให้มีการตรวจวัดระดับความร้อนบริเวณที่มีลูกจ้างปฏิบัติงานอยู่ใน สถานภาพทำงานปกติและต้องตรวจวัดในช่วงระยะเวลาที่ลูกจ้างอาจได้รับอันตรายจากความร้อนสูงสุด

หน้า ๑๒  
เล่ม ๑๓๕ ตอนที่ ๕๗ ง ราชกิจจานุเบกษา ๑๒ มีนาคม ๒๕๖๓

ข้อ ๕ ประเภทกิจการที่ต้องดำเนินการตรวจวัด ได้แก่ การผลิตน้ำตาลและทำให้อาหาร การป้อนอาหารหรือเลี้ยงสัตว์ การผลิตเยื่อกระดาษหรือกระดาษ การผลิตยางรถยนต์หรือล้อรถยนต์ การผลิตกระจก เครื่องแก้วหรือหลอดไฟ การผลิตซิเมนต์หรือปูนขาว การถลุง หลอมหรือหล่อโลหะ หรือกิจการที่มีแหล่งกำเนิดความร้อนหรือมีการทำงานที่อาจทำให้ลูกจ้างได้รับอันตรายเนื่องจากความร้อน

ข้อ ๕ อุปกรณ์การตรวจวัดระดับความร้อน ประกอบด้วย

(๑) เทอร์โมมิเตอร์กระเปาะแห้ง เป็นชนิดปรอทหรือแอลกอฮอล์ที่มีความละเอียดของสเกล ๐.๕ องศาเซลเซียส และมีความแม่นยำบวกหรือลบ ๐.๕ องศาเซลเซียส มีการกำบังป้องกันเทอร์โมมิเตอร์ จากแสงอาทิตย์ หรือแหล่งที่แผ่รังสีความร้อน โดยไม่รบกวนการไหลเวียนอากาศ

(๒) เทอร์โมมิเตอร์กระเปาะเปียกตามธรรมชาติ มีความละเอียดของสเกล ๐.๕ องศาเซลเซียส ที่มีความแม่นยำบวกหรือลบ ๐.๕ องศาเซลเซียส มีผ้าฝ้ายชุบน้ำที่สะอาดห่อหุ้มกระเปาะ หยดน้ำกลั่น ลงบนผ้าฝ้ายที่ห่อหุ้มกระเปาะให้เปียกชุ่มและให้ปลายอีกด้านหนึ่งของผ้าฝ้ายอยู่ในน้ำกลั่นเพื่อให้ส่วนที่ห่อหุ้มกระเปาะเทอร์โมมิเตอร์เปียกอยู่ตลอดเวลา

(๓) โกลบเทอร์โมมิเตอร์ มีช่วงการวัดตั้งแต่ลบ ๕ องศาเซลเซียส ถึง ๑๐๐ องศาเซลเซียส ที่ปลายกระเปาะเทอร์โมมิเตอร์เปียกอยู่ทั้งกลางทรงกลมกระเปาะที่ห่อหุ้มด้วยกระดาษเส้นผ่านศูนย์กลาง สิบห้าเซนติเมตร ภายนอกห่อหุ้มด้วยสีดำด้านที่สามารถดูดกลืนรังสีความร้อนได้ดี

อุปกรณ์ที่ใช้ในการตรวจวัดระดับความร้อนตามวรรคหนึ่งต้องทำการปรับเทียบตามถูกต้อง (Calibration) อย่างน้อยปีละครั้ง

ในกรณีที่ไม่มีอุปกรณ์ตามวรรคหนึ่ง ให้ใช้เครื่องวัดระดับความร้อนชนิดอิเล็กทรอนิกส์ ที่สามารถอ่านและคำนวณค่าอุณหภูมิเวทบอล์โกลบ (WBGT) ได้ตามมาตรฐาน ISO 7243 ขององค์การมาตรฐานระหว่างประเทศ (International Organization for Standardization) หรือเทียบเท่า และให้ทำการปรับเทียบตามถูกต้อง (Calibration) ก่อนใช้งานทุกครั้ง

ข้อ ๖ วิธีการตรวจวัดระดับความร้อนให้วัดที่อุปกรณ์หรือเครื่องวัดตามข้อ ๕ ในตำแหน่ง สูงจากพื้นระดับหน้าอกของลูกจ้าง

อุปกรณ์ตามข้อ ๕ วรรคหนึ่ง ก่อนเริ่มอ่านค่าต้องตั้งอุปกรณ์ให้ทำงานไว้อย่างน้อยสามสิบนาที และให้บันทึกค่าตรวจวัดในช่วงระยะเวลาที่เหมาะสม ทั้งนี้ อุณหภูมิที่อ่านค่าเป็นองศาเซลเซียส ให้คำนวณหาค่าอุณหภูมิเวทบอล์โกลบ (WBGT) ตามวิธีการที่กำหนดไว้ในกฎกระทรวง ให้หาค่าระดับความร้อนจากค่าเฉลี่ยของอุณหภูมิเวทบอล์โกลบ (WBGT) ที่คำนวณได้ในช่วง ระยะเวลาทำงานสองชั่วโมงที่ร้อนที่สุดได้จากสูตร ดังต่อไปนี้

$$WBGT_{calc} = \frac{WBGT_{a \times t_{a}} \times t_{a} + WBGT_{b \times t_{b}} \times t_{b} + WBGT_{n \times t_{n}}}{t_{a} + t_{b} + t_{n}}$$

WBGT<sub>a</sub> หมายถึง WBGT(°C) ในเวลา t<sub>a</sub> (นาที)

WBGT<sub>b</sub> หมายถึง WBGT(°C) ในเวลา t<sub>b</sub> (นาที)

WBGT<sub>n</sub> หมายถึง WBGT(°C) ในเวลา t<sub>n</sub> (นาที)

t<sub>a</sub> + t<sub>b</sub> + t<sub>n</sub> = ๑๒๐ นาที ที่มีอุณหภูมิเวทบอล์โกลบ (WBGT) สูงสุด



ภาคผนวก จ

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ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	BKK_F50372	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50373	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50367	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50370	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F50375	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F50382	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F50383	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F51060	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F50779	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F51098	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F50789	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F50782	1-Jul-23	1-Jan-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50778	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F51097	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50788	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50781	2-Jul-23	2-Jan-24	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F51369	30-May-23	30-Nov-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50888	30-May-22	28-Nov-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50909	10-Dec-22	9-Jun-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50919	21-Feb-23	21-Aug-24	18
Stack (CEMs)	Carbon Monoxide	Analyzer , System calibration, Start	-	-	-	-
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Start	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Start	-	-	-	-
Stack (CEMs)	Oxygen	Analyzer , System calibration, Start	-	-	-	-
Stack (CEMs)	Flowrate	Analyzer , System calibration, Start	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50485	4-Jul-23	3-Jan-24	6
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_F50632	17-Jan-23	17-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50101	29-May-23	29-May-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50100	17-Jul-23	17-Jul-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50115	3-Jan-23	3-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50108	19-Jan-23	19-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50106	2-Nov-22	2-Nov-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50116	3-Jan-23	3-Jan-24	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_F50632	17-Jan-23	17-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50098	14-Aug-23	14-Aug-24	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_F50630	25-May-23	25-May-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50111	16-Dec-22	16-Dec-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50927	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50109	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50875	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50879	21-Nov-22	21-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50925	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50110	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50924	25-Oct-22	25-Oct-23	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_F50632	17-Jan-23	17-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50028	14-Mar-23	14-Mar-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50025	20-Jun-23	20-Jun-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50031	20-Jun-23	20-Jun-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50929	19-Jan-23	19-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50116	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50030	19-Jan-23	19-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50032	1-Sep-23	1-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50029	20-Jun-23	20-Jun-24	12

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

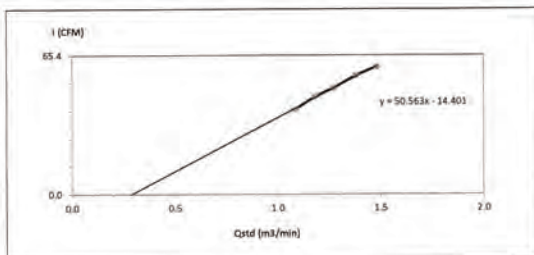
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Heat	Heat Stress	Heat Stress Monitor	BKK_F50672	22-Feb-23	22-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50668	18-Jul-23	18-Jul-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50653	19-Dec-22	19-Dec-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50673	15-May-23	15-May-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50669	18-Jul-23	18-Jul-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50658	17-Jul-23	17-Jul-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50663	15-May-23	15-May-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50668	18-Jul-23	18-Jul-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50657	15-May-23	15-May-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50680	7-Apr-23	7-Apr-24	12
Workplace	Sodium hydroxide as NaOH	Field Rotameter	BKK_F51031	1-Jul-23	1-Oct-23	3
Workplace	Sodium hydroxide as NaOH	Field Rotameter	BKK_F51028	2-Oct-23	2-Jan-24	3
Workplace	Chlorine	Field Rotameter	BKK_F51031	1-Jul-23	1-Oct-23	3
Workplace	Chlorine	Field Rotameter	BKK_F51028	2-Oct-23	2-Jan-24	3
Workplace	Sulfuric Acid	Field Rotameter	BKK_F51030	1-Jul-23	1-Oct-23	3
Workplace	Sulfuric Acid	Field Rotameter	BKK_F51027	2-Oct-23	2-Jan-24	3
Workplace	Sulfuric Acid	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Illuminance	Illuminance	Lux Meter	BKK_F51146	13-Sep-22	13-Sep-23	12
Illuminance	Illuminance	Lux Meter	BKK_F51345	19-Jan-23	19-Jan-24	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0148	4-Jul-23	4-Jan-25	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Conductivity	Conductivity meter	BKK_EN0373	3-Jan-23	3-Jan-24	12
Water Lab	BOD	DO Meter	BKK_EN0205	3-Aug-22	3-Feb-24	18
Water Lab	BOD	Incubator	BKK_EN0304	5-Apr-23	5-Apr-24	12
Water Lab	COD	Hot Block	BKK_EN0222	25-Apr-23	25-Apr-24	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Water Lab	Temperature	pH meter	BKK_LG0013	1-Feb-23	1-Feb-24	12



### High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg): 755  
Calibrate Location: อู่เรือ/ท่าเรือ  
Calibrate Date: 6-Sep-23 Temperature (°C): 35  
Calibration Sheet No.: C-060923-BKK\_FS0372 High Volume ID: BKK\_FS0372  
Calibrator ID: BKK\_FS0624 High Volume Model: TE-5009X  
Calibrator Model: TE-5028A High Volume S/N: 5332  
Calibrator S/N: 2584 Calibrator Slope: 1.63932  
Calibrator Intercept: -0.01785

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>as</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.2	1.0877	40	Slope: 50.5627 Intercept: -14.4010 Correlation Coefficient: 0.9974
2	3.8	1.1837	46	
3	4.4	1.2723	50	
4	5.2	1.3916	56	
5	6.0	1.4928	60	



Calibrated by

(Mr. Prommee Sripranet)  
Field Scientist(2)

Approved by

(Mr. Noppong Jantarapan)  
Enviro Field Coordinator Scientist (3)

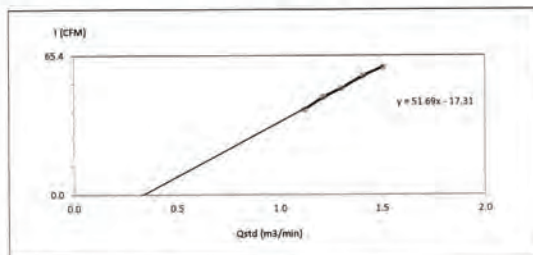
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg): 755  
Calibrate Location: อู่เรือ/ท่าเรือ  
Calibrate Date: 6-Sep-23 Temperature (°C): 35  
Calibration Sheet No.: C-060923-BKK\_FS0373 High Volume ID: BKK\_FS0373  
Calibrator ID: BKK\_FS0624 High Volume Model: G1051  
Calibrator Model: TE-5028A High Volume S/N: 1330  
Calibrator S/N: 2584 Calibrator Slope: 1.67922  
Calibrator Intercept: -0.01785

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>as</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.1306	40	Slope: 51.6903 Intercept: -17.3099 Correlation Coefficient: 0.9973
2	4.0	1.2139	46	
3	4.6	1.3005	50	
4	5.4	1.4076	56	
5	6.2	1.5070	60	



Calibrated by

(Mr. Prommee Sripranet)  
Field Scientist(2)

Approved by

(Mr. Noppong Jantarapan)  
Enviro Field Coordinator Scientist (3)

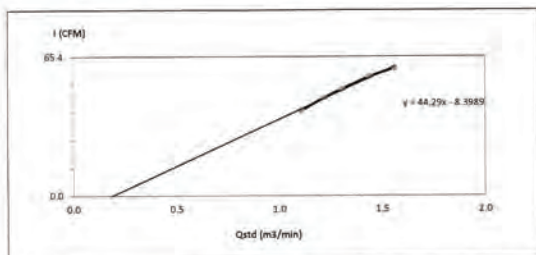
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg): 755  
Calibrate Location: อู่เรือ/ท่าเรือ  
Calibrate Date: 6-Sep-23 Temperature (°C): 32  
Calibration Sheet No.: C-060923-BKK\_FS0367 High Volume ID: BKK\_FS0367  
Calibrator ID: BKK\_FS0624 High Volume Model: TE-5009X  
Calibrator Model: TE-5028A High Volume S/N: 4162  
Calibrator S/N: 2584 Calibrator Slope: 1.63932  
Calibrator Intercept: -0.01785

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>as</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.2	1.1096	40	Slope: 44.2896 Intercept: -8.3989 Correlation Coefficient: 0.9961
2	4.0	1.2198	46	
3	4.6	1.3068	50	
4	5.6	1.4400	56	
5	6.6	1.5618	60	



Calibrated by

(Mr. Prommee Sripranet)  
Field Scientist(2)

Approved by

(Mr. Noppong Jantarapan)  
Enviro Field Coordinator Scientist (3)

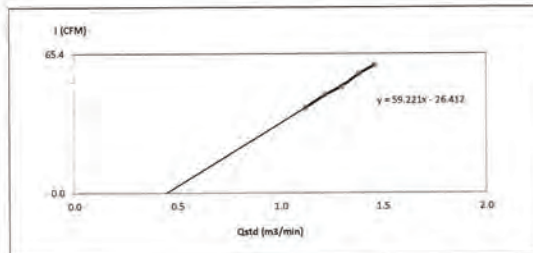
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg): 755  
Calibrate Location: อู่เรือ/ท่าเรือ  
Calibrate Date: 6-Sep-23 Temperature (°C): 34  
Calibration Sheet No.: C-060923-BKK\_FS0370 High Volume ID: BKK\_FS0370  
Calibrator ID: BKK\_FS0624 High Volume Model: TE-5009X  
Calibrator Model: TE-5028A High Volume S/N: 4798  
Calibrator S/N: 2584 Calibrator Slope: 1.63932  
Calibrator Intercept: -0.01785

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>as</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.8	1.1224	40	Slope: 59.2211 Intercept: -26.4116 Correlation Coefficient: 0.9982
2	4.0	1.2159	46	
3	4.6	1.3026	50	
4	5.2	1.3838	56	
5	5.8	1.4605	60	



Calibrated by

(Mr. Prommee Sripranet)  
Field Scientist(2)

Approved by

(Mr. Noppong Jantarapan)  
Enviro Field Coordinator Scientist (3)

FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16





SARTORIUS

# Certificate

## of Calibration

Model Number: XP105DU  
Description: Semi-micro Balance  
Serial Number: 1123091884  
ID No: BKK\_EN0004  
Manufacturer: Mettler Toledo

Certificate No.: 23BCI0071  
Issued Date: Monday, February 13, 2023  
Reference No.: 203245  
Page No.: 1 of 3

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Calibrated Place: Balance Room

Calibrated By: Mr. Chonchai Inthana  
Calibration Date: Wednesday, February 08, 2023

Calibration Procedure No.: This calibration was conducted by Using in-house calibration procedure number (WI-003) Based on UKAS LAB 14 : 2019

Metrological data:  
Capacity: 31/120 g Readability: 0.0001 g

Ambients Conditions:  
Temperature: 21.0 °C ± 3.0 °C  
Humidity: 65.0 % RH ± 5.0 % RH  
Pressure: ±

Reasons for calibration:  
☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

### Measurement Method UKAS Publication Ref: Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 1kg E2 s/n 37929119	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barenometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full receipt with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr. Chonchai Inthana (Technical Manager)



SARTORIUS

# Certificate

## of Calibration

Model Number: XP105DU  
Description: Semi-micro Balance  
Serial Number: 1123091884  
ID No: BKK\_EN0004  
Manufacturer: Mettler Toledo

Certificate No.: 23BCI0071  
Issued Date: Monday, February 13, 2023  
Reference No.: 203245  
Page No.: 2 of 3

### Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the reading of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to GUM, RFE).		
Nominal Value : (Low Load)	2.00002	20.00002	Nominal value :	20	g
2 g	2.00001	20.00001	Tolerance	N/A	g
Tolerance	2.00002	20.00001	Difference		
N/A g	2.00002	20.00001	1		
	2.00002	20.00000	2		
Nominal Value : (High Load)	2.00002	20.00000	3		
20 g	2.00002	20.00001	4		
Tolerance	2.00002	20.00000	5		
N/A g	2.00001	20.00000	6		
	2.00001	20.00001			
Standard Deviation	0.000005	0.000007			

### Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance	N/A	g
Nominal Value	Conventional Mass Value	Displayed Value
(g)	(g)	(g)
0.1	0.10000	0.10000
0.5	0.50001	0.50000
1	1.00000	1.00000
2	2.00002	2.00001
5	5.00002	5.00002
10	10.00002	10.00002
15	15.00004	15.00004
20	20.00000	20.00000
25	25.00002	25.00002
30	30.00002	30.00004
		Deviation
		(g)
		Uncertainty
		(g)

SCP FM 33 03 February 2022

SARTORIUS

# Certificate

## of Calibration

Model Number: XS105DU  
Description: Semi-micro Balance  
Serial Number: 1123091884  
ID No: BKK\_EN0004  
Manufacturer: Mettler Toledo

Certificate No.: 23BCI0071  
Issued Date: Monday, February 13, 2023  
Reference No.: 203245  
Page No.: 3 of 3

### Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the reading of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to GUM, RFE).		
Nominal Value : (Low Load)	100.0000	100.0000	Nominal value :	g	
100 g	100.0000	100.0000	Tolerance	N/A	g
Tolerance	100.0000	100.0000	Difference		
N/A g	100.0000	100.0000	1		
	100.0000	100.0000	2		
Nominal Value : (High Load)	100.0000	100.0000	3		
100 g	100.0000	100.0000	4		
Tolerance	100.0000	100.0000	5		
N/A g	100.0000	100.0000	6		
	100.0000	100.0000			
Standard Deviation	0.00003				

### Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance	N/A	g
Nominal Value	Conventional Mass Value	Displayed Value
(g)	(g)	(g)
50	50.0000	50.0000
55	55.0000	55.0000
60	60.0000	60.0000
65	65.0001	65.0001
70	70.0000	70.0000
75	75.0000	75.0000
80	80.0000	80.0000
85	85.0001	85.0001
90	90.0000	90.0000
95	95.0000	95.0000
100	100.0000	100.0000
105	105.0000	105.0000
110	110.0000	110.0000
115	115.0000	115.0000
120	120.0000	120.0000
		Deviation
		(g)
		Uncertainty
		(g)

End of Report

SCP FM 33 03 February 2022

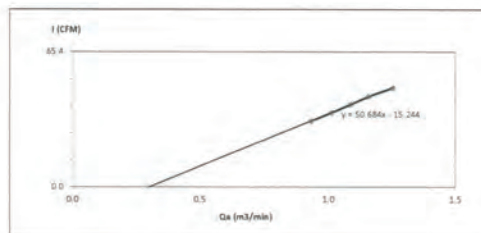


### High Volume Air Sampler Calibration Worksheet

Project Site: Gulf JPL Co., Ltd.  
Calibrate Location: กรุงเทพมหานคร  
Calibrate Date: 8-Sep-23  
Calibration Sheet No.: C-040923-BKK\_PS0375  
Calibrator Model: BKK\_PS0624  
Calibrator S/N: 2584

Barometric Pressure (mm Hg): 755  
Temperature (°C): 35  
High Volume ID: BKK\_PS0375  
High Volume Model: TE-5009X  
High Volume S/N: 5196  
Calibrator Slope: 1.0268  
Calibrator Intercept: -0.01116

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	0.934	32	Slope: 50.6867
2	2.6	1.014	36	Intercept: -15.2441
3	3.0	1.089	40	Correlation Coefficient: 0.9985
4	3.4	1.158	44	
5	4.0	1.255	48	



Calibrated by:

[Mr. Promsom Sripattana]  
Field Scientist(2)

Approved by:

[Mr. Noppong Juntarapan]  
Enviros Field Coordinator Scientist (3)

YOSHIDA R-66-074 REVISION NO.: ISSUE DATE: 14/03/16

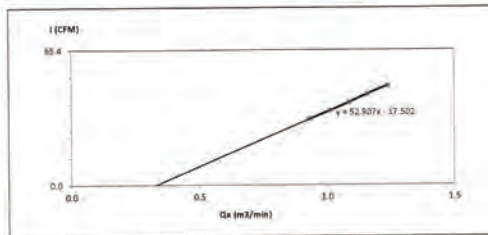




### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg) : 755  
 Calibrate Location : กรุงเทพมหานคร Temperature (°C) : 35  
 Calibrate Date : 6-Sep-23 High Volume ID : BKK\_F50383  
 Calibration Sheet No. : C-060923-BKK\_F50382 High Volume Model : TE-5009X  
 Calibrator ID : BKK\_F50624 High Volume S/N : 4786  
 Calibrator Model : TE-5028A Calibrator Slope : 1.0268  
 Calibrator S/N : 2584 Calibrator Intercept : -0.01116

Test No.	Delta H <sub>2</sub> O (Inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.934	32	Slope : 52.8074 Intercept : -17.5023 Correlation Coefficient : 0.9997
2	2.6	1.014	36	
3	3.0	1.089	40	
4	3.4	1.158	44	
5	3.8	1.240	48	



Calibrated by : Prom S.  
 (Mr. Promsom Sripanet)  
 Field Scientist(2)

Approved by : P. P.  
 (Mr. Noppong Jantaraporn)  
 Enviro Field Coordinator Scientist (3)

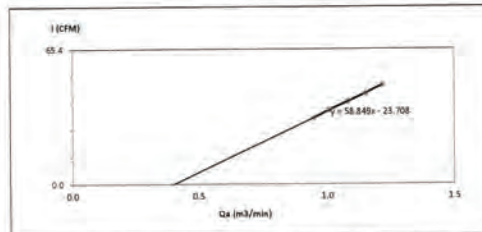
FORM NO. F 06-074 REVISION NO. - ISSUE DATE: 31/03/14



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg) : 755  
 Calibrate Location : กรุงเทพมหานคร Temperature (°C) : 32  
 Calibrate Date : 6-Sep-23 High Volume ID : BKK\_F50383  
 Calibration Sheet No. : C-060923-BKK\_F50383 High Volume Model : TE-5009X  
 Calibrator ID : BKK\_F50624 High Volume S/N : 4787  
 Calibrator Model : TE-5028A Calibrator Slope : 1.0268  
 Calibrator S/N : 2584 Calibrator Intercept : -0.01116

Test No.	Delta H <sub>2</sub> O (Inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.950	32	Slope : 58.8487 Intercept : -23.7073 Correlation Coefficient : 0.9995
2	2.6	1.009	36	
3	3.0	1.083	40	
4	3.4	1.153	44	
5	3.8	1.219	48	



Calibrated by : Prom S.  
 (Mr. Promsom Sripanet)  
 Field Scientist(2)

Approved by : P. P.  
 (Mr. Noppong Jantaraporn)  
 Enviro Field Coordinator Scientist (3)

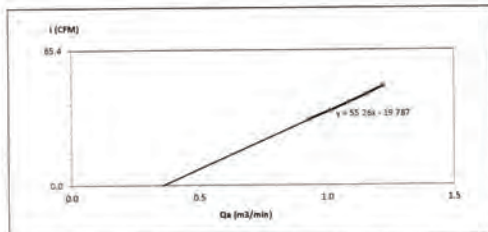
FORM NO. F 06-074 REVISION NO. - ISSUE DATE: 31/03/14



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP TLC Co., Ltd. Barometric Pressure (mm Hg) : 755  
 Calibrate Location : กรุงเทพมหานคร Temperature (°C) : 34  
 Calibrate Date : 6-Sep-23 High Volume ID : BKK\_F51060  
 Calibration Sheet No. : C-060923-BKK\_F51060 High Volume Model : TE-5009X  
 Calibrator ID : BKK\_F50624 High Volume S/N : 5503  
 Calibrator Model : TE-5028A Calibrator Slope : 1.0268  
 Calibrator S/N : 2584 Calibrator Intercept : -0.01116

Test No.	Delta H <sub>2</sub> O (Inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.932	32	Slope : 55.2597 Intercept : -19.7873 Correlation Coefficient : 0.9992
2	2.6	1.013	36	
3	3.0	1.087	40	
4	3.4	1.156	44	
5	3.8	1.222	48	



Calibrated by : Prom S.  
 (Mr. Promsom Sripanet)  
 Field Scientist(2)

Approved by : P. P.  
 (Mr. Noppong Jantaraporn)  
 Enviro Field Coordinator Scientist (3)

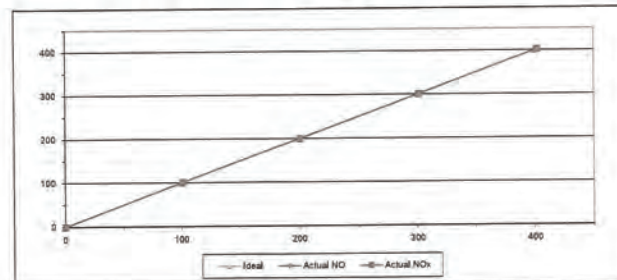
FORM NO. F 06-074 REVISION NO. - ISSUE DATE: 14/03/14



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 1-Jul-23 Equipment Name : NOx Analyzer  
 Manufacturer : HORIBA Model : APNA-370  
 Serial No. : VJV8GEEP Equipment ID : BKK\_F80779  
 Calibrator Manufacturer : Teledyne API Model : 700  
 Serial No. : 947  
 Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222  
 Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.  
 Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	100.10	0.10	0.10	101.00	1.00	1.00
2	200.00	199.80	-0.20	-0.10	200.50	0.50	0.25
3	300.00	299.60	-0.40	-0.13	301.20	1.20	0.40
4	400.00	400.50	0.50	0.13	402.20	2.20	0.55
AVERAGE (%)				0.02			0.48



Calibrated By

Approved By

(Mr. Jirawut Sakam)  
 Field Environmental Scientist (3)

(Mr. Sarayuth Jitranont)  
 Assistant General Manager

ALS Laboratory Group  
 FORM NO. F 06-060 REVISION NO. - ISSUE DATE: 02/04/13

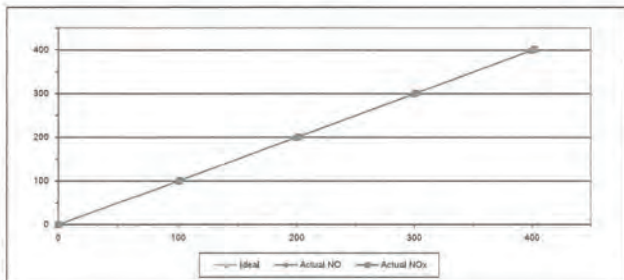




## MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23 Equipment Name NOx Analyzer  
Manufacturer Teledyne API Model T200  
Serial No. 6305 Equipment ID BKK\_FS1098  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.40	-0.60	-0.60	101.20	1.20	1.20
2	200.00	198.40	-1.60	-0.80	201.40	1.40	0.70
3	300.00	298.50	-1.50	-0.50	301.30	1.30	0.43
4	400.00	398.50	-1.50	-0.38	402.20	2.20	0.55
AVERAGE (%)				-0.43			0.60



Calibrated By  
  
(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By  
  
(Mr. Sarayuth Jittrantont)  
Assistant General Manager

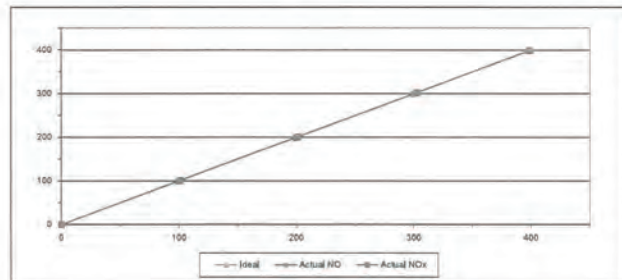
ALS Laboratory Group  
FORM NO. F-06-058 REVISION NO. - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. R28E09EW Equipment ID BKK\_FS0789  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.10	1.10	1.10
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	302.50	2.50	0.83
4	400.00	398.50	-1.50	-0.38	399.90	-1.10	-0.28
AVERAGE (%)				-0.54			0.48



Calibrated By  
  
(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By  
  
(Mr. Sarayuth Jittrantont)  
Assistant General Manager

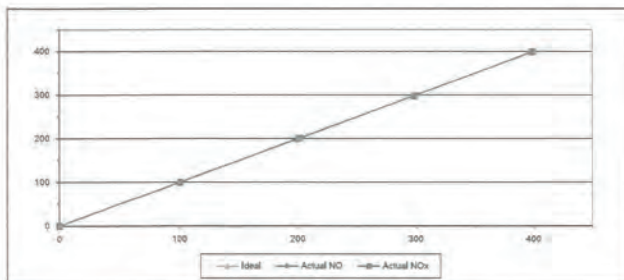
ALS Laboratory Group  
FORM NO. F-06-058 REVISION NO. - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. WPYDJMWD Equipment ID BKK\_FS0782  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.80	0.80	0.80
2	200.00	199.70	-0.30	-0.15	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	298.30	-1.70	-0.57
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.28			0.11



Calibrated By  
  
(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By  
  
(Mr. Sarayuth Jittrantont)  
Assistant General Manager

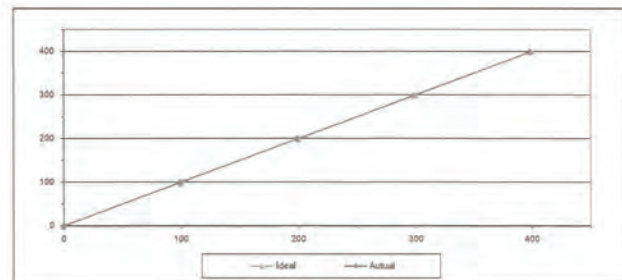
ALS Laboratory Group  
FORM NO. F-06-058 REVISION NO. - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-23 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model AP8A-370  
Serial No. VXABVTRT Equipment ID BKK\_FS0778  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00
2	200.00	198.70	-1.30	-0.65
3	300.00	298.10	-1.90	-0.63
4	400.00	398.20	-1.80	-0.45
AVERAGE (%)				-0.53



Calibrated By  
  
(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By  
  
(Mr. Sarayuth Jittrantont)  
Assistant General Manager

ALS Laboratory Group  
FORM NO. F-06-058 REVISION NO. - ISSUE DATE: 02/04/12

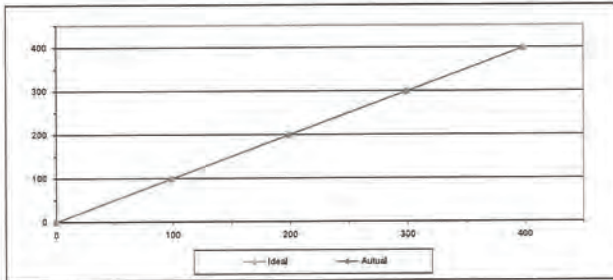




## MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	5345	Equipment ID	BKK_FS1067
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40
2	200.00	198.80	-1.20	-0.60
3	300.00	298.40	-1.60	-0.53
4	400.00	397.80	-2.20	-0.55
AVERAGE (%)				-0.80



Calibrated By

(Mr.Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

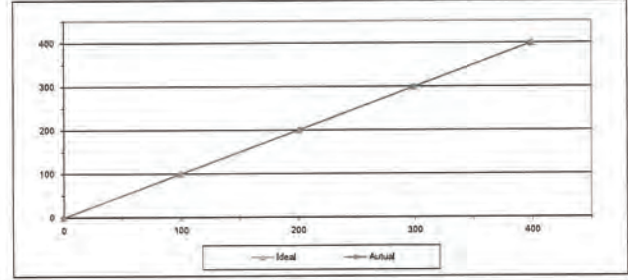
ALS Laboratory Group  
FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	PFDW4YU4	Equipment ID	BKK_FS0788
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	99.00	-1.00	-1.00
2	200.00	201.30	1.30	0.65
3	300.00	298.30	-1.70	-0.57
4	400.00	398.60	-1.40	-0.35
AVERAGE (%)				-0.24



Calibrated By

(Mr.Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

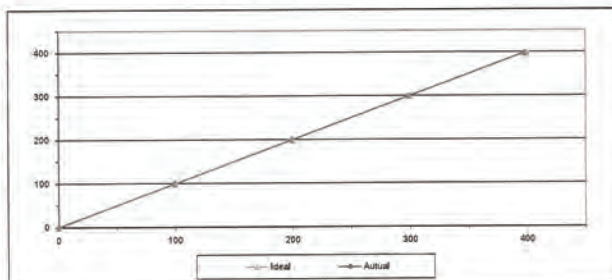
ALS Laboratory Group  
FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	Y53SNSFB	Equipment ID	BKK_FS0781
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.20	-0.80	-0.40
3	300.00	298.50	-1.50	-0.50
4	400.00	397.40	-2.60	-0.65
AVERAGE (%)				-0.35



Calibrated By

(Mr.Jirawut Sakam)  
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

ALS Laboratory Group  
FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12



Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TSU-TS-17025  
CALIBRATION 0367

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TSU-TS-17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-004-86

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Cup anemometer

Sensor: WS-50F

Data logger: 110-WS-250L-C

Sensor: WSO-A5964

Data logger: AS964

BNC-F51369

New Item

ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows:

Temperature

Relative Humidity

Atmospheric Pressure

23.0 ± 3.0 °C

55.0 ± 15.0 %RH

1010 ± 10 hPa

PLACE OF CALIBRATION

Effel type wind tunnel of Jranatite Associates Co., Ltd

CALIBRATION CONDITIONS

Wind tunnel cross-section area<sup>1</sup>Wind direction (frontal area)<sup>2</sup>Diameter of mounting pipe<sup>3</sup>Blockage ratio of test object<sup>4</sup>800 cm<sup>2</sup>100 cm<sup>2</sup>

mm

0.111 [-]

Preconditioning

Measurement Condition

24 hours at ambient conditions

The average values during measurement are (25.0) °C; (42.7) %RH and (1007.4) hPa

TABULATION OF RESULTS

The table on next page give the measured values.

Calibrated by

Mr. Sorasim Thachakul

Mr. Jitranont Jitranont



Approved signature

Mr. Parrya Booncharon  
Calibration Department Manager

Remark:

1. Ideally cross-section area of the wind tunnel

2. Projected cross-section area of the tested object include mounting pipe

3. Diameter of mounting pipe

4. Ratio = 1

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED  
IN WRITING FROM THE LABORATORY



Certificate Number

CC-004-66

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pilot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
1.049	24.90	25.00	0.9	-0.1	0.31
2.048	25.10	25.00	1.8	-0.2	0.31
3.044	24.92	25.00	2.8	-0.1	0.31
4.170	24.58	25.00	3.9	-0.3	0.31
5.02	25.10	25.00	4.8	-0.2	0.31
6.00	24.50	25.00	5.9	-0.1	0.31
7.04	25.20	25.00	6.9	-0.2	0.31
8.17	24.60	25.00	8.0	-0.2	0.31
9.09	25.28	25.00	8.9	-0.2	0.31
10.09	24.60	25.00	10.0	-0.1	0.31
11.13	25.30	25.00	11.0	-0.2	0.31
12.11	24.64	25.00	11.9	-0.2	0.31
13.18	25.16	25.00	13.0	-0.2	0.31
14.24	24.72	25.00	14.6	-0.2	0.31
15.22	25.02	25.00	15.1	-0.1	0.31
16.28	24.88	25.00	16.0	-0.3	0.31

## Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not to scale due to image quality.



**J NAC**  
JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
63/14-15, 67/35-36  
Petchkasem 7/71, Khe Sanh, Bangkok 10600  
Bangkok 10600 (Thailand)  
Tel: +662 6680812  
Mobile: +662 6680813  
E-mail: jiracal@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
RSC: TSI-75 17025  
CALIBRATION 0367

An speed measurement laboratory  
Calibration services department

Certificate Number

CD-004-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

Wind Direction Sensor

Manufacturer: Novalyns

Model/Type: Sensor: WS-02F

Data logger: 110-WS-25CL-D

Serial Number: Sensor: WS0-A5964

ID Number: BKH\_FS1369

Condition as received: New Item

Customer: ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

Received Date: 19 May 2023

Measurement Date: 30 May 2023

Issue Date: 31 May 2023

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

## PLACE OF CALIBRATION

Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

## CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>: 900 cm<sup>2</sup>

Win direction frontal area<sup>2</sup>: 129 cm<sup>2</sup>

Diameter of mounting pipe<sup>3</sup>: - mm

Blockage ratio of test object<sup>4</sup>: 0.143 [-]

## Preconditioning:

24 hours at ambient condition.

## Measurement Condition:

The average values during measurement are (24.0)°C, (46.3) %RH and (1005.8) hPa.

## TABULATION OF RESULTS:

The table on next page give the measured values.

## Calibrated by:

Mr. Sorawit Thachalad

Miss Jitraporn Lertsomphol



## Approved signature:

*Mr. Panyra Booncharoen*

Calibration Department Manager

## Remark:

<sup>1</sup> Net cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio: 100

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CD-004-66

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D <sub>1</sub> <sup>2</sup> Degree (°)	D <sub>2</sub> <sup>2</sup> Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	1.0
	45.000	42	-3	3.0
	90.001	88	-2	3.0
	135.000	133	-2	1.0
5.00	180.000	180	0	1.0
	225.000	227	2	1.0
	270.000	272	2	1.0
	315.000	318	3	1.0

## Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Direction of standard

Direction of Unit Under Calibration



**J NAC**

63/14-15, 67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Wathapra, Banghokwai, Bangkok 10600 Thailand  
Tel: (66) 02-6680812#13 Fax: (66) 02-6680860 www.jiranatee.com



## CERTIFICATE OF CALIBRATION

Certificate No.: CT-005-66  
Page 1 of 2

## Equipment Name: Data Logger with Temperature

Sensor:

Manufacturer: Novalyns

Model: 110-WS-25CL-D

Serial No.: A5964

ID No.: BKH\_FS1369

## Customer:

Name: ALS laboratory group (Thailand) Co., Ltd.

Address: 104 Phatthanakan 40, Phatthanakan Rd,

Khwaeng Suan Luang, Khet Suan Luang, Bangkok

10250 Thailand.

Received date: 19 May 2023

Calibration date: 31 May 2023

Issue date: 31 May 2023

## Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500.

Serial No.: 667682-09. Due date: 28 Mar 2024

2. Digital Temperature Indicator Model: DTI-1000-A MH

II. Serial No.: 671407-00591 Due date: 22 July 2023

## Calibration Condition

Temperature: (23±3) °C

Relative Humidity: (55±15)%

## Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

## Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23. Certificate number: ER-0092-22

Noted: The certificate is valid only to the item calibrated on date and place of calibration

## Calibrated by:

Mr. Sorawit Thachalad

Miss Jitraporn Lertsomphol



## Approved Signature:

*Mr. Panyra Booncharoen*

Calibration Department Manager

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Certificate No.: CT-005-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20-40 °C

#### Function

This equipment was connected with temperature sensor Model: HMP60 S/N: U3911251.

Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.001	19.9	-0.1	0.099
60	25.004	24.8	-0.2	0.099
60	30.005	29.8	-0.2	0.099
60	35.002	34.8	-0.2	0.099
60	40.001	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Calibration No.: RH-02052023  
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger.  
Manufacturer: Novolym  
Model/Type: 110-WS-250L-D  
Serial Number: A5964  
ID No.: BKK-F81369  
Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khel Suan Luang, Bangkok 10250 Thailand.

#### Environmental Condition:

The measurement was carried out in an ambient temperature of (26±3)°C, and relative humidity of (50±15)%.

#### Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

#### Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology in the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20926-001. Due date: Sep 26, 2024.

Measurement Date: May 31, 2023  
Issued Date: May 31, 2023

#### Measurement Results:

This equipment was connected with indoor air quality probe and Displayed (URI) on display. Model: HMP60. Serial number: U3911251.

Calibration was performed in the range of 20%RH to 80%RH.

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ±(%RH)
20	20.04	19.2	-0.8	0.62
50	50.28	49.3	-1.0	0.61
80	80.30	79.7	-0.6	0.61

Performed by:  
☐ Mr. Sorewit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory: Mr. Parnye Booncharoen  
Calibration Department Manager

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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367  
Pressure measurement laboratory  
Calibration services department.



NSC - TIS - TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No.: CP-001-66

Page 2 of 2 Pages

MEASUREMENT ITEM: Digital barometer  
MANUFACTURER: Novolym  
MODEL/TYPE: 110-WS-250P  
SERIAL NUMBER: BP-A5964  
ID NUMBER: BKK-F81369  
CONDITION AS-RECEIVED: New Item  
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd.,  
Khwaeng Suan Luang, Khel Suan Luang,  
Bangkok 10250 Thailand.  
RECEIVED DATE: 19 May 2023  
MEASUREMENT DATE: 31 May 2023  
ISSUE DATE: 31 May 2023

#### Calibration procedure:

The pressure calibration was done by in-house calibration method as per G-003 according to comparison method with Digital pressure calibrator based on OGD-R 6-1

#### Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) which complies with the requirements of ISO/IEC 17025:2017, ANSI/NCSL Z540-1 via Certificate number: MP-0205-22

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%

#### CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0205-22	07 Dec 2023

2. Calibration effort for calibration sequence A

3. The UUC\* was installed in vertical orientation above reference standard instrument and center of UUC\* was used as the reference level

4. Calibration conditions

4. Condition: ☒ Normal ☐ Abnormal  
Pressure transmitting medium: Air  
 $p_0$  (20°C, 1 bar): 1.19 kg/m<sup>3</sup>  
 $R_{\text{flow}}$ : (55±15) %  
 $T_{\text{amb}}$ : (23±3) °C  
 $p_{\text{amb}}$ : (1010±10) mbar

5. The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:  
☒ Mr. Sorewit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved signatory: Mr. Parnye Booncharoen  
Calibration Department Manager

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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367  
Pressure measurement laboratory  
Calibration services department.



NSC - TIS - TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No.: CP-001-66

Page 2 of 2 Pages

MEASUREMENT RESULTS: ☒ Without adjustment ☐ With adjustment  
CALIBRATION IN THE RANGE OF: 950 - 1050 mbar

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.08	950.9	0.8	1.0
970.12	970.7	0.6	0.79
990.02	990.4	0.3	0.56
1010.04	1010.1	0.0	0.39
1030.06	1029.9	-0.1	0.40
1050.05	1049.7	-0.4	0.57

Note: UUC\* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100







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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-077-65  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor  
Manufacturer: Novolyth  
Model: 200-WS-25LB  
Serial No.: A5261  
ID No.: BKK\_FS0888

Customer  
Name: ALS laboratory group (Thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan  
Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 23 May 2022  
Calibration date: 30 May 2022  
Issue date: 02 Jun 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500.  
Serial No.: 667682-09. Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 04 June 2022

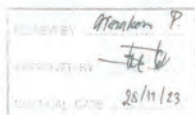
Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

### Calibration Procedure

The temperature calibration was done by in-house  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

### Traceability

The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology (NIMT) Certificate  
number: IT-0034-22, Certificate number: ER-0032-  
21.



Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Peniya Booncharoen  
Calibration Department Manager

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Certificate No.: CL-077-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20-40 °C

### Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: N0330783  
Dimension: Diameter 12mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.98	20.0	0.1	0.30
60	24.96	24.7	-0.3	0.30
60	30.02	29.6	-0.4	0.30
60	35.01	34.5	-0.5	0.30
60	40.01	39.3	-0.7	0.30

### UUC\* Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of  
confidence of approximately 95%.

★ End of Certificate ★



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## CALIBRATION REPORT

Calibration No.: RH-02062022  
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger  
Manufacturer: Novolyth  
Model/Type: 200-WS-25LB  
Serial Number: A5261  
ID No.: BKK\_FS0888  
Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250  
Thailand

### Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C and relative humidity of (50±15)%

### Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator  
chamber to determine the errors.

### Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceable through National Institute of Standards and  
Technology to the international system of units (SI) via MCB Calibration, Inc. Certificate number: 20314-101. Due date: Mar-  
14-2023.

Measurement Date: Jun 01, 2022  
Issued Date: Jun 02, 2022

### Measurement Results:

The equipment was connected with indoor air quality probe and Display (JUR) or display. Model: HMP60. Serial number:  
N0330783

Calibration was performed in the range of 20RH to 80RH.  
The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty ±(%RH)
20	20.02	16.8	-1.2	0.61
50	50.22	49.4	-0.8	0.57
80	80.50	79.3	-1.3	0.69

Performed by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Peniya Booncharoen  
Calibration Department Manager

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## CERTIFICATE OF CALIBRATION

Certificate No.: WS-02062022  
Page 1 of 2 pages

Measurement Item: Cup anemometer with data logger

Manufacturer: Data logger, Novolyth  
Cup anemometer, Novolyth

Model/Type: Data logger, 200-WS-25LB  
Cup anemometer, WS-00F

Serial Number: Data logger, A5261  
Cup anemometer, -

ID No.: Data logger, BKK\_FS0888  
Cup anemometer, -

Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250  
Thailand.

Test Conditions: Wind tunnel cross test section area: 900 cm<sup>2</sup>  
Anemometer frontal area: 100 cm<sup>2</sup>  
Diameter of mounting pipe: mm  
Blockage ratio of test object: 0.111 [-]

Test Conditions: Air temperature: 24.7 ±0.8 °C  
Air pressure: 1005.2 ±0.4 hPa  
Relative air humidity: 46.1 ±3.5 %RH

Calibration Procedure: Calibration was carried out based on:  
IEC 61400-12-1 Ed.1, 2005 Power Performance Measurements of Directly Producing Wind  
Turbines.  
MBSNET Anemometer Calibration Procedure - Version 2, 2009.

Traceability: This calibration documents the traceable to national standards which realize the unit of  
measurements according to the international system of units (SI) through National Institute of  
Metrology (NIMT).

Measurement Date: Jun 01, 2022  
Issued Date: Jun 02, 2022

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Peniya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. WS-02062022  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 - 10 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>act</sub> Reading m/s	V <sub>act</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.087	2.0	-0.1	2.4
4.140	4.0	-0.1	1.0
6.02	6.0	0.0	0.88
8.00	8.0	0.0	0.74
10.00	10.0	0.0	0.69
11.99	12.1	0.1	0.65
14.02	14.3	0.3	0.42
16.00	16.4	0.4	0.63
18.01	18.4	0.4	0.39
12.97	13.1	0.1	0.59
11.00	11.0	0.0	0.52
9.01	9.0	0.0	0.66
7.01	7.0	0.0	0.85
5.186	5.2	0.0	0.76
3.003	3.1	0.1	1.0
1.053	0.8	-0.3	4.8

UUC\* Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

Appendix 1: Instrumentation

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Wind speed	TESTO INC	06352145	Aug 07, 2021	MA-0034-21	5 - 30 m/s
2	Pressure Differential Pressure Meter	Zorglab	DPM2800	Aug 07, 2021	MA-0034-21	5 - 30 m/s
3	Altitude sensor (Barometric)	TD INC	E455-12	Aug 08, 2021	MA-0735-21	0 - 5 m/s
4	Temperature	Zorglab	DPH-TMP	March 26, 2022	CL-027-05	-30 - 70°C
5	Relative humidity	Zorglab	DPH-RH	March 26, 2022	MA-0033-2022	0 - 100 %RH
6	Atmospheric pressure	Zorglab	DPH-PRES	March 26, 2022	MA-0735-22	500 - 1100 mPa
7	Wind tunnel	ESSEN	MP3300			0 - 55 m/s

\*\*\*End of certificate of calibration\*\*\*



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## CERTIFICATE OF CALIBRATION

Certificate No. WD-02062022  
Page 1 of 2 pages

Measurement Item: Wind direction sensor with data logger.

Manufacturer: Data logger: Novatlyn  
Wind direction sensor: Novatlyn

Model/Type: Data logger: 200-WS-25LB  
Wind direction sensor: WS-02F

Serial Number: Data logger: A5261  
Wind direction sensor: -

ID No: Data logger: BKH\_FS0888  
Wind direction sensor: -

Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of (23±3) °C and relative humidity of (40±10) %.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and the laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed.

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No. Q21060014, Certificate No. NWS64/0025.

Measurement Date: Jun 01, 2022.

Issued Date: Jun 02, 2022.

Calibrated by:  
☒ Mr. Soravit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panyee Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. WD-02062022  
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 - 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty (°)
1		0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	133	-2	3.0
5		180	180	181	1	3.0
6		225	225	229	4	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9		0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	133	-2	3.0
13		180	180	181	1	3.0
14		225	225	229	4	3.0
15		270	270	274	4	3.0
16		315	315	319	4	3.0

UUC\* Unit Under Calibration: The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-200-65  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor  
Manufacturer: Novatlyn  
Model: 200-WS-25LB  
Serial No.: A5262  
ID No.: BKH\_FS0909

Customer: ALS laboratory group (Thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 02 Dec 2022  
Calibration date: 10 Dec 2022  
Issue date: 12 Dec 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500.  
Serial No.: 667682-09. Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II. Serial No.: 671407-00591. Due date: 22 July 2023

Calibration Condition

Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-003 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TI-0034-22. Certificate number: ER-0092-22

Calibrated by:  
☒ Mr. Soravit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panyee Booncharoen  
Calibration Department Manager

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Certificate No.: CL-200-85  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20-40 °C

Function:  
This equipment was connected with temperature sensor Model: HMP60 S/N: N0330785.  
Dimension : Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.062	19.7	-0.4	0.099
60	25.058	24.7	-0.4	0.099
60	30.049	29.7	-0.3	0.099
60	35.041	34.7	-0.3	0.099
60	40.033	39.7	-0.3	0.099

UUC\*: Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Calibration No.: RH-19122022  
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger  
Manufacturer : Novatynx  
Model/Type : 200-WS-25LB  
Serial Number : A5262  
ID No. : BKH\_F80909  
Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang, Khel Suan Luang, Bangkok  
10250 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of  $(25 \pm 3)^\circ\text{C}$ , and relative humidity of  $(50 \pm 1)\%$ .

Measurement Method:  
Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator chamber to determine the errors.

Traceability:  
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20314-101. Due date: Mar 14, 2023.

Measurement Date : Dec 10, 2022  
Issued Date : Dec 12, 2022

Measurement Results:  
This instrument was connected with indoor air quality probe and Displayed (JRI) on display. Model: HMP60, Serial number: N0330785.

Calibration was performed in the range of 20%RH to 80%RH  
The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	19.99	18.0	-2.0	0.56
50	50.26	47.8	-2.5	0.62
80	80.39	77.8	-2.6	0.62

Performed by  
☒ Mr. Sorawit Thechadit  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.



Jiranatee Associates Co., Ltd.  
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Mobile : +66(0)286812  
E-mail : jna-calibration@jiranatee.com  
Web site : www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NAC-150-105-F2023  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

Certificate Number

CL-013-65

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer  
MANUFACTURER : Novatynx  
MODEL/TYPE : Sensor: WS-02T  
Data logger: 200-WS-25LB  
SERIAL NUMBER : Sensor:  
Data logger: A5262  
ID NUMBER : BKH\_F80909  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (Thailand) co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang, Khel Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 02 Dec 2022  
MEASUREMENT DATE : 09 Dec 2022  
ISSUE DATE : 12 Dec 2022

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure : 1010.1 hPa

PLACE OF CALIBRATION : Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS : Wind tunnel cross-section area : 900 cm<sup>2</sup>  
Win direction frontal area : 100 cm<sup>2</sup>  
Diameter of mounting pipe : 10 mm  
Blockage ratio of test object : 0.111 [-]

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  $(24.4)^\circ\text{C}$ ,  $(47.7) \%RH$  and  $(1012.7) hPa$ .

TABULATION OF RESULTS:  
The table on next page give the measured values.

Calibrated by:  
☒ Mr. Sorawit Thechadit  
☐ Miss Jitraporn Lertsomphol



Approved signatory  
Mr. Parinya Booncharoen  
Calibration Department Manager

Remarks:  
1. Result cross-section area of the wind tunnel  
2. Projected cross-section area of the tested object includes mounting pipe  
3. Diameter of mounting pipe  
4. Ratio:  $h_{obj}/h_{tunnel}$

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CL-0013-65

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 18 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{std}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
0.985	24.34	24.40	0.7	-0.3	0.15
2.059	24.56	24.40	1.8	-0.3	0.16
3.080	24.38	24.40	2.9	-0.2	0.21
4.214	24.60	24.40	3.9	-0.3	0.19
5.04	24.16	24.40	4.8	-0.2	0.17
8.03	24.50	24.40	5.9	-0.1	0.19
7.08	24.10	24.40	6.9	-0.2	0.18
8.19	24.44	24.40	8.0	-0.3	0.19
9.11	24.10	24.40	9.0	-0.3	0.22
10.11	24.33	24.40	9.8	-0.3	0.20
11.16	24.10	24.40	10.8	-0.3	0.20
12.17	24.24	24.40	11.8	-0.3	0.20
13.22	24.10	24.40	12.9	-0.3	0.23
14.29	24.16	24.40	13.8	-0.5	0.24
15.26	24.10	24.40	14.9	-0.4	0.25
16.32	24.10	24.40	15.9	-0.4	0.29

### Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.







JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TS-17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-013-65

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

#### MANUFACTURER

#### MODEL/TYPE

#### SERIAL NUMBER

#### ID NUMBER

#### CONDITION AS-RECEIVED

#### CUSTOMER

Wind Direction Sensor

Navalys

Sensor: WS-02F

Data logger: Z00-WS-25LB

Sensor: BKX\_F50809

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

### Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder, model: A3402075 DMD4-P3-S-UD in an close fit-section of Elfler-type wind tunnel with 900 cm<sup>2</sup> cross test-section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to recognition of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate Number: DA-0043-22

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement)

### RECEIVED DATE

02 Dec 2022

### MEASUREMENT DATE

12 Dec 2022

### ISSUE DATE

12 Dec 2022

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

### PLACE OF CALIBRATION

Elfler-type wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>

Wind direction frontal area<sup>2</sup> 129 cm<sup>2</sup>

Diameter of mounting pipe<sup>3</sup> - mm

Blockage ratio of test object<sup>4</sup> 0.143 [-]

### Preconditioning

24 hours at ambient conditions.

### Measurement Condition

The average values during measurement are (24.0) °C, (49.5) %RH and (1009.8) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Sorawat Thairadilad

Miss Jitrasriam Lertwongthong



### Approved signatory:

Mr. Panyee Booncharatam  
Calibration Department Manager

### Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio to S<sub>0</sub>

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CL-013-65

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	D <sub>ref</sub>	D <sub>unc</sub>	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.00	0.001	0	0	0.58
	45.000	42	-3	0.76
	90.000	88	-3	0.76
	135.000	133	-2	0.68
	180.000	181	1	0.74
	225.001	226	1	0.74
	270.000	275	5	0.74
	315.000	320	5	0.76

### Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



JIRANATEE ASSOCIATES CO., LTD.

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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TS-17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-024-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

#### MANUFACTURER

#### MODEL/TYPE

#### SERIAL NUMBER

#### ID NUMBER

#### CONDITION AS-RECEIVED

#### CUSTOMER

Cup anemometer

Navalys

Sensor: WS-02F

Data logger: Z00-WS-25LB

Sensor: BKX\_F50809

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

### Calibration procedure:

The cup anemometer was calibrated against Standard air velocity transducer model: B455-12 and pilot tube with precision differential pressure meter model: DPM4500 in an close fit-section of Elfler-type wind tunnel with 900 cm<sup>2</sup> cross test-section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to recognition of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate Number: MHV-0052-21 and MHV-0056-22

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement)

### RECEIVED DATE

19 Feb 2023

### MEASUREMENT DATE

21 Feb 2023

### ISSUE DATE

21 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

### PLACE OF CALIBRATION

Elfler-type wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>

Wind direction frontal area<sup>2</sup> 100 cm<sup>2</sup>

Diameter of mounting pipe<sup>3</sup> - mm

Blockage ratio of test object<sup>4</sup> 0.111 [-]

### Preconditioning

24 hours at ambient conditions.

### Measurement Condition

The average values during measurement are (23.7) °C, (44.3) %RH and (1013.2) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Sorawat Thairadilad

Miss Jitrasriam Lertwongthong

### Approved signatory:

Mr. Panyee Booncharatam  
Calibration Department Manager

### Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio to S<sub>0</sub>

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CL-024-66

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V <sub>unc</sub> (m/s)	Error (m/s)	U (k=2) (m/s)
0.584	23.80	23.65	0.8	-0.2	0.15
1.031	23.50	23.65	1.9	-0.2	0.16
3.044	23.80	23.65	2.9	-0.2	0.18
4.139	23.80	23.65	3.9	-0.2	0.19
4.87	23.60	23.65	4.8	-0.1	0.19
5.98	23.84	23.65	5.9	-0.1	0.18
7.04	23.58	23.65	6.9	-0.2	0.18
8.18	23.78	23.65	7.9	-0.3	0.21
9.08	23.44	23.65	9.0	-0.1	0.20
10.07	23.50	23.65	9.9	-0.2	0.28
11.14	23.26	23.65	10.9	-0.3	0.22
12.11	23.42	23.65	11.9	-0.3	0.21
13.30	23.30	23.65	12.0	-0.3	0.21
14.25	23.34	23.65	13.0	-0.3	0.22
15.17	23.30	23.65	14.0	-0.2	0.24
16.29	23.26	23.65	16.0	-0.5	0.26

### Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

### PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.

\*\*\*End of Certificate of Calibration\*\*\*



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Web site: www.jiranate.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
JAG-TIS-19.17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-022-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Wind Direction Sensor

Nonalys

Sensor: WS-G2F

Data logger: 200-WS-2518

Sensor: -

Data logger: AS379

3002\_F09019

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanalan 40, Phatthanalan Rd, Khwaeng Suan Luang,

Khwaeng Suan Luang, Bangkok 10250 Thailand

Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: A960975-DMD4-P3-1-UD in an east direction of 0 degree and 180 degrees. The wind speed sensor was calibrated in the wind energy generation system, Part 12-1, Power performance measurement of electricity generating wind turbines, March 2017 was used as a calibration guideline.

Traceability:

The certificate provides a traceability of the measurement to recognize the national standards, and so realization of the international system of units (SI) through the NMI (National Metrology Institute of Thailand) via Certificate number: DA 0043-27

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM "Evaluation of measurement data - Guide to the expression of uncertainty in measurement"

RECEIVED DATE

15 Feb 2023

MEASUREMENT DATE

21 Feb 2023

ISSUE DATE

21 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature

23.0 ± 3.0 °C

Relative Humidity

55.0 ± 15.0 %RH

Atmospheric Pressure

1010 ± 10 hPa

### PLACE OF CALIBRATION

Effluent wind tunnel of Jiranate Associates Co., Ltd.

### CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>

900 cm<sup>2</sup>

Wind direction frontal area<sup>2</sup>

179 cm<sup>2</sup>

Diameter of mounting pipe<sup>3</sup>

mm

Blockage ratio of test object<sup>4</sup>

0.143 [-]

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are 23.7 °C, (54.4) 50% and 1013.5 hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Saran Thakhalad

Mr. Jiraporn Lertsomkul

Approved signature

Mr. Purnap Booncherson

Calibration Department Manager

Remarks:

<sup>1</sup> Rectangular cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio  $A/A_0$

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

Certificate Number

CL-022-66

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>5</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	D <sub>15m</sub>	D <sub>10m</sub>	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
	0.000	0	0	0.58
	44.999	42	-3	0.58
	90.000	87	-3	0.58
	135.000	133	-2	0.58
	180.001	180	0	0.68
	225.000	228	8	0.74
	270.001	274	4	0.74
	315.000	313	-2	0.74

Remarks:

Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>5</sup> Direction of standard

<sup>6</sup> Direction of wind Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Lot No. 2390397-1

## ANALYZER CALIBRATION DATA

Client : Gulf JP TLC Co., Ltd. Location : HRSG 11

Date : 08 Sep 23 Test Operator : Usaree N.

O<sub>2</sub> ANALYZER Model : TELEDYNE API 200EH Serial No. : 548

Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.05	0.12
Low-Level Gas	8.00	8.03	8.03	0.00
Span Gas	16.06	16.09	16.11	0.08

NO<sub>x</sub> ANALYZER Model : TELEDYNE API 200EH Serial No. : 548

Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.06	0.01
Low-Level Gas	50.32	50.48	50.54	0.03
Span Gas	158.20	158.37	158.41	0.02

SO<sub>2</sub> ANALYZER Model : TELEDYNE API 100EH Serial No. : 282

Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	50.27	50.42	50.00	0.21
Span Gas	161.60	161.32	161.06	0.13

CO ANALYZER Model : TELEDYNE API 300EH Serial No. : 300

Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.05	0.05	0.00
Low-Level Gas	49.99	50.13	50.74	0.31
Span Gas	157.50	157.28	157.90	0.31

Calibrated by

(Mr. Usaree Namburne)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 506/19

ALS Laboratory Group



Lot No. 2390397-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP TLC Co., Ltd. Location : HRSG 11

Date : 08 Sep 23 Test Operator : Usaree N.

O<sub>2</sub> ANALYZER Cylinder Conc. (%) : 16.08 Span (%) : 25

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.03	0.04	0.05	0.12	0.08
Upscale Gas	16.09	16.12	0.12	16.13	0.16	0.04

NO<sub>x</sub> ANALYZER Cylinder Conc. (ppm) : 158.20 Span (ppm) : 200

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.04	0.05	0.01	0.05	0.01	0.00
Upscale Gas	158.37	157.40	0.48	157.12	0.83	0.14

SO<sub>2</sub> ANALYZER Cylinder Conc. (ppm) : 161.60 Span (ppm) : 200

	SO <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	161.32	160.22	0.55	159.63	0.84	0.30

CO ANALYZER Cylinder Conc. (ppm) : 157.50 Span (ppm) : 200

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.05	0.06	0.01	0.07	0.01	0.01
Upscale Gas	157.28	156.27	0.50	156.05	0.61	0.11

Calibrated by

(Mr. Usaree Namburne)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 506/19

ALS Laboratory Group





## EMISSION TEST RESULT

Client	Gulf JP TLC Co., Ltd.	Run #	1
Date	08 Sep 23	Location	HRBG 11
Start Time	10:00	Test Operator	Usanee N.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	10:20
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	282
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	548
		Serial No.	300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:00	13.95	4.05	12.40	0.06	3.18	
10:01	13.97	4.05	12.39	0.06	3.21	
10:02	13.93	4.12	12.33	0.06	3.17	
10:03	13.94	4.08	12.39	0.06	3.26	
10:04	13.95	4.11	12.40	0.06	3.29	
10:05	13.91	4.18	12.44	0.06	3.22	
10:06	13.96	4.08	12.40	0.06	3.13	
10:07	13.92	4.10	12.38	0.07	3.11	
10:08	13.88	4.17	12.37	0.08	3.24	
10:09	13.93	4.12	12.38	0.06	3.19	
10:10	13.96	4.11	12.39	0.06	3.14	
10:11	13.91	4.16	12.44	0.03	3.18	
10:12	13.91	4.11	12.38	0.04	3.20	
10:13	13.91	4.14	12.39	0.04	3.25	
10:14	13.92	4.12	12.43	0.04	3.13	
10:15	13.94	4.17	12.45	0.03	3.08	
10:16	13.94	4.05	12.30	0.04	3.02	
10:17	13.91	4.11	12.32	0.06	3.11	
10:18	13.90	4.16	12.37	0.03	3.05	
10:19	13.87	4.11	12.62	0.04	3.14	
10:20	13.90	4.10	12.52	0.04	3.12	
Average	13.93	4.12	12.44	0.06	3.15	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 (ISSUE DATE 30/01/18)

ALS Laboratory Group



## EMISSION TEST RESULT

Client	Gulf JP TLC Co., Ltd.	Run #	2
Date	08 Sep 23	Location	HRBG 11
Start Time	10:21	Test Operator	Usanee N.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	10:41
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	282
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	548
		Serial No.	300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:21	13.95	4.11	12.40	0.04	3.13	
10:22	13.90	4.14	12.41	0.04	3.18	
10:23	13.93	4.11	12.46	0.04	3.29	
10:24	13.95	4.11	12.33	0.03	3.00	
10:25	13.91	4.09	12.27	0.02	2.97	
10:26	13.92	4.15	12.34	0.03	2.97	
10:27	13.96	4.09	12.27	0.02	3.16	
10:28	13.90	4.14	12.32	0.02	3.13	
10:29	13.93	4.11	12.41	0.02	3.02	
10:30	13.96	4.12	12.28	0.00	3.08	
10:31	13.91	4.18	12.39	0.02	2.98	
10:32	13.94	4.10	12.63	0.02	2.88	
10:33	13.95	4.19	12.46	0.02	3.01	
10:34	13.92	4.17	12.44	0.02	2.98	
10:35	13.97	4.07	12.28	0.00	3.13	
10:36	13.94	4.13	12.11	0.01	3.18	
10:37	13.93	4.14	12.28	0.01	3.02	
10:38	13.96	4.05	12.29	0.00	3.16	
10:39	13.92	4.12	12.29	0.03	3.08	
10:40	13.94	4.12	12.34	0.01	2.99	
10:41	13.95	4.04	12.26	0.00	3.01	
Average	13.93	4.12	12.34	0.02	3.05	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 (ISSUE DATE 30/01/18)

ALS Laboratory Group



## EMISSION TEST RESULT

Client	Gulf JP TLC Co., Ltd.	Run #	3
Date	08 Sep 23	Location	HRBG 11
Start Time	10:42	Test Operator	Usanee N.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	11:02
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	282
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	548
		Serial No.	300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:42	13.93	4.14	12.17	0.02	2.95	
10:43	13.94	4.10	12.23	0.02	2.91	
10:44	13.92	4.14	12.19	0.05	2.89	
10:45	13.94	4.12	12.14	0.02	3.05	
10:46	13.90	4.16	12.22	0.02	2.91	
10:47	13.90	4.12	12.29	0.01	2.91	
10:48	13.95	4.10	12.12	0.03	3.13	
10:49	13.90	4.20	12.15	0.04	2.94	
10:50	13.92	4.07	12.18	0.02	2.89	
10:51	13.94	4.15	12.08	0.05	2.90	
10:52	13.90	4.19	12.10	0.04	2.94	
10:53	13.89	4.18	12.39	0.05	2.92	
10:54	13.90	4.10	12.35	0.01	2.88	
10:55	13.94	4.12	12.09	0.04	2.29	
10:56	13.91	4.17	11.97	0.03	3.03	
10:57	13.90	4.19	12.22	0.04	3.03	
10:58	13.94	4.12	12.21	0.03	3.03	
10:59	13.95	4.14	12.02	0.03	2.91	
11:00	13.93	4.15	11.95	0.05	2.93	
11:01	13.91	4.19	12.06	0.05	2.88	
11:02	13.94	4.14	12.19	0.03	2.88	
Average	13.92	4.14	12.18	0.03	2.95	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 (ISSUE DATE 30/01/18)

ALS Laboratory Group



## ANALYZER CALIBRATION DATA

Lot No.: 2380401-1

Client	Gulf JP TLC Co., Ltd.	Location	HRBG 12
Date	08 Sep 23	Test Operator	Usanee N.

SO <sub>2</sub> ANALYZER		Serial No.	548
Model	TELEDYNE API 200EH		
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.05	0.12
Low-Level Gas	8.00	8.03	8.03	0.00
Span Gas	16.06	16.09	16.11	0.08

NO <sub>x</sub> ANALYZER		Serial No.	548
Model	TELEDYNE API 200EH		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.08	0.01
Low-Level Gas	50.32	50.48	50.54	0.03
Span Gas	158.20	158.37	158.41	0.02

SO <sub>2</sub> ANALYZER		Serial No.	282
Model	TELEDYNE API 100EH		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	50.27	50.42	50.50	0.21
Span Gas	161.60	161.32	161.05	0.13

CO ANALYZER		Serial No.	300
Model	TELEDYNE API 300EM		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.05	0.05	0.00
Low-Level Gas	49.99	50.13	50.74	0.31
Span Gas	157.50	157.28	157.90	0.31

Calibrated by

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 (ISSUE DATE 30/01/18)

ALS Laboratory Group





Lot No. 2395401-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf J.P. TLC Co., Ltd. Location: HRSG 12  
Date: 08 Sep 23 Test Operator: Usamee N.O<sub>2</sub> ANALYZER  
Cylinder Conc. (%): 16.06 Span (%): 25

	O <sub>2</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.02	0.03	0.04	0.05	0.12	0.08
Upscale Gas	16.09	16.12	0.12	16.13	0.19	0.04

NO<sub>x</sub> ANALYZER  
Cylinder Conc. (ppm): 158.20 Span (ppm): 200

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.04	0.05	0.01	0.05	0.01	0.00
Upscale Gas	158.37	157.40	0.48	157.12	0.63	0.14

SO<sub>2</sub> ANALYZER  
Cylinder Conc. (ppm): 161.60 Span (ppm): 200

	SO <sub>2</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.01	0.00	0.01	0.00	0.00
Upscale Gas	161.32	160.22	0.55	159.83	0.84	0.30

CO ANALYZER  
Cylinder Conc. (ppm): 157.50 Span (ppm): 200

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.05	0.06	0.01	0.07	0.01	0.01
Upscale Gas	157.28	156.27	0.50	156.05	0.81	0.11

Calibrated by

(Mr. Usamee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE: 30/01/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client: Gulf J.P. TLC Co., Ltd. Run #: 1  
Date: 08 Sep 23 Location: HRSG 12  
Start Time: 12:00 Test Operator: Usamee N.  
Finish Time: 12:30  
SO<sub>2</sub> Analyzer Model: TELEDYNE API 100EH Serial No.: 282  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH Serial No.: 549  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
12:00	13.93	4.21	11.70	0.20	2.81	
12:01	13.92	4.20	12.07	0.22	2.74	
12:02	13.91	4.24	12.16	0.20	2.80	
12:03	13.92	4.13	12.16	0.21	2.68	
12:04	13.87	4.19	12.37	0.21	2.74	
12:05	13.83	4.20	12.32	0.21	2.64	
12:06	13.93	4.20	12.18	0.21	2.83	
12:07	13.88	4.18	12.30	0.23	2.72	
12:08	13.88	4.20	12.83	0.22	2.85	
12:09	13.95	4.17	12.30	0.23	2.90	
12:10	13.93	4.11	12.17	0.20	2.86	
12:11	13.90	4.15	12.27	0.24	2.72	
12:12	13.89	4.15	12.50	0.21	2.70	
12:13	13.93	4.15	12.45	0.22	2.63	
12:14	13.94	4.22	12.24	0.20	2.68	
12:15	13.91	4.21	12.29	0.21	2.72	
12:16	13.94	4.13	12.33	0.22	2.83	
12:17	13.94	4.22	12.30	0.24	2.93	
12:18	13.93	4.19	12.35	0.26	2.86	
12:19	13.85	4.16	12.39	0.21	2.81	
12:20	13.85	4.19	12.32	0.23	2.70	
Average	13.62	4.18	12.28	0.22	2.76	

(Mr. Usamee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE: 30/01/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client: Gulf J.P. TLC Co., Ltd. Run #: 2  
Date: 08 Sep 23 Location: HRSG 12  
Start Time: 12:21 Test Operator: Usamee N.  
Finish Time: 12:41  
SO<sub>2</sub> Analyzer Model: TELEDYNE API 100EH Serial No.: 282  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH Serial No.: 549  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
12:21	13.92	4.15	12.37	0.24	2.71	
12:22	13.90	4.14	12.40	0.21	2.77	
12:23	13.94	4.26	12.36	0.23	2.73	
12:24	13.93	4.20	12.43	0.23	2.73	
12:25	13.96	4.23	12.29	0.23	2.83	
12:26	13.95	4.14	12.28	0.25	2.73	
12:27	13.95	4.24	12.33	0.23	2.83	
12:28	13.95	4.14	12.44	0.24	2.57	
12:29	13.93	4.15	12.45	0.25	2.54	
12:30	13.94	4.17	12.51	0.24	2.62	
12:31	13.95	4.11	12.47	0.24	2.43	
12:32	13.93	4.20	12.54	0.25	2.49	
12:33	13.94	4.16	12.56	0.24	2.52	
12:34	13.91	4.21	12.57	0.26	2.69	
12:35	13.95	4.21	12.60	0.25	2.70	
12:36	13.96	4.21	12.51	0.27	2.64	
12:37	13.94	4.23	12.36	0.24	2.70	
12:38	13.91	4.22	12.52	0.27	2.32	
12:39	13.93	4.28	12.49	0.26	2.54	
12:40	13.90	4.19	12.52	0.27	2.58	
12:41	13.90	4.25	12.42	0.25	2.57	
Average	13.94	4.20	12.46	0.25	2.64	

(Mr. Usamee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE: 30/01/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client: Gulf J.P. TLC Co., Ltd. Run #: 3  
Date: 08 Sep 23 Location: HRSG 12  
Start Time: 12:42 Test Operator: Usamee N.  
Finish Time: 13:02  
SO<sub>2</sub> Analyzer Model: TELEDYNE API 100EH Serial No.: 282  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH Serial No.: 549  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
12:42	13.95	4.17	12.18	0.26	2.51	
12:43	13.91	4.18	12.32	0.26	2.67	
12:44	13.91	4.15	12.56	0.27	2.53	
12:45	13.95	4.19	12.47	0.24	2.56	
12:46	13.95	4.21	12.22	0.25	2.62	
12:47	13.95	4.17	12.22	0.24	2.87	
12:48	13.94	4.16	12.35	0.25	2.92	
12:49	13.95	4.15	12.36	0.26	2.82	
12:50	13.93	4.18	12.37	0.26	3.07	
12:51	13.93	4.12	12.36	0.25	2.60	
12:52	13.97	4.08	12.30	0.26	2.68	
12:53	13.93	4.10	12.24	0.26	2.64	
12:54	13.92	4.14	12.46	0.27	2.60	
12:55	13.93	4.02	12.43	0.29	2.64	
12:56	13.94	4.18	12.22	0.27	2.67	
12:57	13.89	4.15	12.28	0.27	2.88	
12:58	13.92	4.08	12.41	0.26	2.88	
12:59	13.95	4.08	12.31	0.25	2.75	
13:00	13.94	4.10	12.17	0.26	2.78	
13:01	13.91	4.09	12.31	0.27	2.72	
13:02	13.94	4.10	12.37	0.25	2.64	
Average	13.93	4.14	12.35	0.27	2.73	

(Mr. Usamee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE: 30/01/19

ALS Laboratory Group





Airgas Specialty Gases  
Airgas USA, LLC  
6141 Easton Road  
Bldg 1  
Plumsteadville, PA 18949  
Airgas.com

## CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N189E15A0617  
Cylinder Number: EB0143265  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12020  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-401977168-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Dec 22, 2020

Expiration Date: Dec 22, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 8200R-12031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a moisture basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	160.0 PPM	158.2 PPM	G1	12/14/2020, 12/22/2020
CARBON MONOXIDE	160.0 PPM	157.3 PPM	G1	12/14/2020
NITRIC OXIDE	160.0 PPM	155.1 PPM	G1	12/14/2020, 12/22/2020
SULFUR DIOXIDE	160.0 PPM	151.6 PPM	G1	12/14/2020, 12/22/2020
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	13010210	KAL001128	243.3 PPM CARBON MONOXIDE/NITROGEN	±0.2%
NTRM	13010210	D485028	8.91 PPM ARSENITROGEN DIOXIDE	2.0%
NTRM	13010210	KAL000202	243.4 PPM NITRIC OXIDE/NITROGEN	±0.5%
GMIS	12406688	CC233707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%
NTRM	10010212	AAL072872	255.3 PPM SULFUR DIOXIDE/NITROGEN	±0.8%

ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
Nudel 6700 APV1100391 CO	FTIR	Nov 30, 2020		
Nudel 6700 APV1100391 NO	FTIR	Dec 02, 2020		
Nudel 6700 APV1100391 NO2	FTIR	Dec 02, 2020		
Nudel 6700 APV1100391 SO2	FTIR	Dec 02, 2020		

Triad Data Available Upon Request

NOTES:  
Gross Weight: 37.7 Kg  
Net Weight: 4.7 Kg



*Michael A. Huber*  
Approved for Release

Page 1 of 160-401977168-1



Airgas Specialty Gases  
Airgas USA, LLC  
6141 Easton Road  
Bldg 1  
Plumsteadville, PA 18949  
Airgas.com

## CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N189E3HA0023  
Cylinder Number: GN0024388  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12020  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-401754137-1  
Cylinder Volume: 247.2 CF  
Cylinder Pressure: 2215 PSIG  
Valve Outlet: 660  
Certification Date: Mar 26, 2020

Expiration Date: Mar 26, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 8200R-12031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a moisture basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	50.00 PPM	50.32 PPM	G1	03/19/2020, 03/26/2020
CARBON MONOXIDE	50.00 PPM	49.89 PPM	G1	03/19/2020
NITRIC OXIDE	50.00 PPM	50.32 PPM	G1	03/19/2020, 03/26/2020
SULFUR DIOXIDE	50.00 PPM	50.27 PPM	G1	03/19/2020, 03/26/2020
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	13010130	KAL004330	97.31 PPM CARBON MONOXIDE/NITROGEN	±0.4%
NTRM	13010405	KAL003584	97.80 PPM NITRIC OXIDE/NITROGEN	±0.8%
NTRM	13010405	KAL003584	97.80 PPM NO/NITROGEN	±0.8%
NTRM	13010230	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	±0.8%

ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
MKS FTIR - CO - 000928781	FTIR	Mar 12, 2020		
MKS FTIR - NO - 000928781	FTIR	Mar 05, 2020		
MKS FTIR - NOX - 000928781	FTIR	Mar 05, 2020		
MKS FTIR - SO2 - 000928781	FTIR	Mar 18, 2020		

Triad Data Available Upon Request

NOTES: Gross Weight: 47.7 Kg Net Weight: 7.5 Kg



*Michael A. Huber*  
Approved for Release

Page 1 of 160-401754137-1



Airgas Specialty Gases  
Airgas USA, LLC  
6141 Easton Road  
Plumsteadville, PA 18949  
Airgas.com

## CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE  
(THAILAND) LTD  
Part Number: E02N182E3HA0000  
Cylinder Number: GN0027004  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12022  
Gas Code: O2,BALN

Reference Number: 160-402340009-1  
Cylinder Volume: 248.4 CF  
Cylinder Pressure: 2214 PSIG  
Valve Outlet: 590  
Certification Date: Feb 10, 2022

Expiration Date: Feb 10, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 8200R-12031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a moisture basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
OXYGEN	8.000 %	8.000 %	G1	02/10/2022
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	10010635	K022176	9.907 % OXYGEN/NITROGEN	±0.3%

ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
SIEMENS OXYMAT 6 - N1-WS-951 - O2	PARAMAGNETIC	Jan 27, 2022		

Triad Data Available Upon Request

NOTES: Gross Weight: 48.3 Kg  
Net Weight: 8.1 Kg



*Michael A. Huber*  
Approved for Release

Page 1 of 160-402340009-1



Airgas Specialty Gases  
Airgas USA, LLC  
6141 Easton Road  
Bldg 1  
Plumsteadville, PA 18949  
Airgas.com

## CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02N184E16A0787  
Cylinder Number: CC740033  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12020  
Gas Code: O2,BALN

Reference Number: 160-401948145-1  
Cylinder Volume: 145.8 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Certification Date: Nov 11, 2020

Expiration Date: Nov 11, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 8200R-12031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a moisture basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
OXYGEN	16.00 %	16.06 %	G1	11/11/2020
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	18000503	CC109642	23.204 % OXYGEN/NITROGEN	±0.2%

ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
SIEMENS OXYMAT 6 - N1-WS-951 - O2	PARAMAGNETIC	Oct 26, 2020		

Triad Data Available Upon Request

NOTES:  
Gross Weight: 27.8 Kg  
Net Weight: 4.7 Kg



*Michael A. Huber*  
Approved for Release

Page 1 of 160-401948145-1

**CONSOLE CONTROL UNIT CALIBRATION TEST REPORT**

Calibration of: BKH  
Meter/ID: 131005

Calibration Date: 4 Jul 23  
Next Cal. Date: 3 Jan 24

Barometric Pressure (mmHg): 759  
Relative Humidity (%): 58.0

Reference Stopwatch Data  
Stopwatch ID No: E18061  
Model: F808  
Serial No: -  
Calibration Date: 8 Sep 20  
Certificate No: E-2009018

Console Control Meter Data  
Reference Dry Gas Meter ID: BKH\_F50485  
Serial No: 1310055  
Correction Factor: 1.0000  
Next Calibration Date: 9 Sep 23

Run No	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:11	5:00	11	0.00018
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:10	5:00	10	0.00017
10	5:00:11	5:00	11	0.00018
Average				0.00016
SD				0.00002

Calibrate by: Prasert S.  
Mr. Prasert Surakhian  
Field Scientist (3)

Approved by: S.P.  
Mr. Samart Roo-ngan  
Specialist (1)

**PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET**

Calibration Date: 4 Jul 23  
Calibration Sheet No: C-040723-BKH\_F50485

Nozzle Set ID: BKH\_F50485  
Vernier Caliper ID: RYG\_F50539

Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$
	$D_1$	$D_2$	$D_3$		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.530	0.530	0.530	0.000	0.530
4	0.635	0.635	0.635	0.000	0.635
5	0.790	0.790	0.790	0.000	0.790
6	0.950	0.950	0.950	0.000	0.950
7	1.110	1.110	1.110	0.000	1.110
8	1.270	1.270	1.270	0.000	1.270
9	1.600	1.600	1.600	0.000	1.600

Where:

$D_1, D_2, D_3$  = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

$\Delta D$  = Maximum distance between any two diameters, must be  $\leq 0.100$  mm.

$D_{avg}$  =  $(D_1 + D_2 + D_3) / 3$

MEASUREMENT PLANE

Calibrated by: Worachit  
(Mr. Worachit Teengroom)  
Field Scientist (2)

Approved by: S.P.  
(Mr. Samart Roo-ngan)  
Field Specialist (1)

**Stopwatch Calibration Test Report**

Calibration Date: 4 Jul 23  
Barometric Pressure (mmHg): 759  
Relative Humidity (%): 58.0

Next Cal. Date: 3 Jan 24  
Temperature (°C): 27.0

Reference Stopwatch Data  
Stopwatch ID No: E18061  
Model: F808  
Serial No: -  
Calibration Date: 8 Sep 20  
Certificate No: E-2009018

Console Control Meter Data  
Dry Gas Meter No: BKH\_F50485  
Model: XC-572-V  
Serial No: 1310055

Run No	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:11	5:00	11	0.00018
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:10	5:00	10	0.00017
10	5:00:11	5:00	11	0.00018
Average				0.00016
SD				0.00002

Calibrate by: Prasert S.  
Mr. Prasert Surakhian  
Field Scientist (3)

Approved by: S.P.  
Mr. Samart Roo-ngan  
Specialist (1)

**DIGITAL TEMPERATURE CALIBRATION DATA SHEET**

Calibration Date: 4 Jul 23  
Calibration sheet No: C-040723-BKH\_F50485

Ambient Temperature (°C): 30  
Relative Humidity (%): 82

Digital Temperature ID: BKH\_F50485  
Serial No: 1310055  
Model: XC-572-V

Reference Temperature ID: BKH\_FS1144  
Serial No: 20109000013  
Model: Digicon-CC-VT-MS  
Next Calibrate: 14 Aug 24

Location	Reference Temperature (°C)	Digital Temperature (°C)	Error (°C)	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	149	-1	±3	Pass
Probe	200	199	-1	±3	Pass
	250	248	-2	±3	Pass
	300	298	-2	±3	Pass
	500	498	-2	±3	Pass
	100	99	-1	±3	Pass
Oven	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
	100	100	0	±3	Pass
Filter	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
Exit	120	120	0	±3	Pass
	140	139	-1	±3	Pass
	0	1	1	±3	Pass
Meter	10	10	0	±3	Pass
	20	20	0	±3	Pass
	0	0	0	±3	Pass
AUX	25	25	0	±3	Pass
	50	50	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	0	0	0	±3	Pass

MPE (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนที่ยอมรับได้

Calibrated by: Prasert S.  
(Mr. Prasert Surakhian)  
Field Scientist (3)

Approved by: S.P.  
(Mr. Samart Roo-ngan)  
Specialist (1)

FORM NO: F 06-07 REVISION NO: 2 ISSUE DATE: 9 Feb 23





### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0489 Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0489 Cp Standard : 0.99


Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
$\bar{C}_p$				0.842	0.842

$$Cp(S) = Cp = \sqrt{\frac{\Delta P(s)}{\Delta P(s)}}$$

$$|Cp(A) - Cp(B)| \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by   
(Mr. Wiswich Tongsom)  
Field Scientist (2)

Approved by   
(Mr. Samart Rongnani)  
Specialist (1)

FORM NO. 01-001-01 (REV.01) (01/01/2023)



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0490 Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0490 Cp Standard : 0.99


Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
$\bar{C}_p$				0.842	0.842

$$Cp(S) = Cp = \sqrt{\frac{\Delta P(s)}{\Delta P(s)}}$$

$$|Cp(A) - Cp(B)| \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by   
(Mr. Wiswich Tongsom)  
Field Scientist (2)

Approved by   
(Mr. Samart Rongnani)  
Specialist (1)



FORM NO. 01-001-01 (REV.01) (01/01/2023)

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com



NSC-TIS-715 17025  
CALIBRATION 0428

SARTORIUS

REVIEW BY   
APPROVED BY   
NEXT CAL DATE 8/2/24

## Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BC10072  
Description : Analytical Balance Issued Date : Monday, February 13, 2023  
Serial Number : 26207042 Reference No. : 203245  
ID No. : BKK\_EN0002  
Manufacturer : Sartorius Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40 Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Calibrated Place : Balance Room

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, February 08, 2023

Metrological data : Capacity : 220 g Readability : 0.0001 g  
Ambients Conditions : Temperature : 23.2 °C ± 5.0 °C  
Humidity : 60.0 % RH ± 10.0 % RH  
Pressure : ±

Reasons for calibration : ☐ New Installation ☐ Service / Required ☒ Re-calibration/ Maintenance  
Equipment Condition : ☒ Good Operate ☐ Fail

Measurement Method : UKAS Publication Ref: Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

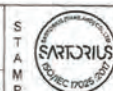
### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC8011-522-02	Sartorius weight set 1mg - 5000g E2 YC8011-522-02	SPC-RT	C02212566	14-Sep-2023
MH3-352SD	Humidity/Balometer/Temp. Luton MH3-352SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

SOP FM 33 03 February 2022

Mr. Chonchai Inthana (Technical Manager)



Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-6 Fax: +66 2643-8307, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BC10072  
Description : Analytical Balance Issued Date : Monday, February 13, 2023  
Serial Number : 26207042 Reference No. : 203245  
ID No. : BKK\_EN0002  
Manufacturer : Sartorius Page No. : 2 of 2

### Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant load conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to assess repeatability quantitatively.			The off-center loading error is yielded by the difference between the reading of the load, i.e. 102 or 104 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value (Low Load)	20 g	20.0000	Nominal value	50 g	9
Tolerance	0.0001 g	20.0000	Tolerance	0.0004 g	9
Nominal Value (High Load)	200 g	200.0000	Difference		
Tolerance	0.0001 g	200.0000	1	-	
Standard Deviation	0.00004	0.00005	2	-0.0001	
			3	0.0000	
			4	0.0001	
			5	0.0000	
			6	-	

### Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00013
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report

SOP FM 33 03 February 2022



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23006  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178119  
ID No. : BKK\_FS0632

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 06 JANUARY 2023  
Calibration Date : 17 JANUARY 2023  
Date of Issue : 19 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchur )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

# SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23006  
Job No. : VC66AC0024  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V74HB6069	EF-0010-22	07-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

*T. Petchur*

# SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23006  
Job No. : VC66AC0024  
Pages : 3 of 3

### Result of calibration :

#### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.93	-0.07	0.14	0.40

#### 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit (Hz)
1000	1001.0	0.1	0.1	1.0

#### 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.71	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

*T. Petchur*

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23173  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00658244 / 158766 / 58768  
ID No. : BKK\_FS0101

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 29 MAY 2023  
Calibration Date : 29-30 MAY 2023  
Date of Issue : 31 MAY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchur )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter,  
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.3
Flat	24.2

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.4	-0.3	-0.3	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Petchum

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchum

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 8 of 8

## 11. Overload Indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchum

451-451/1 Sirinthon Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23237  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00658243 / 157783 / 48098  
ID No.: BKK FS0100

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 06 JULY 2023  
Calibration Date : 17-18 JULY 2023  
Date of Issue : 19 JULY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchum  
( Thanakul Petchum )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53230104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60034273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAL	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.4

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	13.1
C-weight	19.0
Flat	24.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.7	-1.6	-1.6	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.2
C-weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	± 1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 3.0
One	136.4	135.9	-0.5	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 2.0
Positive half cycle	135.4	135.1	-0.3	± 2.0
Negative half cycle	135.4	135.1	-0.3	± 2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23237  
Job No. : VC66AC0072  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	-0.1	± 1.5
89.7	89.6		

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	± 0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23005  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858525 / 170383 / 72889  
ID No.: BKK FS0115

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUWAENG PHATTHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisarn

Approved by : T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

7. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

7. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.5

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.4
Flat	25.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.7	-1.6	-1.6	± 5.0

QF-TS12-04-04-020664

7. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

7. Rth

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5; -5.0
	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23005  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k=2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comNSC-TS12-TS 17025  
CALIBRATION 0304Cert. No. : ACL23056  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone U/C-52 / Preamplifier NH-24  
Serial No.: 00858518 / 158769 / 58770  
ID No.: BKK\_FSD108

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUWAENG PHATTHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 17 JANUARY 2023  
Calibration Date : 19-20 JANUARY 2023  
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaissan

Approved by : T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
17.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	14.8
C - weight	20.8
Flat	26.6

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.8	-0.7	-0.7	± 5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23056  
Job No. : VC66AC0026  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23251  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52/ Preamplifier NH-24  
Serial No.: 00858516 / 158777 / 58778  
ID No.: BKK\_FS0106

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 01 NOVEMBER 2022  
Calibration Date : 02-03 NOVEMBER 2022  
Date of Issue : 04 NOVEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Retin

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Retin

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.6
Flat	22.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.8	0.8	0.8	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.6	-2.5	-2.5	±5.0

QF-TS12-04-04-020664

T. Retin

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	-0.1	±1.5
250	-0.1	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Retin

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangumru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23006  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858526 / 175176 / 85721  
ID No.: BKK\_FS0116

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Nishakorn Pisutpaisan

Approved by : T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/02/65	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/02/65	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/02/65	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.4

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.9
Flat	25.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.3	1.4	1.3	± 5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	± 1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Cpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	± 2.0
Negative half cycle	135.4	135.2	-0.2	± 2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	± 1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	± 0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Srinthorn Rd., Bangumru, Bangalud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23255  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00658241 / 158767 / 58769  
ID No. : BKK\_FS0098

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 25 JULY 2023  
Calibration Date : 14-15 AUGUST 2023  
Date of Issue : 22 AUGUST 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024773	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

7 B.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter,

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

7 B.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.9

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.2
Flat	23.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.1	-1.0	-1.0	± 5.0

QF-TS12-04-04-020664

7 B.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

7 B.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	± 1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 3.0
One	136.4	135.6	-0.8	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 2.0
Positive half cycle	135.4	135.1	-0.3	± 2.0
Negative half cycle	135.4	135.1	-0.3	± 2.0

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## Continuation of Calibration Certificate

Cert. No. : ACL23255  
Job No. : VC66AC0089  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	± 1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	± 0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

451-451/1 Sindhorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC23014  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178117  
ID No. : BKK\_FS0630

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 22 MAY 2023  
Calibration Date : 24 MAY 2023  
Date of Issue : 25 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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## Continuation of Calibration Certificate

Cert. No. : ACC23014  
Job No. : VC66AC0059  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained as :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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## Continuation of Calibration Certificate

Cert. No. : ACC23014  
Job No. : VC66AC0059  
Pages : 3 of 3

## Result of calibration :

## 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.16	0.16	0.14	0.40

## 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.7	0.2	0.1	1.0

## 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.69	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Srinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22302  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858521 / 158765 / 58767  
ID No. : BKK\_FS0111

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 07 DECEMBER 2022  
Calibration Date : 16-20 DECEMBER 2022  
Date of Issue : 21 DECEMBER 2022

Calibrated by : Nuthakorn Pisutpaisan

Approved by :

( Thanakul Petchumai )

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## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained as :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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T. R. R. R.

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	18.1
Flat	23.8

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.4	±1.5
1000	0.1	0.0	0.0	±1.0
8000	-1.9	-1.8	-1.8	±5.0

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T. R. R. R.

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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T. R. R. R.

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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T. R. R. R.



Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.7	89.7		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND  
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Cert. No. : ACL22233  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00672737 / 158772 / 58773  
ID No. : BKK\_FS0927

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 03 OCTOBER 2022  
Calibration Date : 18-19 OCTOBER 2022  
Date of Issue : 20 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchur )

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ASSOCIATES CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.5

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
Flat	22.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.6	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Retan

## Continuation of Calibration Certificate

Cert. No. : ACL22233  
Job No. : VC65AC0088  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Retan

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23003  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No.: 00858519 / 158770 / 58771  
ID No.: BKK FS0109

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Natthakorn Pisutpaisan

Approved by :

T. Retan  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Retan

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.1

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.6
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.1	-1.0	-1.0	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.1	0.1	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23003  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirintherm Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23002  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00572566 / 142140 / 22309  
ID No. : BKK\_FS0875

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Nattakorn Pisutpaisan

Approved by :

( Thanakul Peichurui )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 3 of 8

## Summary of Measurement Result:

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

S. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.4

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.4
Flat	25.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.8	-1.8	-1.7	±5.0

QF-TS12-04-04-020664

S. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.2	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

S. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

*T. Petchurai*

Continuation of Calibration Certificate

Cert. No. : ACL23002  
Job No. : VC66AC0021  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

*T. Petchurai*

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22276  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00572563 / 170399 / 72900  
ID No. : BRK\_FS0879

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 NOVEMBER 2022  
Calibration Date : 21 NOVEMBER 2022  
Date of Issue : 24 NOVEMBER 2022

Calibrated by : Nathakorn Pisutpaian

Approved by : *T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD.  
ASSOCIATES CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

*T. Petchurai*

## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.2

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-2.2	-2.2	-2.2	±5.0

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

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T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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T. Petchu-

## Continuation of Calibration Certificate

Cert. No. : ACL22276  
Job No. : VC66AC0011  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.7	89.7		

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k=2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchu-

SITHIPORN ASSOCIATES CO.,LTD.  
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CALIBRATION 0994  
Cert. No. : ACL22232  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00584982 / 157781 / 48096  
ID No. : BKK\_FS0925

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN RD.,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 03 OCTOBER 2022  
Calibration Date : 18-19 OCTOBER 2022  
Date of Issue : 20 OCTOBER 2022

Calibrated by : Natchorn Pisutpaisan

Approved by :

T. Petchu-  
( Thanakul Petchurui )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests in Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchu-

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
17.3

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.0
Flat	24.7

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.5	-0.4	-0.4	± 5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22232  
Job No. : VC65AC0088  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23004  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RJON  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00858520 / 158771 / 58772  
ID No. : BKK FS0110

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUAEANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Nathakorn Pisutpansan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY4801 7076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.1

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.5
C - weight	18.8
Flat	24.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.4	±5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch.



## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	126.4	135.3	-8.9	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.6	89.7		

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd.,Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22245  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00572609 / 170133 / 72947  
ID No.: BKK\_FS0924

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN RD.,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 11 OCTOBER 2022  
Calibration Date : 25-26 OCTOBER 2022  
Date of Issue : 27 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC66AC0090  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_05/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

1. National Institute of Metrology (Thailand).
2. Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.1

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	± 5.0

QF-TS12-04-04-020664

T. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Peth.



## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighing	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22245  
Job No. : VC65AC0090  
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## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	-0.1	±1.5
89.6	89.5		

## 12. High level stability

Frequency	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664



## Certificate of Calibration

Customer: AULS Laboratory Group Thailand Co., Ltd.  
Name: AULS Laboratory Group Thailand Co., Ltd.  
Address: 104 Soi Phatthanasak 40, Phatthanasak Road, Nua 1 Sang, Bangkok 10250  
Certificate No.: 23-SLM-091  
Request No.: Req-2023-0917

## 1. Under Calibration Details

Measurement Item: Sound Level Meter  
Manufacturer: RION  
Model: NI-42  
Serial Number: 00710844  
ID: BKK\_F50025  
Resolution: 0.1 dB  
Microphone Class: 2  
Microphone Model: UC-52  
Microphone S/N: 157228  
Preamplifier Model: NH-24  
Preamplifier S/N: 10645  
Instrument Status: Check

## Calibrating Environment and Details

Temperature: 23 °C ± 2 °C  
Humidity: 50 % RH ± 20 % RH  
Barometric Pressure: 1013.3 hPa ± 10 hPa  
Received Date: 1 March 2023  
Calibrated Date: 14 March 2023  
Calibration Procedure: In-house method CP-SLM-01 based on IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration: Lab-Acoustic

## Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	108273	6 October 2023	GRAS
Multi-frequency Calibrator	Quest	Quest-01	07A000254	29 June 2023	ITS
Audio Generator	Swank	Swan01	131	12 October 2023	W3, Electric

Note:  
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k = 2$ , providing a level of confidence approximately 95 %.

Calibrated By:   
Mr. Nopadon Laungnit  
Calibration Officer

Approved By:   
Mr. Pachi Mallavorn  
Calibration Engineer/Supervisor  
Issue Date: 14 March 2023



Certificate No.: 23-SLM-091  
Request No.: Req-2023-0917

## 1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST A 30-130							
Calibrator Setting	113.79	113.9	-0.11	113.8	-0.01	0.20	0.3

Note: Absolute sensitivity was established by the use of Sound Calibrator brand SVANTEK, Model SV 35A, SN: 28079

## 2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 30-130		
UUC Weighting		
A	14.9	0.10

## 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 30-130		
UUC Weighting		
A	11.7	0.10
C	16.1	0.10
Z	20.6	0.10

## 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST 30-130					
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.4	0.5	0.5	0.50	1.5
1000 Hz	0.0	0.0	0.0	0.60	3.0
4000 Hz	-1.1	-1.1	-1.1	0.60	3.0
8000 Hz	-1.8	-1.7	-1.8	0.70	3.0

Certificate No: 23-SLM-091  
Request No: Req-2023-0317

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit
FAST / 20-130	Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)
63 Hz	-0.2	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	-0.1		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.3
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5
16000 Hz	-1.4	-1.4	0.0		~5, (N)

6. Frequency and time weightings at 1kHz

UVC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / 30-130	REF	UVC	ERR		
UVC Weighting	(dB)	(dB)	(dB)	0.2	0.2
A	114.00	114.0	0.0		
C	114.00	114.0	0.0		
Z	114.00	114.0	0.0		
UVC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
30-130 / A	REF	UVC	ERR		
UVC Time Response	(dB)	(dB)	(dB)	0.2	0.1
Fast	114.00	114.0	0.0		
Slow	114.00	114.0	0.0		
Leq	114.00	114.0	0.0		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No: 23-SLM-091  
Request No: Req-2023-0317

7. Long Term Stability

UVC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 30-130	UVC		
STD Setting	(dB)	0.1	0.3
Initial	114.0		
Final	114.0		
Deviation	0.0		

8. Level linearity on the reference level range

UVC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 30-130	REF	UVC	ERR		
STD dB	(dB)	(dB)	(dB)	0.3	1.1
130.00	130	130.0	0.0		
129.00	129	129.0	0.0		
128.00	128	128.0	0.0		
127.00	127	127.0	0.0		
126.00	126	126.0	0.0		
125.00	125	125.0	0.0		
124.00	124	124.0	0.0		
123.00	123	123.0	0.0		
122.00	122	122.0	0.0		
121.00	121	121.0	0.0		
120.00	120	120.0	0.0		
119.00	119	119.0	0.0		
118.00	118	118.0	0.0		
117.00	117	117.0	0.0		
116.00	116	116.0	0.0		
115.00	115	115.0	0.0		
114.00	114	114.0	0.0		
113.00	113	113.0	0.0		
112.00	112	112.0	0.0		
111.00	111	111.0	0.0		
110.00	110	110.0	0.0		
109.00	109	109.0	0.0		
108.00	108	108.0	0.0		
107.00	107	107.0	0.0		
106.00	106	106.0	0.0		
105.00	105	105.0	0.0		
104.00	104	104.0	0.0		
103.00	103	103.0	0.0		
102.00	102	102.0	0.0		
101.00	101	101.0	0.0		
100.00	100	100.0	0.0		
99.00	99	99.0	0.0		
98.00	98	98.0	0.0		
97.00	97	97.0	0.0		
96.00	96	96.0	0.0		
95.00	95	95.0	0.0		
94.00	94	94.0	0.0		
93.00	93	93.0	0.0		
92.00	92	92.0	0.0		
91.00	91	91.0	0.0		
90.00	90	90.0	0.0		
89.00	89	89.0	0.0		
88.00	88	88.0	0.0		
87.00	87	87.0	0.0		
86.00	86	86.0	0.0		
85.00	85	85.0	0.0		
84.00	84	84.0	0.0		
83.00	83	83.0	0.0		
82.00	82	82.0	0.0		
81.00	81	81.0	0.0		
80.00	80	80.0	0.0		
79.00	79	79.0	0.0		
78.00	78	78.0	0.0		
77.00	77	77.0	0.0		
76.00	76	76.0	0.0		
75.00	75	75.0	0.0		
74.00	74	74.0	0.0		
73.00	73	73.0	0.0		
72.00	72	72.0	0.0		
71.00	71	71.0	0.0		
70.00	70	70.0	0.0		
69.00	69	69.0	0.0		
68.00	68	68.0	0.0		
67.00	67	67.0	0.0		
66.00	66	66.0	0.0		
65.00	65	65.0	0.0		
64.00	64	64.0	0.0		
63.00	63	63.0	0.0		
62.00	62	62.0	0.0		
61.00	61	61.0	0.0		
60.00	60	60.0	0.0		
59.00	59	59.0	0.0		
58.00	58	58.0	0.0		
57.00	57	57.0	0.0		
56.00	56	56.0	0.0		
55.00	55	55.0	0.0		
54.00	54	54.0	0.0		
53.00	53	53.0	0.0		
52.00	52	52.0	0.0		
51.00	51	51.0	0.0		
50.00	50	50.0	0.0		
49.00	49	49.0	0.0		
48.00	48	48.0	0.0		
47.00	47	47.0	0.0		
46.00	46	46.0	0.0		
45.00	45	45.0	0.0		
44.00	44	44.0	0.0		
43.00	43	43.0	0.0		
42.00	42	42.0	0.0		
41.00	41	41.0	0.0		
40.00	40	40.0	0.0		
39.00	39	39.0	0.0		
38.00	38	38.0	0.0		
37.00	37	37.0	0.0		
36.00	36	36.0	0.0		
35.00	35	35.0	0.0		
34.00	34	34.0	0.0		
33.00	33	33.0	0.0		
32.00	32	32.0	0.0		
31.00	31	31.0	0.0		
30.00	30	30.0	0.0		
29.00	29	29.0	0.0		
28.00	28	28.0	0.0		
27.00	27	27.0	0.0		
26.00	26	26.0	0.0		
25.00	25	25.0	0.0		
24.00	24	24.0	0.0		
23.00	23	23.0	0.0		
22.00	22	22.0	0.0		
21.00	21	21.0	0.0		
20.00	20	20.0	0.0		
19.00	19	19.0	0.0		
18.00	18	18.0	0.0		
17.00	17	17.0	0.0		
16.00	16	16.0	0.0		
15.00	15	15.0	0.0		
14.00	14	14.0	0.0		
13.00	13	13.0	0.0		
12.00	12	12.0	0.0		
11.00	11	11.0	0.0		
10.00	10	10.0	0.0		
9.00	9	9.0	0.0		
8.00	8	8.0	0.0		
7.00	7	7.0	0.0		
6.00	6	6.0	0.0		
5.00	5	5.0	0.0		
4.00	4	4.0	0.0		
3.00	3	3.0	0.0		
2.00	2	2.0	0.0		
1.00	1	1.0	0.0		
0.00	0	0.0	0.0		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSI-706-SLM-01 Rev.0 Issue date 01/07/19

Certificate No: 23-SLM-091  
Request No: Req-2023-0317

12. Overload indication

UVC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 30-130	UVC		
STD Setting	(dB)	0.2	1.5
Positive one-half cycle	139.5		
Negative one-half cycle	139.5		
Deviation	-0.2		

13. High Level Stability

UVC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 30-130	UVC		
STD Setting	(dB)	0.1	0.3
Initial	129.0		
Final	129.0		
Deviation	0.0		

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSI-706-SLM-01 Rev.0 Issue date 01/07/19

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No.: ACL23192  
Pages : 1 of 8

### Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00710641 / 136960 / 10642  
ID No.: BKK\_FS0025

Condition As Found : GOOD



## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter.

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QI-TS12-04-04-020064

## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
22.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	16.1
C - weight	22.5
Flat	28.0

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.8	-0.8	± 5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL23192  
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Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QI-TS12-04-04-020064

## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23192  
Job No. : VC66AC0066  
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## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k=2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthon Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23194  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01022262 / 180410 / 25310  
ID No. : BKK FS0031

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 15 JUNE 2023  
Calibration Date : 20-22 JUNE 2023  
Date of Issue : 23 JUNE 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :   
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560485	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter,  
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

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## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
21.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	19.4
C - weight	26.8
Flat	31.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.9	-0.9	-0.9	±5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.1	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.1	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QH-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QH-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23194  
Job No. : VC66AC0066  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k=2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QH-TS12-04-04-020664

T. Petch

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23055  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00672789 / 170666 / 73129  
ID No.: BKK\_FS0929

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUWAENG PHATTHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 17 JANUARY 2023  
Calibration Date : 19-20 JANUARY 2023  
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Petch  
( Thanakul Petchurai )

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QH-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Reth

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Reth

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.5

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.1	-0.1	± 5.0

QF-TS12-04-04-020664

T. Reth

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.1	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

T. Reth

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23055  
Job No. : VC66AC0026  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

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Tel:0-2435-8800 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23006  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No.: 00858526 / 175176 / 85721  
ID No.: BKK\_FS0116

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by :

Naihakorn Pisutpeisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_03/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	23-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.9
Flat	25.5

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.3	1.4	1.3	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.1	0.1	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23006  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

## 12. High level stability

Frequency Weighing	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthon Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23059  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01022261 / 180399 / S8169  
ID No. : BKK\_FS0030

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUWAENG PHATTHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 17 JANUARY 2023  
Calibration Date : 19-20 JANUARY 2023  
Date of Issue : 23 JANUARY 2023



Calibrated by : Nathakorn Pisuraisan

Approved by : T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.7

## 2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.6

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Retch

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Retch

## Continuation of Calibration Certificate

Cert. No. : ACL23059  
Job No. : VC66AC0026  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Retch

451-451/1 Sirinhor Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23265  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01022263 / 136951 / 22311  
ID No. : BKK FS0032

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,  
KHAENG PIATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 23 AUGUST 2023  
Calibration Date : 01 SEPTEMBER 2023  
Date of Issue : 04 SEPTEMBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Retch  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.7

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.6
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-1.9	-1.8	-1.8	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23265  
Job No. : VC66AC0094  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k=2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23193  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00710645 / 136966 / 10646  
ID No. : BKK FS0029

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 15 JUNE 2023  
Calibration Date : 20-22 JUNE 2023  
Date of Issue : 23 JUNE 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QH-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter,

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QH-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	19.5
Flat	24.9

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at ± level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.1	-0.1	± 5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.1	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

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## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

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S. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23193  
Job No. : VC66AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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S. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23193  
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Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

S. Petch.

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-040-66  
Page 1 of 2Equipment Name: Heat Stress Monitor  
Manufacturer: Delta DHM  
Model: HD32.2  
Serial No: 15006710  
ID No: BKH\_F0672Customer  
Name: A/S laboratory group (thailand) Co., Ltd.  
Address: 104 Phantanasikan 40, Phantanasikan Rd.,  
Phraeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.Received date: 15 Feb 2023  
Calibration date: 22 Feb 2023  
Issue date: 23 Feb 2023Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500.  
Serial No: 667662-09. Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK II.  
Serial No: 671407-00591 Due date: 22 July 2023Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0034-22. Certificate number: ER-0092-22Calibrated by  
□ Mr. Sorpen Thachalad  
□ Miss Jitraporn LertsompholApproved Signatory:   
Mr. Parinye Booncharoen  
Calibration Department Manager



63/14-15,67/35-36, Soi Petchkasem 7/1, Petchkasem Rd, Walthapra, Bangkok, Bangkok 10600 Thailand. Tel: (66) 02-8608012 Fax: (66) 02-8608060 www.jranatee.com

Certificate No.: CL-040-66 Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function: Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15015852. Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.065	20.0	-0.1	0.099
60	25.060	25.0	-0.1	0.099
80	30.053	30.0	-0.1	0.099
60	35.047	35.0	0.0	0.099
60	40.044	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14036714. Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.065	20.1	0.0	0.099
70	25.061	24.9	-0.2	0.099
70	30.053	29.8	-0.3	0.099
70	35.047	34.7	-0.3	0.099
70	40.043	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021832. Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.065	20.1	0.0	0.099
110	25.060	25.1	0.0	0.099
110	30.053	30.1	0.0	0.099
110	35.047	35.1	0.1	0.099
110	40.043	40.1	0.1	0.099

UUC\* : Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★

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Certificate No.: CDT-030-66 Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15006318  
ID No: BKK\_F50668

Customer: Name: AIS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 11 Jul 2023  
Calibration date: 15 Jul 2023  
Issue date: 18 Jul 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS 100 A500, Serial No. 667682-09, Due date: 26 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0092-22

Notes: The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by: ☐ Mr. Sorawit Thachalad  
☒ Miss Jittaporn Lertsomphol  
☐ Miss Ruangnumjai Poommool

Approved Signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CDT-030-66 Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function: Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15017685. Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.060	20.0	-0.1	0.099
80	25.054	25.0	-0.1	0.099
80	30.050	30.0	0.0	0.099
80	35.043	35.0	0.0	0.099
80	40.036	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015968. Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.0	-0.1	0.099
110	25.056	25.0	-0.1	0.099
110	30.050	30.0	-0.1	0.099
110	35.043	35.0	0.0	0.099
110	40.036	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015495. Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.060	20.4	0.3	0.099
75	25.056	25.2	0.1	0.099
75	30.050	30.1	0.1	0.099
75	35.043	35.0	0.0	0.099
75	40.036	39.9	-0.1	0.099

UUC\* : Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★

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Certificate No.: CDT-059-66 Page 1 of 2

MEASUREMENT ITEM: Heat Stress Monitor  
MANUFACTURER: Delta OHM  
MODEL/TYPE: HD32.2  
SERIAL NUMBER: 17020558  
ID NUMBER: BKK\_F50653  
CONDITION AS-RECEIVED  
CUSTOMER: AIS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE: 20 Dec 2023  
MEASUREMENT DATE: 20 Dec 2023  
ISSUE DATE: 20 Dec 2023

ENVIRONMENTAL CONDITIONS:  
Ambient condition in the laboratory are as follow:  
Temperature: 23.0 ± 3.0 °C  
Relative Humidity: 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:  
The table on next page give the measured values.

Calibration procedure:  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

Reference Used During Calibration:  
1. Standard Temperature Probe Model: STS 100 A500, Serial No: 667682-09, Due date: 26 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:  
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data Guide to the expression of uncertainty in measurement

Calibrated by: ☐ Mr. Sorawit Thachalad  
☒ Miss Jittaporn Lertsomphol  
☐ Miss Ruangnumjai Poommool

Approved Signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13035020.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.056	20.2	0.1	0.099
80	25.048	25.2	0.2	0.099
80	30.044	30.2	0.2	0.099
80	35.038	35.2	0.2	0.099
80	40.038	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13044156.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.2	0.1	0.099
110	25.048	25.2	0.2	0.099
110	30.044	30.2	0.2	0.099
110	35.038	35.2	0.1	0.16
110	40.038	40.2	0.1	0.16

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13044778.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.056	19.7	-0.4	0.099
75	25.048	24.6	-0.4	0.099
75	30.044	29.6	-0.4	0.099
75	35.038	34.6	-0.4	0.099
75	40.038	39.6	-0.4	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.21 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



**CERTIFICATE OF CALIBRATION**

Certificate No.: CL-065-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15036012  
ID No: BKH\_FSO673

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanasak 40, Phatthanasak Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 May 2023  
Calibration date: 15 May 2023  
Issue date: 15 May 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 667682-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0038-23. Certificate number: ER-0092-  
22

Noted: The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol

Approved Signatory:

Mr. Pannya Booncharoen  
Calibration Department Manager



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OBTAINED BY WRITING FROM THE LABORATORY.

Certificate No.: CL-065-66  
Page: 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13035040.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	19.997	19.9	-0.1	0.099
80	25.000	24.9	-0.1	0.099
80	30.004	29.9	-0.1	0.099
80	35.004	34.9	-0.1	0.099
80	40.003	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008276.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	19.998	19.9	-0.1	0.099
110	25.000	25.0	0.0	0.099
110	30.004	30.0	0.0	0.099
110	35.005	35.1	0.1	0.099
110	40.003	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16009354.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	19.997	20.1	0.1	0.099
75	25.001	24.9	-0.1	0.099
75	30.004	29.8	-0.2	0.099
75	35.005	34.8	-0.2	0.099
75	40.003	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



**CERTIFICATE OF CALIBRATION**

Certificate No.: CDT-031-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15006698  
ID No: BKH\_FSO669

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanasak 40, Phatthanasak Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 Jul 2023  
Calibration date: 18 Jul 2023  
Issue date: 18 Jul 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 667682-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House  
calibration method as WI-CL-001 according to  
comparison method with standard digital temperature  
indicator and standard temperature probe. The  
temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0038-23. Certificate number: ER-0092-  
22

Noted: The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangsri Phoomnil

Approved Signatory:

Mr. Pannya Booncharoen  
Calibration Department Manager



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Certificate No.: CDT-031-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15015840.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.044	20.2	0.2	0.099
80	25.057	25.2	0.1	0.099
80	30.046	30.2	0.2	0.099
80	35.043	35.2	0.2	0.099
80	40.041	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22035485.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.045	20.1	0.1	0.099
110	25.056	25.2	0.1	0.099
110	30.046	30.2	0.2	0.099
110	35.043	35.2	0.2	0.099
110	40.041	40.2	0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015490.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.045	20.3	0.3	0.099
75	25.057	25.2	0.1	0.099
75	30.046	30.2	0.2	0.099
75	35.043	35.1	0.1	0.099
75	40.041	40.1	0.1	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Certificate No.: CDT-028-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor

Manufacturer: Delta OHM

Model: HD32.2

Serial No: 15002056

ID No: BKH\_FS0658

Customer

Name: ALS laboratory group (Thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 Jul 2023  
Calibration date: 17 Jul 2023  
Issue date: 18 Jul 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 657852-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: (23±3)°C  
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0092-22

Noted: The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by

☐ Mr. Sorawit Thachalad  
☒ Miss Jitrasorn Lertsomphol  
☐ Miss Ruangrumpal Phoommit



Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CDT-028-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15006957.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	19.9	-0.2	0.099
80	25.052	24.9	-0.2	0.099
80	30.045	29.9	-0.1	0.099
80	35.038	34.9	-0.1	0.099
80	40.031	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18009534.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.055	19.9	-0.2	0.099
110	25.051	24.9	-0.2	0.099
110	30.046	29.9	-0.1	0.099
110	35.038	34.9	-0.1	0.099
110	40.031	39.9	-0.1	0.099

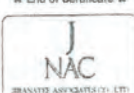
Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15003274.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.055	20.1	0.0	0.099
75	25.052	25.0	-0.1	0.099
75	30.046	29.9	-0.1	0.099
75	35.038	34.8	-0.2	0.099
75	40.031	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-064-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor

Manufacturer: Delta OHM

Model: HD32.2

Serial No: 15006302

ID No: BKH\_FS0653

Customer

Name: ALS laboratory group (Thailand) Co., Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 May 2023  
Calibration date: 15 May 2023  
Issue date: 15 May 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 657852-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: (23±3)°C  
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0092-22

Noted: The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by

☐ Mr. Sorawit Thachalad  
☒ Miss Jitrasorn Lertsomphol



Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CL-054-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20 - 40 °C  
Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22035259.  
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.001	19.9	-0.1	0.099
80	25.000	24.9	-0.1	0.099
80	30.003	30.0	0.0	0.099
80	35.000	35.0	0.0	0.099
80	40.004	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20032620.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.001	20.1	0.1	0.099
110	25.000	25.1	0.1	0.099
110	30.003	30.1	0.1	0.099
110	35.000	35.1	0.1	0.099
110	40.004	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15008018.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.001	20.2	0.2	0.099
75	25.000	25.0	0.0	0.099
75	30.004	29.9	-0.1	0.099
75	35.000	34.9	-0.1	0.099
75	40.003	39.8	-0.2	0.099

UUC\* : Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



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Walthapa, Bangkok, Bangkok 10600 Thailand.  
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## CERTIFICATE OF CALIBRATION

Certificate No.: CD1-030-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15006318  
ID No: BKK\_FS0668

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanasak 40, Phatthanasak Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 Jul 2023  
Calibration date: 16 Jul 2023  
Issue date: 18 Jul 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500.  
Serial No. 667682-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II  
Serial No. 671407-00591 Due date: 22 July 2023

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23. Certificate number: ER-0092-22

Noted: This certificate is valid only to the item calibrated on date and place of calibration.

REVIEW BY: *Maniam P*  
APPROVED BY: *hct*  
DATE: 18/7/24  
Signature: *hct*

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangsungjai Pradomlil



Approved Signatory: *Maniam P*  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CD1-030-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20 - 40 °C  
Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15017685.  
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.060	20.0	-0.1	0.099
80	25.054	25.0	-0.1	0.099
80	30.050	30.0	0.0	0.099
80	35.043	35.0	0.0	0.099
80	40.036	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015968.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.0	-0.1	0.099
110	25.055	25.0	-0.1	0.099
110	30.050	30.0	-0.1	0.099
110	35.043	35.0	0.0	0.099
110	40.036	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015495.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.060	20.4	0.3	0.099
75	25.055	25.2	0.1	0.099
75	30.050	30.1	0.1	0.099
75	35.043	35.0	0.0	0.099
75	40.036	39.9	-0.1	0.099

UUC\* : Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-062-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15002053  
ID No: BKK\_FS0657

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanasak 40, Phatthanasak Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 11 May 2023  
Calibration date: 15 May 2023  
Issue date: 15 May 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500.  
Serial No. 667682-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II  
Serial No. 671407-00591 Due date: 22 July 2023

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23. Certificate number: ER-0092-22

Noted: This certificate is valid only to the item calibrated on date and place of calibration.

REVIEW BY: *Maniam P*  
APPROVED BY: *hct*  
DATE: 16/5/24  
Signature: *hct*

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory: *Maniam P*  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No.: CL-062-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15003262.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.000	20.0	0.0	0.099
80	25.004	25.0	0.0	0.099
80	30.000	30.0	0.0	0.099
80	35.001	35.0	0.0	0.099
80	39.999	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 14039050.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.000	20.0	0.0	0.099
110	25.004	25.0	0.0	0.099
110	30.000	30.0	0.0	0.099
110	35.001	35.0	0.0	0.099
110	39.999	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15008019.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.000	20.2	0.2	0.099
75	25.004	25.1	0.1	0.099
75	30.000	30.1	0.1	0.099
75	35.002	35.2	0.2	0.099
75	39.999	40.2	0.2	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-058-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta DHM  
Model: HD32.2  
Serial No: 15036132  
ID No: BKK\_FS0680

Customer  
Name: ALS laboratory group (thailand) Co., Ltd.  
Address: 104 Phatthanasri Rd.,  
Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Received date: 03 Mar 2023  
Calibration date: 07 Apr 2023  
Issue date: 07 Apr 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500.  
Serial No: 667662-09. Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II. Serial No: 671407-00591. Due date: 22 July 2023

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (65±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TI-0038-23. Certificate number: ER-0092-22

Calibrated by  
☐ Mr. Soran Thachalad  
☒ Miss Jiraporn Lertsophon



Approved Signatory:   
Mr. Pannya Boonchairoon  
Calibration Department Manager

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Certificate No.: CL-058-66  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15015846.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.068	20.1	0.0	0.099
60	25.060	25.1	0.0	0.099
60	30.050	30.1	0.1	0.099
60	35.041	35.1	0.1	0.099
60	40.046	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015972.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.068	20.0	-0.1	0.099
110	25.060	25.0	-0.1	0.099
110	30.050	30.0	-0.1	0.099
110	35.041	35.0	0.0	0.099
110	40.046	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14032362.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.068	20.2	0.1	0.099
70	25.060	25.1	0.0	0.099
70	30.050	29.9	-0.1	0.099
70	35.042	34.8	-0.2	0.099
70	40.046	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.



## ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	03 Jul 23	Y = 1.2484x - 0.6741	0.9931
BKK_FS0579	03 Jul 23	Y = 1.0997x - 0.4918	1.0000
BKK_FS0583	01 Jul 23	Y = 1.0068x + 1.6459	0.9998
BKK_FS0584	01 Jul 23	Y = 0.9804x + 9.469	0.9999
BKK_FS0585	07 Jul 23	Y = 1.0248x + 0.8333	0.9996
BKK_FS0586	01 Jul 23	Y = 0.9907x + 11.074	1.0000
BKK_FS0587	07 Jul 23	Y = 0.986x + 17.77	0.9993
BKK_FS0588	01 Jul 23	Y = 0.9751x + 9.8452	0.9999
BKK_FS0589	03 Jul 23	Y = 1.0174x + 0.0381	1.0000
BKK_FS0590	01 Jul 23	Y = 1.0127x - 3.4333	1.0000
BKK_FS0591	03 Jul 23	Y = 1.0452x - 51.824	0.9998
BKK_FS0592	07 Jul 23	Y = 1.0003x + 14.344	1.0000
BKK_FS0593	01 Jul 23	Y = 1.0386x - 41.415	0.9997
BKK_FS0594	07 Jul 23	Y = 1.0025x + 6.32	0.9999
BKK_FS0595	01 Jul 23	Y = 1.0871x - 114.97	0.9985
BKK_FS0596	03 Jul 23	Y = 1.038x - 51.974	0.9993
BKK_FS0597	01 Jul 23	Y = 1.0059x - 9.9086	1.0000
BKK_FS1004	01 Jul 23	Y = 1.0186x + 6.731	0.9998
BKK_FS1005	01 Jul 23	Y = 0.9922x + 13.993	0.9970
BKK_FS1006	01 Jul 23	Y = 1.1747x - 3.1235	0.9991
BKK_FS1007	07 Jul 23	Y = 1.0737x + 0.8677	0.9997
BKK_FS1008	07 Jul 23	Y = 1.0446x + 1.2156	0.9999
BKK_FS1009	01 Jul 23	Y = 1.1044x - 0.8245	1.0000
BKK_FS1010	03 Jul 23	Y = 1.2271x - 2.0139	1.0000
BKK_FS1011	03 Jul 23	Y = 1.261x - 1.7003	1.0000
BKK_FS1012	03 Jul 23	Y = 0.9978x - 3.7238	0.9990
BKK_FS1013	03 Jul 23	Y = 1.0245x - 28.65	0.9999
BKK_FS1014	01 Jul 23	Y = 1.3135x - 7.0966	0.9961
BKK_FS1015	01 Jul 23	Y = 0.9802x + 3.8214	0.9999
BKK_FS1016	01 Jul 23	Y = 1.0726x - 85.581	0.9995
BKK_FS1020	01 Jul 23	Y = 1.1161x - 1.1986	1.0000
BKK_FS1021	01 Jul 23	Y = 0.9566x + 16.524	0.9987
BKK_FS1022	01 Jul 23	Y = 1.0712x - 89.51	0.9990
BKK_FS1023	01 Jul 23	Y = 1.3791x - 8.8721	0.9944
BKK_FS1024	01 Jul 23	Y = 0.9449x + 11.421	0.9993
BKK_FS1025	01 Jul 23	Y = 1.0477x - 41.116	1.0000
BKK_FS1026	01 Jul 23	Y = 1.3389x - 4.918	1.0000
BKK_FS1027	01 Jul 23	Y = 0.9852x + 1.5238	1.0000
BKK_FS1028	01 Jul 23	Y = 1.0281x - 19.897	0.9996





# ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	01 Jul 23	$Y = 1.3382x - 8.9776$	0.9941
BKK_FS1030	01 Jul 23	$Y = 0.9818x + 2.3476$	0.9995
BKK_FS1031	01 Jul 23	$Y = 1.0526x - 64.415$	0.9997
BKK_FS1039	01 Jul 23	$Y = 0.998x + 14.823$	0.9997
BKK_FS1040	01 Jul 23	$Y = 1.0041x - 2.7552$	0.9999
BKK_FS1041	01 Jul 23	$Y = 1.115x - 1.0078$	0.9999
BKK_FS1042	01 Jul 23	$Y = 1.0209x + 3.55$	0.9980
BKK_FS1043	01 Jul 23	$Y = 1.0039x - 5.0143$	0.9999
BKK_FS1044	01 Jul 23	$Y = 1.0807x + 0.9837$	0.9998
BKK_FS1164	03 Jul 23	$Y = 1.0589x + 4.6051$	0.9996
BKK_FS1165	03 Jul 23	$Y = 0.9809x + 7.5262$	0.9981
BKK_FS1166	03 Jul 23	$Y = 1.0567x - 50.446$	0.9999
BKK_FS1200	03 Jul 23	$Y = 1.3634x - 1.3816$	0.9991
BKK_FS1201	03 Jul 23	$Y = 1.0388x - 7.0524$	0.9999
BKK_FS1202	03 Jul 23	$Y = 1.0518x - 59.531$	0.9998
RYG_FS0197	01 Jul 23	$Y = 1.0087x - 3.2838$	0.9999
RYG_FS0198	01 Jul 23	$Y = 0.9877x + 36.487$	0.9999
RYG_FS0199	01 Jul 23	$Y = 1.0295x - 0.357$	0.9992
PHK_FS0027	13 Jul 23	$Y = 1.1219x - 2.2432$	0.9984
PHK_FS0028	13 Jul 23	$Y = 1.0341x - 6.7967$	0.9999
PHK_FS0029	13 Jul 23	$Y = 0.9977x + 8.7829$	0.9999
SGK_FS0135	14 Jul 23	$Y = 0.9877x + 11.513$	0.9974
SGK_FS0138	13 Jul 23	$Y = 1.0571x - 1.1565$	0.9991
SGK_FS0139	13 Jul 23	$Y = 0.9801x + 8.6267$	0.9997
SGK_FS0140	13 Jul 23	$Y = 0.9978x + 11.644$	1.0000
SGK_FS0141	13 Jul 23	$Y = 1.1349x - 2.2867$	0.9990
SGK_FS0142	13 Jul 23	$Y = 0.9915x + 11.403$	0.9994
SGK_FS0143	13 Jul 23	$Y = 1.0054x - 4.0648$	1.0000

Review By:

(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jittrantont)  
Assistant General Manager



# ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	02 Oct 23	$Y = 1.2862x - 1.2952$	0.9963
BKK_FS0579	02 Oct 23	$Y = 1.2546x + 0.0065$	0.9946
BKK_FS0583	03 Oct 23	$Y = 1.0773x - 2.4138$	0.9989
BKK_FS0584	02 Oct 23	$Y = 0.9787x + 12.569$	0.9999
BKK_FS0585	18 Oct 23	$Y = 1.0322x + 3.7767$	0.9998
BKK_FS0586	02 Oct 23	$Y = 0.9777x + 15.405$	0.9997
BKK_FS0587	18 Oct 23	$Y = 1.0175x + 14.717$	0.9997
BKK_FS0589	03 Oct 23	$Y = 1.0148x + 2.4143$	1.0000
BKK_FS0590	03 Oct 23	$Y = 1.0088x + 0.8429$	1.0000
BKK_FS0591	02 Oct 23	$Y = 1.0733x - 88.805$	0.9989
BKK_FS0592	18 Oct 23	$Y = 1.0037x + 10.388$	1.0000
BKK_FS0593	02 Oct 23	$Y = 1.0538x - 60.63$	0.9996
BKK_FS0594	18 Oct 23	$Y = 1.0052x + 5.3238$	0.9999
BKK_FS0596	03 Oct 23	$Y = 1.0449x - 48.241$	0.9996
BKK_FS0597	03 Oct 23	$Y = 1.0697x - 83.62$	0.9994
BKK_FS1004	02 Oct 23	$Y = 0.9855x + 14.75$	0.9992
BKK_FS1005	02 Oct 23	$Y = 1.02x + 1.7167$	0.9996
BKK_FS1006	02 Oct 23	$Y = 1.1762x - 3.5619$	0.9999
BKK_FS1007	18 Oct 23	$Y = 1.1405x + 2.6044$	0.9993
BKK_FS1008	18 Oct 23	$Y = 1.1267x + 4.8333$	0.9991
BKK_FS1010	03 Oct 23	$Y = 1.0027x + 2.5832$	0.9986
BKK_FS1011	02 Oct 23	$Y = 1.3811x - 6.2068$	0.9998
BKK_FS1012	02 Oct 23	$Y = 1.0017x + 0.9$	1.0000
BKK_FS1013	02 Oct 23	$Y = 1.0593x - 46.02$	0.9994
BKK_FS1014	03 Oct 23	$Y = 1.0961x - 1.6895$	0.9983
BKK_FS1015	03 Oct 23	$Y = 0.9979x + 6.2595$	0.9993
BKK_FS1016	03 Oct 23	$Y = 1.0683x - 82.491$	0.9995
BKK_FS1017	06 Oct 23	$Y = 0.9981x - 2.2235$	0.9998
BKK_FS1018	06 Oct 23	$Y = 0.9817x - 20.653$	0.9999
BKK_FS1019	06 Oct 23	$Y = 1.0152x - 64.485$	0.9998
BKK_FS1020	02 Oct 23	$Y = 1.2691x - 2.4721$	0.9983
BKK_FS1021	02 Oct 23	$Y = 1.0036x + 2.3286$	0.9999
BKK_FS1022	02 Oct 23	$Y = 1.0633x - 73.266$	0.9990
BKK_FS1023	03 Oct 23	$Y = 1.0879x - 1.0694$	0.9984
BKK_FS1024	02 Oct 23	$Y = 1.0035x + 1.4857$	1.0000
BKK_FS1025	03 Oct 23	$Y = 1.0556x - 58.597$	0.9999
BKK_FS1026	02 Oct 23	$Y = 1.2894x - 1.497$	0.9970
BKK_FS1027	02 Oct 23	$Y = 1.0032x + 1.5167$	1.0000
BKK_FS1028	02 Oct 23	$Y = 1.0433x - 30.012$	0.9994



# ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	02 Oct 23	$Y = 1.3494x - 3.5078$	0.9981
BKK_FS1030	02 Oct 23	$Y = 1.0015x + 1.2214$	1.0000
BKK_FS1031	02 Oct 23	$Y = 1.0516x - 56.996$	0.9994
BKK_FS1039	02 Oct 23	$Y = 0.9991x + 14.527$	0.9994
BKK_FS1040	02 Oct 23	$Y = 1.0049x - 2.4324$	1.0000
BKK_FS1041	02 Oct 23	$Y = 1.1682x - 2.1293$	1.0000
BKK_FS1042	02 Oct 23	$Y = 1.0051x + 6.2533$	0.9989
BKK_FS1043	02 Oct 23	$Y = 1.0022x + 3.96$	1.0000
BKK_FS1044	02 Oct 23	$Y = 1.0796x + 2.9806$	0.9993
BKK_FS1164	02 Oct 23	$Y = 1.2714x + 0.234$	0.9945
BKK_FS1165	02 Oct 23	$Y = 1.0029x + 3.3571$	0.9994
BKK_FS1166	02 Oct 23	$Y = 1.061x - 56.83$	1.0000
BKK_FS1200	02 Oct 23	$Y = 1.2803x - 1.4599$	0.9962
BKK_FS1201	02 Oct 23	$Y = 1.0374x - 6.1952$	1.0000
BKK_FS1202	02 Oct 23	$Y = 1.0486x - 44.05$	0.9997
PHK_FS0027	09 Oct 23	$Y = 1.1052x + 1.0293$	1.0000
PHK_FS0028	09 Oct 23	$Y = 1.0377x - 1.9833$	1.0000
PHK_FS0029	09 Oct 23	$Y = 1.0021x + 7.5248$	1.0000
RYG_FS0197	02 Oct 23	$Y = 1.0036x + 9.0133$	1.0000
RYG_FS0198	02 Oct 23	$Y = 0.9991x + 17.568$	1.0000
RYG_FS0199	02 Oct 23	$Y = 1.0814x - 1.2993$	0.9997
RYG_FS0654	02 Oct 23	$Y = 1.1168x - 2.1207$	1.0000
RYG_FS0655	02 Oct 23	$Y = 1.0086x + 6.2733$	0.9991
RYG_FS0656	02 Oct 23	$Y = 1.0009x + 8.48$	1.0000
RYG_FS0657	02 Oct 23	$Y = 1.0435x + 2.6459$	0.9999
RYG_FS0658	02 Oct 23	$Y = 0.9788x + 10.283$	0.9962
RYG_FS0659	02 Oct 23	$Y = 1.0074x - 6.621$	1.0000
SGK_FS0135	18 Oct 23	$Y = 0.9831x + 14.843$	0.9994
SGK_FS0138	06 Oct 23	$Y = 1.0831x - 0.8401$	0.9998
SGK_FS0139	06 Oct 23	$Y = 0.9826x + 8.6567$	1.0000
SGK_FS0140	06 Oct 23	$Y = 1.0011x + 7.8095$	1.0000
SGK_FS0141	06 Oct 23	$Y = 1.125x - 1.2259$	0.9998
SGK_FS0142	06 Oct 23	$Y = 0.9956x + 10.257$	0.9997
SGK_FS0143	06 Oct 23	$Y = 1.004x + 3.3105$	1.0000

Review By:

(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jittrantont)  
Assistant General Manager

BUY: 1510977

REVIEWER: Aulcharawan S.

APPROVED BY: Sarant M.

NEXT CAL DATE: 12 Jan 24



**Certificate of Calibration**

**ICS-2100: Anion (ID#659)**

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

**ALS Laboratory Group (Thailand) Co., Ltd.**

Operator Signature: Pitakorn Date: Jan 12, 2023

(Mr. Nutdanai Laekhwan)

Application Chemist





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK, 10250  
TEL: 0-2717-3000-24 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 22PH476  
Page: 1 of 2

Equipment: Lux Meter  
Manufacturer: PEAKMETER  
Model: PM6612L  
Serial No.: H12A-K20118  
ID No.: BKK\_FS1146  
Condition As-Received: Used Item  
Received Date: 12 September 2022  
Calibration Date: 13 September 2022  
Reference: 2209-0405WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-PH01 by measuring against  
luminous-intensity standard lamp (source-based method) According to the inverse square law measurement  
method.

### Condition of this result of calibration

#### 1. Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encoder	LMguide 9.6 m	120RC003	DL-0064-22	20 Jul 2025
2) High-accuracy irradiance Standard	OL-FEL-U	F-1471	TP-1037-21	18 Oct 2022

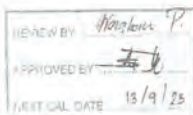
2. This result of calibration was made on requested at the point specified by customer.

3. Test Equipment: Programmable Voltage/Current Source ( Model : DL83A, SN : 05220284 )

4. Test Equipment: Illuminance Meter ( Model : 51002, SN : 080126 )

5. The certificate is valid only to the item calibrated on date and place of calibration.

6. This Certification is traceable to the International System of Unit maintained at:-  
National Institute of Metrology Thailand (NIMT)



Calibrated by: Nival Nitas  
Issue Date: 14 September 2022

Approved Signatory:  
[ ] Phalinee Prabpai  
[ ] Chatchawan Khunpluek  
[x] Nuntawat Khamchai

B 0297390



Cert. No.: 22PH476  
Page: 2 of 2

Result of calibration:- ( ) Without adjustment ( \* ) After adjustment  
Function: Illuminance Measurement Range: Autorange

Standard Value	Before Adjust UUC* Reading	After Adjust UUC* Reading	Error	Uncertainty
( lx )	( lx )	( lx )	( lx )	( ± lx )
0	0.00	0.00	0.00	0.060
15	-	15.06	0.06	0.22
100	-	100.8	0.8	1.5
500	-	501	1	7.3
1000	956	1001	1	15
2000	-	2020	20	30
3000	-	3010	10	45
4000	-	4020	20	60
5000	4800	5030	30	75

The reported uncertainty of measurement was based on a standard uncertainty multiplied by  
a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %

Before adjustment light source factor setting mode: L0 = 1,000

After adjustment light source factor setting mode: L0 = 1.047

UUC\* = Unit Under Calibration.

-000-

B 1125562



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK, 10250  
TEL: 0-2717-3000-24 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 23PH25  
Page: 1 of 2

Equipment: Lux Meter  
Manufacturer: Extech  
Model: 407026  
Serial No.: A.000287  
ID No.: BKK\_FS1345  
Condition As-Received: New Item  
Received Date: 18 January 2023  
Calibration Date: 19 January 2023  
Reference: 2301-056WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %

This certificate may not be reproduced other than in full,  
except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-PH01 by measuring against  
luminous-intensity standard lamp (source-based method) According to the inverse square law measurement  
method.

### Condition of this result of calibration

#### 1. Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encoder	LMguide 9.6 m	120RC003	DL 0064-22	20 Jul 2025
2) Luminous intensity standard lamp	OL FEL-U	F-1542	TP-1021-22	21 Mar 2023

2. This result of calibration was made on requested at the point specified by customer.

3. Test Equipment: Programmable Voltage/Current Source ( Model : DL83A, SN : 05221364 )

4. The certificate is valid only to the item calibrated on date and place of calibration.

5. This Certification is traceable to the International System of Unit maintained at:-  
National Institute of Metrology Thailand (NIMT)

Signature  
Date 18/1/23

Calibrated by: Nival Nitas  
Issue Date: 20 February 2023

Approved Signatory:  
[ ] Phalinee Prabpai  
[ ] Chatchawan Khunpluek  
[x] Nuntawat Khamchai

B 0307480



Cert. No.: 23PH25  
Page: 2 of 2

Result of calibration:- ( \* ) Without adjustment ( ) After adjustment  
Function: Illuminance Measurement Range: 2000 lx

Standard Value	UUC* Reading	Error	Uncertainty
( lx )	( lx )	( lx )	( ± lx )
0	0	0	0.60
15	19	4	0.64
100	105	5	1.9
500	507	7	9.0
1000	1001	1	18
1500	1498	-2	27
1900	1680	-20	35

Function: Illuminance Measurement Range: 20000 lx

Standard Value	UUC* Reading	Error	Uncertainty
( lx )	( lx )	( lx )	( ± lx )
2000	1960	-40	37
3000	2960	-40	55
4000	3910	-90	73
5000	4870	-130	91

The reported uncertainty of measurement was based on a standard uncertainty multiplied by  
a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %

Light source factor setting mode: L

UUC\* = Unit Under Calibration.

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B 1144307



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
514/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 22CH1222  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : B520948426  
ID No. : BKK\_EN0072  
Condition As-Received: Used Item  
Received Date : 09 September 2022  
Calibration Date : 12 September 2022  
Reference : 2209-0312DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

( ) Malee Buktueas  
( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%.

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services



Cert.No.: 22CH1222  
Page.: 2 of 2

### Condition of this calibration result

1. Reference Standard Instrument : -  
Instrument Serial No. ID No. Cert. No. Due Date  
1) Document Process Calibrator S4030049 130RC116 22E2769 24 Aug 2023  
This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT
2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (±mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: PCE-86-EX1001	4.008	3.999	153.9	0.0055	2.00
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95%.

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a 1126274



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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514/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 22CG3154  
Page.: 1 of 2

## Certificate of Calibration

Equipment : Burette  
Capacity : 50 mL  
Serial No. :  
ID No. : BKK\_EN0171  
Manufacturer : Witeg  
Made in : Germany  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khwaeng Phatthanakan, Khet Suan Luang  
Bangkok 10250 Thailand  
Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 759 mmHg  
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Panward Pramklam

Approved by :   
Approved Signatory

( ) Pomthipha Temeyakul  
( ) Malee Buktueas  
( ) Panpan Paipim  
( ) Srisuda Khamtha

Issue Date : 31 August 2022

The Uncertainties are for a confidence probability of approximately 95%.

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services



Equipment : Burette  
Received Date : 26 August 2022  
Condition As-Received : Used Item  
Calibration Date : 30 August 2022  
Reference : 2208-0918DSC-2

Cert.No.: 22CG3154  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :  
Instruments Model Serial No. ID No. Certificate No. Traceability Due date  
1) Balance AE2005 N03679 140RC001 21MM429 NIMT 22 Sep 2022  
2) Thermo-Hygrograph THDX-CE 00016540 140EC001 22H1243 NIST,NIMT 09 June 2023  
3) Thermometer - 1594592 140EC010 22H181 NIMT 10 Feb 2023  
This certification is traceable to SI Unit  
2. The certificate is valid only to the item calibrated on date and place of calibration.  
3. True value is converted to true volume at the standard temperature of 20 °C

### Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9959	0.010	2.00

Remark mL = cm<sup>3</sup>

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95%.

-000-

a 1123908

A 0044607









SARTORIUS

# Certificate of Calibration

## Certificate of Calibration

REVIEW BY: Sirint P.  
APPROVED BY: LL AL  
NEXT CAL DATE: 8/2/24

Model Number: MSE224S-100-DU Certificate No.: 23BCI0072  
Description: Analytical Balance Issued Date: Monday, February 13, 2023  
Serial Number: 26207042 Reference No.: 203245  
ID No.: BKK\_EN0002  
Manufacturer: Sartorius Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.  
Calibrated Place: Balance Room

Calibrated By: Mr. Chonchai Inthana  
Calibration Date: Wednesday, February 08, 2023

Metrological data:  
Capacity: 220 g Readability: 0.0001 g  
Reasons for calibration:  
☒ New Installation ☐ Service / Repair ☒ Re-calibration Maintenance  
Ambient Conditions:  
Temperature: 23.2 °C ± 5.0 °C  
Humidity: 60.0 % RH ± 10.0 % RH  
Pressure: ±  
Equipment Condition: ☒ Good Operate ☐ Fail

Measurement Method: UKAS Publication Ref: Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-00	Sartorius weight set 1mg - 5000g E2 YC5011-522-00	SPC-RT	020212585	14-Sep-2023
MPE-382SD	Humidity/Balometer/Temp. Luton MPE-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division, Sartorius (Thailand) Co., Ltd.

Chonchai



SOP FM 33 03 February 2022

Mr Chonchai Inthana (Technical Manager)

SARTORIUS

# Certificate of Calibration

Model Number: MSE224S-100-DU Certificate No.: 23BCI0072  
Description: Analytical Balance Issued Date: Monday, February 13, 2023  
Serial Number: 26207042 Reference No.: 203245  
ID No.: BKK\_EN0002  
Manufacturer: Sartorius Page No.: 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the result of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value: (Low Load)	20.0000	200.0000	Nominal value:	50	g
20 g	20.0000	199.9999	Tolerance	0.0004	g
0.0001 g	20.0000	199.9999	Difference		
	20.0001	200.0000	1		
Nominal Value: (High Load)	20.0000	200.0000	2		
200 g	20.0000	199.9999	3		
0.0001 g	20.0000	199.9999	4		
	20.0001	200.0000	5		
	20.0001	199.9999	6		
Standard Deviation	0.00004	0.00005			

## Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report

SOP FM 33 03 February 2022



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand.  
Saraburi Tel: +66 3627 3096 Fax: +66 3627 3100  
Bangkok Tel: +668 9205 6851, +668 8247 2360  
Website: www.scieco.co.th E-Mail: calibrate@scg.com



Certificate No. T231303

Page 1 of 3

## Certificate of Calibration

Equipment: Liquid Bath (Water)  
Manufacturer: MEMMERT  
Model: WNB29  
Serial No.: L611.0135  
Customer Code: BKK\_EN0148  
ID No.: T6455A4  
Customer: ALS Laboratory Group (Thailand) Co., Ltd.

REVIEW BY: Sirint P.  
APPROVED BY: LL AL  
NEXT CAL DATE: 04/01/25

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Customer Location: ORGANIC PREPARATION LAB

Date of Receipt: 27 June 2023

Calibrated By: Sujjar Naknakred (Site Calibration Manager)

Approved By: Boonchai Suriyawong (Site Calibration Manager)

Date of Issue: 11 JUL 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM 1.14118 31400-04



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand



Certificate No. T231303

Page 2 of 3

## Calibration Report

Equipment: Liquid Bath (Water)  
Date of Calibration: 4 July 2023  
Environment: Temperature: 22.2-22.5 °C  
Line Voltage: 221.6-224.8 V  
Relative Humidity: 55-65 %RH

### Condition of this results of calibration:

- This equipment was calibrated by insert five resistance thermometer detectors into its water bath, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS-90.
- Reference Standard Instrument:  
Instrument Model Instrument No. Certificate No. Due Date  
RTD 100 OHM M18 (CH1, CH6, CH7, CH9, CH10) T230545 10 April 2024  
DATA LOGGER 34970A T149 T230545
- This certificate is traceable to:  
National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item: good  
Equipment Description:  
Time Constant 3 Hour 45 Minute At 60 °C
- Adjustment:  
( X ) without adjustment ( ) after adjustment

Approved By: Boonchai

FM 1.14118 11215-04-03





## Metrological Center

SCI ECO Services Company Limited

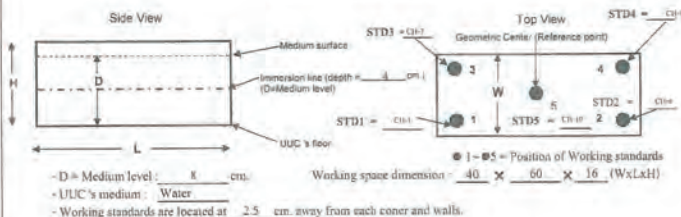
33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand



Certificate No. T231303

Page 3 of 3

### Calibration Report



#### Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-6	CH-7	CH-9	CH-10
60	60.03	60.06	60.24	60.11	60.18
85	84.79	84.83	85.42	85.05	85.20
95	93.71	93.83	94.62	94.15	94.42

Liquid Bath (Water)		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (± °C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max					
81.0	80.9	81.1	81.0	0.13	0.19	0.29	2.04
86.0	85.8	86.2	86.0	0.19	0.47	0.44	2.17
95.0	94.6	95	94.9	0.32	0.65	0.55	2.13

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15 11/15-05-63



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +668 8247 2360

Website : www.scieco.co.th

E-Mail : calibrate@scg.com



Certificate No. T222502

Page 1 of 4

### Certificate of Calibration

Equipment : Chamber ( Oven )

Manufacturer : Memmert

Model : UF 450

Serial No. : B7170531

Customer Code : BKK\_EN0273

ID No. : T8042A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Oven Room

Date of Receipt : 23 November 2022

Calibrated By : Sujjar Nakkakred ( Site Calibration Manager )

Approved By : /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 9 DEC 2022

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L1418/51-08-64



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T222502

Page 2 of 4

### Calibration Report

Equipment : Chamber ( Oven )  
Date of Calibration : 29 November 2022  
Environment : Temperature : 29.1-29.6 °C  
Line Voltage : 221.3-223.2 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T into its chamber , the other one resistance thermometer detector use for ambient temperature measurement. The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Resapproved 2001 ) and AS2853-1986 ) . All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T210004	30 December 2022
TC	TYPE T	TN261-TN270	T210010	30 December 2022
DATA LOGGER	34970A	T149	T210004	30 December 2022

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center / NSC-TISI-TIS 17025 CALIBRATION 0244

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant : 1 Hour 49 Minute At 104 °C  
Fresh Air Damper : ☒ Open ☐ Min ☐ Medium ☒ Max  
☐ Close  
☐ Not Available

#### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By:

FM-L15 11/15-05-63



## Metrological Center

SCI ECO Services Company Limited

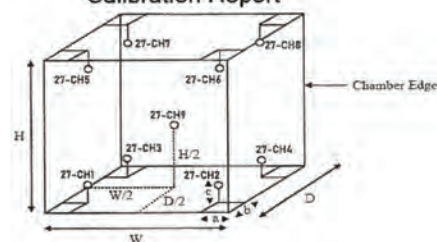
33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T222502

Page 3 of 4

### Calibration Report



#### Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm , H (Height) = 72 cm , and D (Depth) = 60 cm.

Size of Installed Standard sensor number 27-CH1 : s = 5 cm , h = 5 cm , and c = 3 cm.

Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm / 2 , H/2 = 72 cm / 2 , and D/2 = 60 cm / 2

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8
104	104.07	103.80	103.45	104.02	104.47	103.57	104.59	103.78

Chamber ( Oven )		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)
	Min	Max				
104.0		104.0	103.97	0.07	0.70	0.42

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15 11/15-05-63





# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

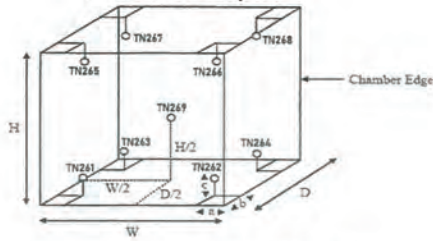


NSC-TIS-17023  
CALIBRATION 2024

Certificate No. T222502

Page 4 of 4

## Calibration Report



### Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number TN241 to number TN248 : a = 5 cm, b = 5 cm. and c = 5 cm.  
Size of Installed Standard sensor number TN249 : W/2 = 104 cm/2, H/2 = 72 cm/2 and D/2 = 60cm/2

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	TN241	TN242	TN243	TN244	TN245	TN246	TN247	TN248
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99

Chamber ( Oven )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
180.0	-	180.0	179.98	0.38	1.78	1.10	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above estimated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing

a level of confidence of approximately 95 %.

Approved By:

FM-115-117/15-05-63



## Certificate of Calibration

Equipment: CONDUCTIVITY METER  
Model: ORION STAR A215  
Serial No. (or ID.): X58031  
Manufacturer: Thermo Scientific  
Electrode Serial No.: YV1-18416 Model: ORION 013005MD  
Condition: In Condition

Certificate No.: C24230001  
Issued Date: 5 January 2023  
Job No.: KSPR2216356  
Page: 1 of 2  
Brand : Thermo Scientific

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.6 °C ± 0.2 °C  
Humidity 58.0 %RH ± 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wel Chemistry Lab 2 )  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Nattapat Rungrueang

Calibration Date: 3 January 2023

The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through  
CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838317, 838313, 838315

(Mr. Nattapat Rungrueang)  
Person in charge

(Mr. Nitinun Srihawan)  
Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to International or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
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2533 Sukhumvit Road, Bangkok, Phra Prachin, Bangkok 10250  
Phone: +66 2839 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-C24-09: 12 Sep 2022



Certificate No.: C24230001

Page: 2 of 2

### Calibration Results:

#### Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 µS/cm	102.4 µS/cm	-16.400 µS/cm	2.00	0.88 µS/cm
1413.0 µS/cm	1689 µS/cm	-276.0 µS/cm	2.00	11 µS/cm
12.881 mS/cm	15.42 mS/cm	-2.5390 mS/cm	2.00	0.098 mS/cm

#### After Adjustment : at 84.0 µS/cm, 1413 µS/cm, 12.88 mS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 µS/cm	84.09 µS/cm	-0.090 µS/cm	2.00	0.88 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	11 µS/cm
12.881 mS/cm	12.89 mS/cm	-0.0090 mS/cm	2.00	0.098 mS/cm

The End of Certificate



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องวัด: CONDUCTIVITY METER รุ่น: ORION STAR A215 หมายเลขเครื่อง: X58031

ตรวจสอบ (วัน)	รายการตรวจสอบ	ตรวจสอบ (ค่า)	หมายเหตุ
03 Jan 2023		03 Jan 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>
Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงยูวีแสง (UV < 3,000 hour)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงยูวีแสง (Visible < 5,000 hour)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องใส่หลอดตัวอย่าง (Carousel Module)	<input type="checkbox"/>
pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. ขั้วไฟฟ้า (Electrode and Connection Cable)	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งขั้วไฟฟ้า (Stand)	<input checked="" type="checkbox"/>
Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ทำความสะอาดเซลล์ (No Sample)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของเซลล์ (>= 2.5 ไม่นาน 3.0)	<input type="checkbox"/>
Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายและอุปกรณ์ประกอบ	<input type="checkbox"/>

ผู้ตรวจ:

Mr.Nattapat Rungrueang  
Service Engineer

DKSH Technology Limited  
2533 หมู่ 9 ถนนสายเอเชีย ถนนพหลโยธิน กรุงเทพมหานคร 10250  
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CAL-FM-C24-08: 12 Sep 2022

DKSH Technology Limited  
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CAL-FM-R31-03: 26 Jul 2022





## Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24230001  
 Model: ORION STAR A215 Issued Date: 5 January 2023  
 Serial No. (or ID.): X58031 Job No.: KSPRZ216356  
 Manufacturer: Thermo Scientific Page: 1 of 2  
 Electrode Serial No.: YV1-18418 Model: ORION 013005MD Brand: Thermo Scientific  
 Condition: In Condition

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Soi Pattanakarn 40, Pattanakarn Rd.,  
 Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.6 °C ± 0.2 °C  
 Humidity 58.0 %RH ± 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
 104 Soi Pattanakarn 40, Pattanakarn Rd.,  
 Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Nattapat Rungruang  
 Calibration Date: 3 January 2023  
 The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
 Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through  
 CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838317, 838313, 838315

REVIEW BY  
 APPROVED BY  
 NEXT CAL DATE

(Mr. Nattapat Rungruang)

Person in charge

(Mr. Nitnun Srihawan)

Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
 The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
 These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
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 2533 Sukhumvit Road, Bangkok, Phraechung, Bangkok 10250  
 Phone: +66 2839 7000 Email: info.asia@dksh.com Website: www.dksh.com/thailand

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CAL-FM-C24-09: 12 Sep 2022



Certificate No.: C24230001

Page: 2 of 2

### Calibration Results:

#### Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 µS/cm	102.4 µS/cm	-18.400 µS/cm	2.00	0.69 µS/cm
1413.0 µS/cm	1669 µS/cm	-276.0 µS/cm	2.00	11 µS/cm
12.881 mS/cm	15.42 mS/cm	-2.5390 mS/cm	2.00	0.098 mS/cm

#### After Adjustment : at 84.0 µS/cm, 1413 µS/cm, 12.88 mS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 µS/cm	84.09 µS/cm	-0.090 µS/cm	2.00	0.68 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	11 µS/cm
12.881 mS/cm	12.88 mS/cm	-0.0080 mS/cm	2.00	0.098 mS/cm

The End of Certificate

DKSH Technology Limited  
 2533 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10250  
 2533 Sukhumvit Road, Bangkok, Phraechung, Bangkok 10250  
 Phone: +66 2839 7000 Email: info.asia@dksh.com Website: www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C24-09: 12 Sep 2022



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPRZ216356

ชื่อเครื่องวัด: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (สัปดาห์)		หมายเหตุ
03 Jan 2023			03 Jan 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์ของเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ เปิด – ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมแสงความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. ขั้วไฟฟ้า ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งขั้วไฟฟ้า (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่คาดหวัง (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นาน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบผสมยาและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ตรวจสอบโดย:

Mr. Nattapat Rungruang

Service Engineer

DKSH Technology Limited  
 2533 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10250  
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CAL-FM-F21-02: 20 Jul 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10258

TEL: 0-2717-5000 FAX: 0-2719-9484

Cert.No.: 22TW178

Page: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
 Manufacturer : YSI  
 Model : 5100  
 Serial No. : 15L103204  
 ID No. : BKK\_EN0205  
 Received Date : 02 August 2022  
 Test Date : 03 August 2022  
 Reference : 2208-0060DSC-1  
 Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Phatthanakan 40, Phatthanakan Rd.,  
 Khwaeng Phatthanakan, Khet Suan Luang,  
 Bangkok 10250 Thailand  
 Laboratory Condition : Temperature ( 25 ± 5 ) °C  
 Humidity ( 50 ± 20 ) %  
 Test Procedure : In - house method : CP-CH9  
 by Comparison Technique with Azide Modification Method  
 Tested by : Walailak Sirthean  
 Approved by :  
 (✓) Malee Buiwut  
 ( ) Sarthip Meangmai  
 ( ) Werakorn Lernagatruakul  
 Issue Date : 4 August 2022

REVIEW BY  
 APPROVED BY  
 NEXT CAL DATE

0293758



Cert.No.: 22TW178  
Page.: 2 of 2

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1399	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

##### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 17A100064

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.06	8.07	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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*Maha*

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0 2717 3000-37 FAX 0-2719-9484



Cert. No.: 22LM107  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L103204  
ID No. : BKK\_EN0205  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 2 August 2022  
Calibrated Date : 4 August 2022  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
AC Line Voltage : (220 ± 22) V  
Calibrated by : Man Pattanapongpaiboon

Approved by : *Maha*  
Approved Signatory  
( ) Ponthippa Tameysakul  
( ) Malee Budsuee  
( ) Suwit Injai

Issue Date : 9 August 2022

The Uncertainties are for a confidence probability of approximately 95 %

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A 0044131



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2206-0060DSC-2

Cert. No.: 22LM107  
Page.: 2 of 2

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	15Q2A	A52847	2111144	20 Oct 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 18C100772

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.002	19.93	-0.072	0.15	2.00

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o0o-

*Maha*

a 1120698



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhoh, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com

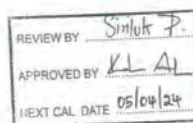


Certificate No. T230682

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Incubator )  
Manufacturer : MEMMERT  
Model : ICP 750  
Serial No. : F819.0021  
Customer Code : BKK\_EN0304  
ID No. : T9572A4  
Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250



Customer Location : Wet Chemistry Lab 2

Date of Receipt : 30 March 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : *Bunlorn* / Boonchai Suriyawong ( Assistant Calibration Manager )

Date of Issue : 18 APR 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L1418/31-08-64





# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T230682

## Calibration Report

Page 2 of 4

Equipment : Chamber (Incubator)  
Date of Calibration : 5 April 2023 (Finished Time 4:30 PM)  
Environment : Temperature 22.9-28.6 °C  
Line Voltage 221.7-225.5 V

### Condition of this results of test :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986.)  
All data show below were final values and the initial data may be obtained upon request.  
The temperature scale used was based on ITS - 90.

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No	Certificate No.	Due Date
RTD	100 ohm	37-(CH1-10)	T222493	28 November 2023
RTD	100 ohm	36-(CH1-10)	T222493	28 November 2023
DATA LOGGER	34970A	T193	T222493	28 November 2023

### 3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244.)

### 4. Condition of calibrated item : good

#### UUC Description :

Time Constant : 1 Hour 37 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max.  
☐ Close  
☒ Not Available.

### 5. Result of test :

( ) without adjustment ( X ) after adjustment

Approved By

FM-L15 11/7/15-05-63



# Metrological Center

SCI ECO Services Company Limited

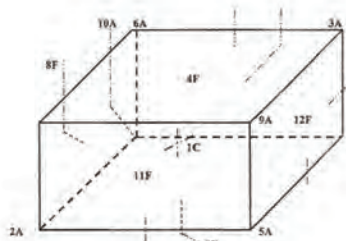
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No T230682

## Calibration Report

Page 3 of 4



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = 37CH1
2A = 37CH2
3A = 37CH3
4F = 37CH4
5A = 37CH5
6A = 37CH6
7F = 37CH7
8F = 37CH8
9A = 37CH9
10A = 37CH10

11F = 36CH1
12F = 36CH2

Approved By

FM-L15 11/7/15-05-63



# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T230682

## Calibration Report

Page 4 of 4

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	37CH1	37CH2	37CH3	37CH4	37CH5	37CH6	37CH7	37CH8	37CH9	37CH10
20.0	20.26	20.17	20.10	20.15	20.12	19.96	20.14	19.69	20.20	19.82
	36CH1	36CH2								
	20.03	20.04								

Chamber (Incubator)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max					
20.0	19.9	20.1	20.0	0.19	0.53	0.38	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k, which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By

FM-L15 11/7/15-05-63



# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

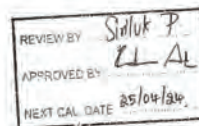
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230760

Page 1 of 5

## Certificate of Calibration

Equipment : HOT BLOCK  
Manufacturer : Environmental Express  
Model : B3000-240  
Serial No. : 2017CODW116  
Customer Code : BKK\_EN0222  
ID No. : T6769A4  
Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab2  
Date of Receipt : 21 April 2023  
Calibrated By : Watcharakas Puttarat (Technician)  
Approved By : / Sujjar Naknakred (Site Calibration Manager)  
Date of Issue : 12 MAY 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 10/30-05-57





Certificate No. T230760

Page 2 of 5

## Calibration Report

Equipment : HOT BLOCK  
Date of Calibration : 25 April 2023  
Environment : Temperature : 22.9-24.4 °C  
Line Voltage : 222.7-227.8 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

- This equipment was calibrated by insert 20 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).  
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS-90.
- Reference Standard Instrument:

Instrument	Model	Instrument No	Certificate No.	Due Date
TC	TYPE T	TN121-TN130	T222122	5 October 2023
TC	TYPE T	TN131-TN140	T222122	5 October 2023
DATA LOGGER	34970A	T150	T222122	5 October 2023
- This certificate is traceable to :  
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 1 Hour 32 Minute At 150 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By.

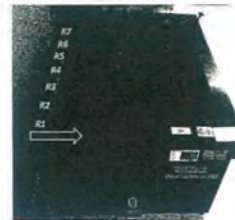
FM-L13 108/30-05-57



Certificate No. T230760

Page 3 of 5

## Calibration Report



Row	Hole															
R7	H49	H50	H51	H52	H53	H54	H55	H56								
R6	H41	H42	H43	H44	H45	H46	H47	H48								
R5	H33	H34	H35	H36	H37	H38	H39	H40								
R4	H25	H26	H27	H28	H29	H30	H31	H32								
R3	H17	H18	H19	H20	H21	H22	H23	H24								
R2	H9	H10	H11	H12	H13	H14	H15	H16								
R1	H1	H2	H3	H4	H5	H6	H7	H8								

H: STANDARD THERMOCOUPLE TYPE T

H1	=	TN121	H9	=	TN129	H17	=	TN137	H25	=	TN125	H33	=	TN133	H41	=	TN121	H49	=	TN129
H2	=	TN122	H10	=	TN130	H18	=	TN138	H26	=	TN126	H34	=	TN134	H42	=	TN122	H50	=	TN130
H3	=	TN123	H11	=	TN131	H19	=	TN139	H27	=	TN127	H35	=	TN135	H43	=	TN123	H51	=	TN131
H4	=	TN124	H12	=	TN132	H20	=	TN140	H28	=	TN128	H36	=	TN136	H44	=	TN124	H52	=	TN132
H5	=	TN125	H13	=	TN133	H21	=	TN121	H29	=	TN129	H37	=	TN137	H45	=	TN125	H53	=	TN133
H6	=	TN126	H14	=	TN134	H22	=	TN122	H30	=	TN130	H38	=	TN138	H46	=	TN126	H54	=	TN134
H7	=	TN127	H15	=	TN135	H23	=	TN123	H31	=	TN131	H39	=	TN139	H47	=	TN127	H55	=	TN135
H8	=	TN128	H16	=	TN136	H24	=	TN124	H32	=	TN132	H40	=	TN140	H48	=	TN128	H56	=	TN136

Approved By.

FM-L13 108/30-05-57



Certificate No. T230760

Page 4 of 5

## Calibration Report

### Measurement Results

Average Standard Reading at each position (°C)										
Calibration Point	TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
Point Setting	Max	149.31	149.49	149.73	148.49	149.26	149.81	149.42	148.86	148.78
150	Min	149.14	149.31	149.54	148.36	149.08	149.65	149.22	148.65	149.07
Average	149.23	149.40	149.64	148.43	149.16	149.73	149.33	148.76	148.77	149.13
Calibration Point	TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140
Point Setting	Max	149.90	150.18	150.18	149.16	148.89	149.72	149.28	149.50	150.01
150	Min	149.78	150.06	149.69	149.03	148.76	149.49	149.12	149.37	149.90
Average	149.84	150.12	149.76	149.09	148.81	149.62	149.19	149.43	149.95	149.27
Calibration Point	TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
Point Setting	Max	149.88	149.14	149.20	150.02	148.75	149.57	149.21	149.18	150.13
150	Min	149.67	148.94	148.98	149.83	148.58	149.43	149.06	149.01	149.91
Average	149.78	149.05	149.11	149.94	148.67	149.51	149.13	149.10	150.01	149.83
Calibration Point	TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140
Point Setting	Max	149.42	149.52	149.13	148.94	148.84	150.16	149.42	149.54	149.66
150	Min	149.27	149.36	148.99	148.81	148.70	149.99	149.27	149.39	149.52
Average	149.36	149.45	149.06	148.88	148.76	150.08	149.36	149.48	149.60	150.03
Calibration Point	TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
Point Setting	Max	149.21	149.16	149.50	148.68	148.58	149.81	149.06	150.40	148.44
150	Min	149.03	148.93	149.27	148.48	148.42	149.62	148.78	150.26	148.14
Average	149.12	149.04	149.39	148.57	148.53	149.72	149.33	148.93	150.33	148.29
Calibration Point	TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140
Point Setting	Max	148.79	148.21	149.03	149.09	148.46	149.25			
150	Min	148.49	147.98	148.88	148.94	148.29	149.12			
Average	148.61	148.06	148.94	148.92	148.35	149.19				

Approved By.

FM-L13 108/30-05-57



Certificate No. T230760

Page 5 of 5

## Calibration Report

### Measurement Results

HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min, Max	Average		
150.0	150.1, 150.1	150.0	0.20	0.82

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on date and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95 %.

Approved By.

FM-L13 108/30-05-57





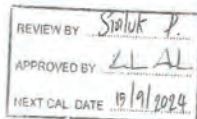
Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 15 September 2023  
Date of calibration 15 September 2023  
Date of issue 22 September 2023

Number of Pages: 1 of 3



Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (23.4 - 24.7) °C (On site)  
Humidity (55.5 - 61.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method: WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95937 and 95924  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr Wanchana Janioy

Approved by

*[Signature]*

Mr.Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated equipment as mentioned in this report. Calibration is necessary for the equipment and validity of the results are dependent on the equipment and also upon the procedures. Except in full, without written approval of the Bara Scientific Co., Ltd.



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Pages: 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.67	-0.03	0.18
334.02	334.03	0.01	0.18
418.53	418.59	0.06	0.18
572.99	573.14	0.15	0.18
879.41	879.21	-0.20	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7460	-0.0007	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8646	-0.0016	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2908	0.0004	0.0075
350	0.0000	0.0001	0.0001	0.0075
	0.6429	0.6415	-0.0014	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated equipment as mentioned in this report. Calibration is necessary for the equipment and validity of the results are dependent on the equipment and also upon the procedures. Except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (2301453)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Pages: 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5793	0.0010	0.0042
	0.7628	0.7624	-0.0004	0.0042
	1.0206	1.0216	0.0010	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5625	0.0004	0.0042
	0.7455	0.7452	-0.0003	0.0042
	0.9985	0.9989	0.0004	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5228	0.0001	0.0042
	0.6680	0.6673	-0.0007	0.0042
	0.9487	0.9485	-0.0002	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5211	0.0004	0.0042
	0.6973	0.6960	-0.0013	0.0042
	0.9959	0.9944	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5538	-0.0006	0.0042
	0.7253	0.7236	-0.0017	0.0042
	1.0942	1.0925	-0.0017	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5612	-0.0004	0.0042
	0.6927	0.6909	-0.0018	0.0042
	1.0881	1.0866	-0.0015	0.0042

\*CNR = Customer not request

4.Stray Light

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%)	Absorbance (A)
200.96±0.11nm	200.55	0.9770	2.0104

The stray light transmission reference is less than 1.0% and stray light absorbance reference is greater than 2.00A.  
\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated equipment as mentioned in this report. Calibration is necessary for the equipment and validity of the results are dependent on the equipment and also upon the procedures. Except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (2301453)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
134/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No.: 23CH132  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter

Manufacturer : Mettler Toledo

Model : SevenGo S2

Serial No. : B729397038

ID No. : BKK\_LG0013

Condition As-Received: Used Item

Received Date : 31 January 2023

Calibration Date : 01 February 2023

Reference : 2301-1029DSC-2

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Warakorn Lengragrakul

Approved by : *[Signature]*  
Approved Signatory

( / ) Malee Burkruas  
( / ) Saithip Meangmai  
( / ) Warakorn Lengragrakul

Issue Date : 3 February 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be valid unless used in full, except with the above mentioned.

Approval of the Head of Corporate Services : Equipment Calibration and Testing Services

A 0050486



Cert. No.: 23CH132  
Page: 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

##### 2. Certified Reference Materials :- The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826589	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.008	CPA chem	826590	09 July 2023

3. This certificate is valid only to the item calibrated on date and place of calibration.

#### Calibration Results

##### Function : mV Measurement

##### Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	mV	pH		
pH Meter S/N: B729397038	4.00	177.48	177	4.00	0.58	2.00	
	7.00	0.00	0	7.00	0.58	2.00	
	10.00	-177.48	-177	10.00	0.58	2.00	

##### Function : pH Measurement

##### Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N: 0020808	4.008	4.02	178	0.0079	2.00
	6.987	6.98	9	0.011	2.00
	10.008	10.00	-169	0.0095	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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a 1146670



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
354/4 PATTANAKARN ROAD, SU 19, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2717-3446-27 FAX: 0-2719-7484



Cert. No.: 23LM17  
Page: 1 of 2

## Certificate of Calibration

Equipment : pH Meter With Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2 Go S2  
Serial No. : B729397038  
ID No : BKK\_LG0013  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 31 January 2023  
Calibrated Date : 2 February 2023  
Ambient Temperature : (26  $\pm$  10) °C  
Relative Humidity : (50  $\pm$  30) %  
AC Line Voltage : (220  $\pm$  22) V  
Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Malee Bulkrus  
( ) Suwit Imjai

Issue Date : 3 February 2023

The Uncertainties are for a confidence probability of approximately 95%.

This certificate does not be reproduced other than as full, except with the prior consent.  
Approved on the Head of Corporate Services & Equipment Calibration and Testing Services

A 0049463



Equipment : pH Meter With Sensor  
Condition As-Received : Used Item  
Reference : 2301-1029DSC-1  
Procedure Used :-

Cert. No.: 23LM17  
Page: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	2211325	31 Oct 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( ° ) Without Adjustment

Function : Temperature Measurement

This instrument was connected with thermistor sensor, S/N: 0020808

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty ( $\pm$ °C)	Coverage Factor k
20.0	100	20.000	20.1	0.100	0.16	2.00
25.0	100	25.002	25.1	0.098	0.16	2.00
30.0	100	30.001	30.1	0.099	0.16	2.00
35.0	100	35.001	35.1	0.099	0.16	2.00
40.0	100	40.002	40.1	0.098	0.16	2.00
45.0	100	45.001	45.2	0.199	0.16	2.00
50.0	100	50.001	50.2	0.199	0.16	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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## ภาคผนวก ฉ

สำเนาหนังสืออนุญาตขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๙



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ เขตราชเทวี  
กรุงเทพมหานคร ๑๐๕๐๐

๒๘ มกราคม ๒๕๖๕

เรื่อง ค่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔  
ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร  
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)  
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้  
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๙ รายการ น้ำใต้ดิน  
จำนวน ๑๒๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๓๕ รายการ และดิน  
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๖๑ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กันยายน ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายจิระ จันทรเจิด)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๑๔๖ ๐ ๒๒๐๒ ๔๐๐๒

โทรสาร ๐ ๒๓๕๔ ๓๒๐๘ ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวยุพาพร จันทรเปล่ง	ทะเบียนเลขที่ ๖-๒๐๔-ค-๔๗๐๐
๒) นางสาวชัชชัย โกมารกุล ณ นคร	ทะเบียนเลขที่ ๖-๒๐๔-ค-๔๗๐๑
๓) นายศรยุทธ จิตราภรณ์	ทะเบียนเลขที่ ๖-๒๐๔-ค-๔๗๐๒
๔) นางสาวกนกกร เอนก	ทะเบียนเลขที่ ๖-๒๐๔-ค-๖๑๑๑
๕) นายสุริยา สอนแก้ว	ทะเบียนเลขที่ ๖-๒๐๔-ค-๖๑๑๒
๖) นายวิชาญ ชุมพรี	ทะเบียนเลขที่ ๖-๒๐๔-ค-๖๑๑๓

(นายจิระ จันทรเจิด)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอนแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕ ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

๑) นางสาวจินดา ไชจุลธรรม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๐๘
๒) นางสาวสาวตรี น้อยเสงี่ยม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๐๙
๓) นางสาวชนัญญาญจน์ อัมมขม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๑๐
๔) นางสาวนรินทร์ สายเสง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๑๕
๕) นางสาวนันทวิดี สมบูรณ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๑๖
๖) นางสาวศรัณยา เฉลิมธำรงค์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๑๗
๗) นางสาวสราวิศม์ มงคลจิรวุฒิ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๑๘
๘) นางสาวศิริลักษณ์ หึงแพง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๗๒๐
๙) นายณพพงศ์ จันทุพันธ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๐๘
๑๐) นายนเรศรชัย โกมลาลัย	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๑
๑๑) นายธินา จริยา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๔
๑๒) นางสาวเกศรินทร์ แก้วมัน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๖
๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๗
๑๔) นางสาวสุชาดา ธรรมอวาร์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๑
๑๕) นางสาวเปมิกา ชัยเดชอนกุล	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๓
๑๖) นางสาวศศิธร หนูสวัสดิ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๔
๑๗) นางสาวเสาวลักษณ์ ภูณภาอำพร	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๕
๑๘) นายอภิสิทธิ์ สิงหา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๖
๑๙) นายศักดิ์สิทธิ์ โพธิ์สุทนต์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๗
๒๐) ว่าที่ร้อยตรีหญิง พรรณิภา จำเจริญ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๑๘
๒๑) นางจิตตา คำแก้ว	ทะเบียนเลขที่ ๖-๒๐๔-๖-๕๕๓๑
๒๒) นางสาวอรรพรรณ รักยง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๑๕
๒๓) นางสาวนพรัตน์ แยมกรานต์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๑๕
๒๔) นายจุลเดช วารินทร์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๐
๒๕) นางสาวดาญรัตน์ ร้องคำ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๑
๒๖) นายนคร สุขเจริญ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๒
๒๗) นายปัญญา นามเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๓
๒๘) นายพรมณ์ ศรีปัดเนตร	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๕
๒๙) นายอุทิศ อุ่นลิ้ม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๖
๓๐) ว่าที่ร้อยตรี เฉลิมเกียรติ อมรศรีเสริม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๘
๓๑) นางสาววริยา สรียงนา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๒๘
๓๒) นายอนุพงศ์ รัตนศรีประเสริฐ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๓๐
๓๓) นางสาวจุฬารัตน์ โอนสันเทียะ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๖๑๔๒
๓๔) นางสาวจารวรรณ พิมพ์อภัยกุล	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๗๖

(นายศิระ จันทร์เกิด)

๓๕) นางสาวปรังคิทธิ...

บริษัท เอนแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ผู้อำนวยการฝ่ายปฏิบัติการวิเคราะห์  
ผู้ดำเนินการทดสอบและควบคุมคุณภาพ

- ๒ -

๓๕) นางสาวปรังคิทธิ กิจไพศาลศักดิ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๗๗
๓๖) นางสาวเดือนใจ ทางกลาง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๐
๓๗) นางสาวจิราพร ศิริเวช	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๒
๓๘) นายวรกร ผูกกรัก	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๓
๓๙) นายทง วิริยะสหกิจ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๔
๔๐) นายณิต เจนจบ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๕
๔๑) นายณิศร ข้าเพชร	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๖
๔๒) นายอรรคพล นิยมวิทยาพันธ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๗
๔๓) นายภูวิช พรหมสะอาด	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๘
๔๔) นายณเดช โกศาพิพัฒน์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๘๙
๔๕) นายชวฤทธิ์ วงษ์จันทร์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๐
๔๖) นายอาทิตย์ ศรีเสน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๑
๔๗) นายเจตติพร คงศักดิ์ไทย	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๒
๔๘) นายจรัส บุญยั้ง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๕
๔๙) นายธนาณัติ เอนก	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๖
๕๐) นายอภิวัฒน์ ทุมหนู	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๗
๕๑) นางสาวสุภาขวัญ มาก	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๐๙๘
๕๒) นางสาวหัตพร ขวาลสมบูรณ์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๐
๕๓) นางสาวอติมา บุญเพ็ง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๑
๕๔) นางสาวกนกพร เข้มเพ็ชร	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๒
๕๕) นางสาวพัชรียา หงษ์สมิต	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๓
๕๖) นางสาวภาณุตา สุวงศ์ตระกูล	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๔
๕๗) นางสาวภาณุมาศ นามวัฒน์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๕
๕๘) นางสาวอุไรรัตน์ หึงสร้างแป้น	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๖
๕๙) นายธีรวัฒน์ ปวงสุข	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๗
๖๐) นายอิทธิพล ยะโส	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๘
๖๑) นายประพนธ์ วรรณชูชัย	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๐๙
๖๒) นายชยธร พงทิพย์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๑๐
๖๓) นางสาวกนกวรรณ จันทบาล	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๑๑
๖๔) นางสาวภาณุกร หลีกบุญ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๑๒
๖๕) นายสิทธิโชค ธงเงิน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๑๑๓
๖๖) นางสาววรรณใจ บุญ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๐๕
๖๗) นางสาวพรรณิศา ทุมคง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๐๘
๖๘) นางสาวศรณีย์ ยิ่งดี	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๐๙
๖๙) นายณภัทร ศรีวิริยะ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๑๐
๗๐) นายสุวิชา ทองอ่อน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๑๑
๗๑) นายวิญญู บุญตะนัย	ทะเบียนเลขที่ ๖-๒๐๔-๖-๗๕๑๓

(นายศิระ จันทร์เกิด)

๓๖) นายสมบูรณ์...

บริษัท เอนแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ผู้อำนวยการฝ่ายปฏิบัติการวิเคราะห์  
ผู้ดำเนินการทดสอบและควบคุมคุณภาพ



๗๒) นายสมบุญ บุตรจันทร์  
๗๓) นายวิรัตน์ ไชยชนะ  
๗๔) นายอนุเบศน์ เพิ่มพูน  
๗๕) นายจิรณัฐ ขาวละออ  
๗๖) นายสมโภช วันสา  
๗๗) นายอัสรี นามบุรี  
๗๘) นายณัฐนันท์ ปานประเสริฐ  
๗๙) นายอัครเดช จอสาว  
๘๐) นายประเสริฐ สุระชัย  
๘๑) นายบุญลุล จันทรเนียม  
๘๒) นายพิรพงษ์ ทองคุณปรีดา  
๘๓) นายณัฐพล ทองนุช  
๘๔) นายอนุวัฒน์ ม่วงแพร่  
๘๕) นายเจตศรวณ ปัตตะมะ  
๘๖) นายกฤษณะ สายวรรณ  
๘๗) นายพิชัย บุญยงค์  
๘๘) นายภาณุพงศ์ โยมางค์  
๘๙) นายสามารถ คุ้มปัส  
๙๐) นายสัญญา โกศรีนาม  
๙๑) นายณัฐวุฒิ ศรีประเสริฐ  
๙๒) นายชวัลชัย นาคพนม  
๙๓) นายพงศ์ธร ชัยทิพย์  
๙๔) ว่าที่ร้อยตรี ภาณุพงศ์ แสนศรี  
๙๕) นายสิทธิโชค ทาสีดา  
๙๖) นายอนากร อินสุตา  
๙๗) นางสาววรรณิษา ขาติวันชัย  
๙๘) นางสาวพิมพ์ตะวัน มีนาถ  
๙๙) นางสาวเพชรรัตน์ สิงห์สมบูรณ์  
๑๐๐) นางสาวชญานิษฐ์ พรหมจันทร์  
๑๐๑) นายกิตติ ทวีราช  
๑๐๒) นายจักริน หมั่นวิชา  
๑๐๓) นายฉัตรชัย สุขเปี้ย  
๑๐๔) นายณรรณท์ ต๊ะทองคำ  
๑๐๕) นายศุภพล สมนอก  
๑๐๖) นายทักษ์คณย์ อุบลศรี  
๑๐๗) นายธนศร นามะกุลณา  
๑๐๘) นายฉัตรพงศ์ บัวแดง

ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๒๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๓

(นายศิระ จันทรนิค)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเขียนแบบคหกรรม  
บัณฑิตวิทยาลัย มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

๑๐๙) นายณนทชัย...

๑๐๙) นายณนทชัย อุปัทม์  
๑๑๐) นายณัฐพล คุณสุทธิ  
๑๑๑) นายณัฏฐาณ สาริน  
๑๑๒) นายปิยะนัฐ พลมะศรี  
๑๑๓) นายพงศ์สิริ โสมเขียว  
๑๑๔) นายพิรพัฒน์ กำคำ  
๑๑๕) นายภาณุพงศ์ มานิตย์  
๑๑๖) นายมงคล ผลาพิทย์  
๑๑๗) นายณัฏฐ์ พูลศิริ  
๑๑๘) นายสิริรัตน์ ทองอิน  
๑๑๙) นายอเนชา หันสมัย  
๑๒๐) นายอดิศักดิ์ ผมไผ  
๑๒๑) นายอนันตชัย วิสม  
๑๒๒) นายณัฐดนัย เจือละออง  
๑๒๓) นายวรุณ ศิณี  
๑๒๔) นายแสงตะวัน นะตะสัด  
๑๒๕) นายบุษยพงศ์ รัตนะ  
๑๒๖) นายชัยณัฐ ไชยชนะ  
๑๒๗) นายวิศรุต ศรีธรรมมา  
๑๒๘) นายณนทกร เผือกผ่อง  
๑๒๙) นายกำชัย สุทธะ  
๑๓๐) นางสาวณัฐภรณ์ รักทะเล  
๑๓๑) นางสาวประภาภรณ์ บุตรพรม  
๑๓๒) นางสาวนิลาวัลย์ นามพรม  
๑๓๓) นางสาวพัชรินทร์ แสนสร้อย  
๑๓๔) นายไพโรจน์ เปี่ยมพินาย  
๑๓๕) นางสาวศุภมาส ทองมาก  
๑๓๖) นางสาวลลิตา จิตรสว่าง  
๑๓๗) นางสาวไข่มพร เล็กภูเขียว  
๑๓๘) นางสาวกฤติมาพร คำมีแก่น  
๑๓๙) นางสาวสกุลรัตน์ ภาณุภูมิ  
๑๔๐) นางสาวกาญจนา คงคุณ  
๑๔๑) นางสาวไพบรินทร์ ศรีรูปี  
๑๔๒) นางสาวทิพนคร ผุยปัญญา  
๑๔๓) นางสาวสาธิตา ปานทอง  
๑๔๔) นางสาวอริสา ทองนวล  
๑๔๕) นางสาวอริยา คำคล่อง

ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๐๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๒  
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ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๑๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๕  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๖  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๗  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๘  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๙  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๐  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๑  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๒  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๔

(นายศิระ จันทรนิค)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเขียนแบบคหกรรม  
บัณฑิตวิทยาลัย มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

๑๔๖) นางสาวสุภาภรณ์...



๑๔๖) นางสาวศุภรณ์ สุนทรสนาน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๓๕
๑๔๗) นางสาวสุวรรณ์ นนทประสาธ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๓๖
๑๔๘) นางสาวรัชนิกร เนียมกลาง	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๓๗
๑๔๙) นางสาวกัญญารัตน์ ศรีนิลหา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๓๘
๑๕๐) นางสาวอัญชลี คำจันทร์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๓๙
๑๕๑) นายบุญฤทธิ์ เอี่ยมเทศ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๐
๑๕๒) นายศิริวัฒน์ พานิชย์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๑
๑๕๓) นางสาวศุภรดา ปิ่นมยุรา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๒
๑๕๔) นางสาวพาดิ คุณนาน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๓
๑๕๕) นางสาวจิราเจต ทองคา	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๔
๑๕๖) นางสาวกนกภรณ์ อูระ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๕
๑๕๗) นางสาวอารยา มีชัย	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๖
๑๕๘) นางสาวจิตสุภา ประเทืองสุข	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๗
๑๕๙) นางสาวอริสา วิรัชดิธรรม	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๘
๑๖๐) นางสาววิษุตา นาคมจัญ	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๔๙
๑๖๑) นางสาวพนิดา ยอดอินทร์	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๕๐
๑๖๒) นางสาวนันทิยา จันทะสุน	ทะเบียนเลขที่ ๖-๒๐๔-๖-๑๒๕๑



(นายจิระ จันทรเจ็ด)

ผู้อำนวยการสำนักงานพิษวิทยา  
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษ  
ปฏิบัติการทางพิษวิทยา สำนักงานพิษวิทยา

เอกสารแนบท้ายหนังสือรับข้ออายัดขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑) ๑๐๖๕

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ขอข้ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๖๑ รายการ

น้ำเสีย จำนวน 59 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
6	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
7	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
8	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
9	δ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
10	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
11	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method <sup>[4]</sup> 2) 5-Day BOD Test, Membrane Electrode Method <sup>[4]</sup>
12	Carbaryl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
13	Carbofuran	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
15	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method <sup>[4]</sup> 2) Closed Reflux, Titrimetric Method <sup>[4]</sup>
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
17	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>
18	Color	ADMI Weighted-Ordinate Spectrophotometric Method

(นางริยาญจน์ ฉัตรสกุลวิไล)

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และทะเบียนห้องปฏิบัติการ

19 Copper...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(3)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(4)</sup> 2) Iodometric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
37	Hexavalent Chromium	Filtration, Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method <sup>(4)</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>


  
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 กรมควบคุมมลพิษ

44 Methomyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup> 2) Soxhlet Extraction Method <sup>(4)</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
49	pH	Electrometric Method <sup>(4)</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
52	Sulfide	Iodometric Method <sup>(4)</sup>
53	Temperature	Laboratory and Field Methods <sup>(4)</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>(4)</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>(4)</sup>
56	Total Suspended Solids	Dried at 103-105 °C <sup>(4)</sup>
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
59	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>

**น้ำเค็ม จำนวน 126 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

  
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3 Aldrin...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

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กรมควบคุมมลพิษ

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	Butyl Benzyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

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กรมควบคุมมลพิษ

34 Chromium (III)...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

51

cis-1,2-Dichloroethylene...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

68

Fluorene...

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กรมพิษวิทยาและพิษวิทยา



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

วิธีใหม่

84 Methanol...

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กรมควบคุมมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

วิธีใหม่

97 Pentachlorophenol...

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กรมควบคุมมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Direct Photometric Method <sup>(4)</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(13,24)</sup>
110	TPH (C <sub>9</sub> -C <sub>10</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>
111	TPH (C <sub>11</sub> -C <sub>35</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

วิมล

114 1,1,2-Trichloroethane...

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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

อากาศเสีย (ปล่องระบาย) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>


วิมล

3 Carbon Monoxide...

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กรมส่งเสริมการค้าระหว่างประเทศ




ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method <sup>[5]</sup> 2) Non-Dispersive Infrared Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) <sup>[5]</sup>
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[5]</sup> 2) Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
11	Opacity	Ringelmann's Method <sup>[2]</sup>
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[5]</sup> 2) Chemiluminescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) UV Fluorescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup>
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[5]</sup>
16	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>[5]</sup>

  
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 กรมควบคุมมลพิษ

สิ่งปลูกสร...

สิ่งปลูกสรหรือวัสดุที่ไม่ใช่แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>

  
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6 Cadmium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,19,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,6,15,17)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,6,16,17)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,15,17)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,17)</sup>
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1,6,17)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>

วิมล

(นางวิภาณูจน์ จัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิชาการวิเคราะห์มลพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ

11 Cobalt...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup>

วิมล

(นางวิภาณูจน์ จัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิชาการวิเคราะห์มลพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ

2) Soxhlet...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1,6,18)</sup>

วิธีวิเคราะห์

2) Waste Extraction...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(1,6,19)</sup> 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1,6,20)</sup> 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(18)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(19)</sup> 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
25	Molybdenum	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>


วิธีวิเคราะห์

27 Polychlorinated...

(นางริภาญจน์ ฉัตรสกุลวิไล)


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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,23)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>

  
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28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
29	pH	Electrometric Method <sup>(29,30)</sup>
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>

  
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4) Digestion...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup> 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(11,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(11,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>

วิภาณี  
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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

9 Benz(a)anthracene....

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
13	Benzoic acid	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
15	Benzo(g,h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(12,24)</sup>
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>

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26 Carbon tetrachloride...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,15,17)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,17)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(26,27,28)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>

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40 DDE...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>

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57 Dieldrin...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>

71 Hexachlorobenzene...  
(นางริกาญจน์ อัครสกุลวิไล)  
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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
74	α-HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
75	β-HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
76	γ-HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(18)</sup>

2) Thermal...  
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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
		2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>[19]</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[20]</sup> Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[12,24]</sup>
84	Methanol	
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,23]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[23,32]</sup>

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- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6'-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5',6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

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และประเมินผลกระทบต่อสุขภาพ

101 Selenium...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
108	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
109	TPH (C <sub>8</sub> -C <sub>16</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(21,31)</sup>
110	TPH (C <sub>16</sub> - C <sub>35</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(21,31)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>

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116 2,4,6-Trichlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>

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
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
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(นางริกาญจน์ ฉัตรสกุลวิไล)  
ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และระเบียบวิธีปฏิบัติการ

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและระเบียบวิธีปฏิบัติการ กองวิจัยและพัฒนายืมเล็งโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๐๒ ๔๐๐๒, ๔๑๔๖



ที่ อก ๐๓๑๐(๑)/ ๕.๓.๗.๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๙ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สดแทนที่เลขที่ ๑๐๔ ขอพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๙ ราย

- ๑) นายนคร สุขเจริญ
- ๒) นายบัญชา นามเขตต์
- ๓) นายอรรถพล นิยมวิทยาพันธ์
- ๔) นางสาวพัชรียา หงษ์สมิต
- ๕) นางสาวภาณุศา สุรวงศ์ตระกูล
- ๖) นางสาวศรัณย์ ยิ่งดี
- ๗) นายสมโภช วันสา
- ๘) นายณัฐนันท์ ปานประเสริฐ
- ๙) ว่าที่ร้อยตรีภาณุพงศ์ แสนศรี
- ๑๐) นายมนันท์ พูลศิริ
- ๑๑) นายณัฐดนัย เจือละออง
- ๑๒) นางสาวภาณุจนา คงคุณ
- ๑๓) นางสาววิชนกร เนียมกลาง
- ๑๔) นางสาวกัญญารัตน์ ศรีนิลทา
- ๑๕) นายศิริวัฒน์ พานิชย์
- ๑๖) นางสาวกนกภรณ์ อูระ
- ๑๗) นางสาวจิตสุภา ประเทืองสุข
- ๑๘) นางสาวอริสา วิริยขันติธรรม
- ๑๙) นางสาวพนิดา ยอดอินทร์

- ทะเบียนเลขที่ ๖-๒๐๔-จ-๖๑๒๒
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๖๑๒๓
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๐๘๗
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๑๐๓
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๑๐๔
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๐๔
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๔
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๔
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๓๖
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๘๖๐๒
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๘๖๐๗
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๒๔
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๒๗
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๓๘
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๔๑
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๔๕
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๔๗
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๔๘
- ทะเบียนเลขที่ ๖-๒๐๔-จ-๙๒๕๐

๒. ให้เพิ่มเจ้าหน้าที่...

-๒-

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- |                             |                            |
|-----------------------------|----------------------------|
| ๑) นายกาจบัณฑิต กิตติคุณชัย | ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๐๑ |
| ๒) นายภัทรพล สว่างใจธรรม    | ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๐๒ |
| ๓) นายนราธิป เทือกชัยคำ     | ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๐๓ |
| ๔) นายศิริโชค พงษ์ประสม     | ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๐๔ |
| ๕) นายณัฐวุฒิ ค้างแพง       | ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๐๕ |

อนึ่ง หนังสือฉบับนี้จะมีผลอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๔ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ทำหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางริกาญจน์ ฉัตรสกุลวิไล)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการสารสนเทศ

ผู้อำนวยการกองวิจัยและเคลื่อนย้ายมลพิษโรงงาน

ปฏิบัติการการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเคลื่อนย้ายมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



อุตสาหกรรมสีเขียว ๖ ประการของกระทรวงอุตสาหกรรมและพลังงาน





ที่อก ๐๓๑๐(๑)/ ๖ ๑๒ ๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๓ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๕ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จากเดิม นางสาวสรวิศ มงคลจิรัฐ ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๓๙๔ เป็น นางสาวธัญญธร มงคลจิรัฐ ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๓๙๔

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม คำทรงษ์)

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติการแผนอำนวยการกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๕๙๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



อุตสาหกรรมสีเขียว ๑ ประสิทธิภาพ ๑ แรงงาน ๑ ชุมชน ๑ สิ่งแวดล้อม ๑ อุตสาหกรรมสีเขียว



คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

แบบ ปอ.1

วันที่ 4 เดือน สิงหาคม พ.ศ. 2566

ข้าพเจ้า ( ) ผู้รับใบอนุญาตประกอบกิจการโรงงาน

( ✓ ) บริษัท/ห้างหุ้นส่วนจำกัด เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

ตั้งอยู่ที่เลขที่ 104 หมู่ที่ - ต.รอก/ซอย พัฒนาการ 40

ถนน พัฒนาการ ตำบล/แขวง พัฒนาการ

อำเภอ/เขต สวนหลวง จังหวัด กรุงเทพมหานคร รหัสไปรษณีย์ 10250

โทรศัพท์ 02 760-3040 โทรสาร 0 2 760-3197

ได้รับทราบระเบียบกรมโรงงานอุตสาหกรรมว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ. 2560 โดยตลอดแล้วและยินยอม

ปฏิบัติตามระเบียบฯทุกประการ และได้แนบเอกสารต่างๆ ตามรายการเอกสารประกอบการพิจารณา (แบบ ปอ.1-1) มาพร้อมนี้

รายการขอดำเนินการ

การดำเนินการ	รายละเอียด (รายการ)				
	น้ำเสีย/น้ำทิ้ง	น้ำใต้ดิน	อากาศเสีย	สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว	ดิน
[ ] ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน					
[ ✓ ] ต่ออายุห้องปฏิบัติการวิเคราะห์เอกชน	59	126	16	35	125
[ ✓ ] เปลี่ยนแปลงสารมลพิษที่วิเคราะห์ ( ✓ ) เพิ่มสารมลพิษ ( ) ยกเลิกสารมลพิษ	-	-	12	-	-
[ ✓ ] เปลี่ยนแปลงบุคลากร ( ✓ ) เพิ่มบุคลากร ( ✓ ) ยกเลิกบุคลากร	จำนวน 38 ราย (รายละเอียดตาม แบบ ปว.1) จำนวน 2 ราย (รายละเอียดตาม แบบ ปว.1)				
[ ] ยกเลิกห้องปฏิบัติการวิเคราะห์เอกชน					
[ ] อื่นๆ โปรดระบุ					

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ  
วันที่ ๔ สิงหาคม ๒๕๖๖  
วันที่ ๗ สิงหาคม ๒๕๖๖  
เวลา ๑๓.๐๐ น.

จึงเรียนมาเพื่อโปรดพิจารณา

ลงชื่อ  
เพื่อโปรดพิจารณา

(นายประสม คำทรงษ์)  
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน

ALS Laboratory Group  
(Thailand) Co., Ltd.



ลงชื่อ  
(นางทัศนีย์ เลหากุลพร)  
ผู้อำนวยการงานเทคนิค  
ประทับตรา (ถ้ามี)

F-ED-LR-01- 1/1





บริษัท เอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด (สำนักงานใหญ่)

104 ซอยพัฒนาการ 40 ถนนพัฒนาการ

แขวงพัฒนาการ เขตสวนหลวง กรุงเทพฯ 10250

ติดต่อเรา

