

ภาคผนวก จ

มาตรฐานคุณภาพสิ่งแวดล้อมที่เกี่ยวข้อง

ภาคผนวก จ-1

ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 24 (พ.ศ. 2547)
เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป
ประกาศในราชกิจจานุเบกษา เล่ม 121 ตอนพิเศษ 104 ง วันที่ 22
กันยายน พ.ศ. 2547





ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ
ฉบับที่ ๒๔ (พ.ศ. ๒๕๔๗)
เรื่อง กำหนดมาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไป

อาศัยอำนาจตามความในมาตรา ๓๒ และมาตรา ๓๔ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจำกัดสิทธิและเสรีภาพของบุคคล ซึ่งมาตรา ๒๙ ประกอบกับมาตรา ๓๕ มาตรา ๔๘ มาตรา ๕๐ และมาตรา ๕๑ ของรัฐธรรมนูญแห่งราชอาณาจักรไทยบัญญัติให้กระทำได้โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย คณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงได้มีมติในคราวการประชุมครั้งที่ ๒/๒๕๔๗ เมื่อวันที่ ๒๔ กุมภาพันธ์ ๒๕๔๗ 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 ๐.๓๐ มิลลิกรัมต่อลูกบาศก์เมตร และค่ามัธยฐานเลขคณิต (Arithmetic Mean) ในเวลา ๑ ปี จะต้องไม่เกิน ๐.๐๔ 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) ค่าเฉลี่ยของฝุ่นละอองรวมหรือฝุ่นละอองขนาดไม่เกิน ๑๐๐ ไมครอน ในเวลา ๒๔ ชั่วโมง จะต้องไม่เกิน ๐.๓๓ มิลลิกรัมต่อลูกบาศก์เมตร และค่ามัธยฐานเลขคณิต (Arithmetic Mean) ในเวลา ๑ ปี จะต้องไม่เกิน ๐.๑๐ มิลลิกรัมต่อลูกบาศก์เมตร”

ประกาศ ณ วันที่ ๙ สิงหาคม พ.ศ. ๒๕๔๗

(ลงนาม) จาตุรนต์ ฉายแสง

(นายจาตุรนต์ ฉายแสง)

รองนายกรัฐมนตรี

ปฏิบัติหน้าที่ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ราชกิจจานุเบกษา ฉบับประกาศทั่วไป เล่ม ๑๒๑ ตอนพิเศษ ๑๐๔ ง วันที่ ๒๒ กันยายน ๒๕๔๗

ภาคผนวก จ-2

ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 15 (พ.ศ. 2540)
เรื่อง กำหนดมาตรฐานระดับเสียงโดยทั่วไป
ประกาศในราชกิจจานุเบกษา เล่ม 114 ตอนที่ 27 ง
วันที่ 3 เมษายน พ.ศ. 2540





ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๑๕ (พ.ศ. ๒๕๔๐)

เรื่อง กำหนดมาตรฐานระดับเสียงโดยทั่วไป

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

ข้อ ๑ ในประกาศนี้

“ระดับเสียงโดยทั่วไป” หมายความว่า ระดับเสียงที่เกิดขึ้นในสิ่งแวดล้อม

“ค่าระดับเสียงสูงสุด” หมายความว่า ค่าระดับเสียงสูงสุดที่เกิดขึ้นในขณะใดขณะหนึ่งระหว่างการตรวจวัดระดับเสียง โดยมีหน่วยเป็นเดซิเบลเอ หรือ dB (A)

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

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

ข้อ ๒ ให้กำหนดมาตรฐานระดับเสียงโดยทั่วไป ไว้ดังต่อไปนี้

(๑) ค่าระดับเสียงสูงสุด ไม่เกิน ๑๑๕ เดซิเบลเอ

(๒) ค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง ไม่เกิน ๙๐ เดซิเบลเอ

ข้อ ๓ การตรวจวัดระดับเสียงโดยทั่วไป ให้ดำเนินการดังต่อไปนี้

(๑) การตรวจวัดค่าระดับเสียงสูงสุด ให้ใช้มาตรระดับเสียงตรวจวัดระดับเสียงในบริเวณที่มีคนอยู่หรืออาศัยอยู่

(๒) การตรวจวัดค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง ให้ใช้มาตรระดับเสียงตรวจวัดระดับเสียงอย่างต่อเนื่องตลอดเวลา ๒๔ ชั่วโมงใดๆ

(๓) การตั้งไมโครโฟนของมาตรระดับเสียงที่บริเวณภายนอกอาคารให้ตั้งสูงจากพื้นไม่น้อยกว่า ๑.๒๐ เมตร โดยในรัศมี ๓.๕๐ เมตร ตามแนวราบรอบไมโครโฟนต้องไม่มีกำแพงหรือสิ่งอื่นใดที่มีคุณสมบัติในการสะท้อนเสียงกีดขวางอยู่

(๔) การตั้งไมโครโฟนของมาตรระดับเสียงที่บริเวณภายในอาคารให้ตั้งสูงจากพื้นไม่น้อยกว่า ๑.๒๐ เมตร โดยในรัศมี ๑.๐๐ เมตร ตามแนวราบรอบไมโครโฟนต้องไม่มีกำแพงหรือสิ่งอื่นใดที่มีคุณสมบัติในการสะท้อนเสียงกีดขวางอยู่และต้องห่างจากช่องหน้าต่างหรือช่องทางที่เปิดออกนอกอาคารอย่างน้อย ๑.๕๐ เมตร

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

ประกาศ ณ วันที่ ๑๒ มีนาคม พ.ศ. ๒๕๔๐

พลเอก ชวลิต ยงใจยุทธ

นายกรัฐมนตรี

ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

(ประกาศในราชกิจจานุเบกษา เล่ม ๑๑๔ ตอนที่ ๒๓ ง วันที่ ๓ เมษายน ๒๕๔๐)

ภาคผนวก จ-3

ประกาศกระทรวงอุตสาหกรรม เรื่อง กำหนดค่าระดับเสียงการรบกวน
และระดับเสียงที่เกิดจากการประกอบกิจการโรงงาน พ.ศ. 2548
ประกาศในราชกิจจานุเบกษา เล่ม 123 ตอนพิเศษ 11 ง
วันที่ 25 มกราคม พ.ศ. 2549



ประกาศกระทรวงอุตสาหกรรม

เรื่อง กำหนดค่าระดับเสียงการรบกวนและระดับเสียงที่เกิดจากการประกอบกิจการโรงงาน

พ.ศ. ๒๕๔๘

อาศัยอำนาจตามความในข้อ ๑๓ แห่งกฎกระทรวง ฉบับที่ ๒ (พ.ศ. ๒๕๓๕) ออกตามความในพระราชบัญญัติโรงงาน พ.ศ. ๒๕๓๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจำกัดสิทธิและเสรีภาพของบุคคล ซึ่งมาตรา ๒๕ ประกอบกับมาตรา ๓๕ มาตรา ๔๘ และมาตรา ๕๐ ของรัฐธรรมนูญแห่งราชอาณาจักรไทย บัญญัติให้กระทำได้โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย รัฐมนตรีว่าการกระทรวงอุตสาหกรรมจึงได้ออกประกาศไว้ ดังต่อไปนี้

ข้อ ๑ ในประกาศนี้

“เสียงรบกวน” หมายความว่า ระดับเสียงตรวจวัดนอกบริเวณโรงงาน ที่เกิดจากการประกอบกิจการโรงงาน ขณะมีการรบกวน ซึ่งมีระดับเสียงสูงกว่าระดับเสียงพื้นฐาน และมีระดับการรบกวนเกินกว่าค่าที่กำหนดไว้ในประกาศนี้

“ระดับเสียงพื้นฐาน” หมายความว่า ระดับเสียงที่ตรวจวัดในสิ่งแวดล้อมเดิม ขณะยังไม่มีเสียงรบกวนจากการประกอบกิจการโรงงานเป็นระดับเสียงเปอร์เซ็นต์ไทล์ที่ ๙๐ (Percentile Level 90, L_{90})

“ระดับเสียงเปอร์เซ็นต์ไทล์ที่ ๙๐ (L_{90})” หมายความว่า ระดับเสียงที่ร้อยละ ๙๐ ของเวลาที่ตรวจวัดจะมีระดับเสียงเกินระดับนี้

“ระดับเสียงขณะมีการรบกวน” หมายความว่า ระดับเสียงที่ตรวจวัดหรือคำนวณจากการประกอบกิจการโรงงานขณะเกิดเสียงรบกวน

“ระดับการรบกวน” หมายความว่า ระดับความแตกต่างของระดับเสียงขณะมีการรบกวนกับระดับเสียงพื้นฐาน

“ระดับเสียงเฉลี่ย ๒๔ ชั่วโมง” หมายความว่า ระดับเสียงคงที่นอกบริเวณโรงงานที่มีพลังงานเทียบเท่าระดับเสียงที่เกิดขึ้นจริง ซึ่งมีระดับเสียงเปลี่ยนแปลงตามเวลาในช่วง ๒๔ ชั่วโมง (24 hours A-weighted Equivalent Continuous Sound Level) ซึ่งเรียกโดยย่อว่า Leq 24 hr โดยมีหน่วยเป็นเดซิเบลเอ หรือ dB(A)

“ระดับเสียงสูงสุด” หมายความว่า ระดับเสียงสูงสุดนอกบริเวณโรงงาน ที่เกิดขึ้นในขณะใดขณะหนึ่ง ระหว่างการตรวจวัดระดับเสียง โดยมีหน่วยเป็นเดซิเบลเอ หรือ dB(A)

“มาตรฐานระดับเสียง” หมายความว่า เครื่องวัดระดับเสียงตามมาตรฐาน IEC 60804 หรือ IEC 61672 ของคณะกรรมการระหว่างประเทศว่าด้วยเทคนิคไฟฟ้า (International Electrotechnical Commission , IEC)

ข้อ ๒ ค่าระดับการรบกวน ที่เกิดจากการประกอบกิจการโรงงาน ไม่เกิน ๑๐ เดซิเบลเอ

ข้อ ๓ ค่าระดับเสียงเฉลี่ย ๒๔ ชั่วโมง ที่เกิดจากการประกอบกิจการโรงงาน ไม่เกิน ๗๐ เดซิเบลเอ

ข้อ ๔ ค่าระดับเสียงสูงสุด ที่เกิดจากการประกอบกิจการโรงงาน ไม่เกิน ๑๑๕ เดซิเบลเอ

ข้อ ๕ วิธีการตรวจวัดระดับเสียงการรบกวน ระดับเสียงเฉลี่ย ๒๔ ชั่วโมง และระดับเสียงสูงสุด ที่เกิดจากการประกอบกิจการโรงงาน ให้เป็นไปตามที่กรมโรงงานอุตสาหกรรมกำหนด

ทั้งนี้ ให้ใช้บังคับตั้งแต่วันถัดจากวันประกาศในราชกิจจานุเบกษาเป็นต้นไป

ประกาศ ณ วันที่ ๒๗ ธันวาคม พ.ศ. ๒๕๔๔

สุริยะ จึงรุ่งเรืองกิจ

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

ภาคผนวก จ-4

ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 29 (พ.ศ. 2550)
เรื่อง ค่าระดับเสียงรบกวน ประกาศในราชกิจจานุเบกษา เล่ม 124
ตอนพิเศษ 98 ง วันที่ 16 สิงหาคม พ.ศ. 2550



ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๒๕ (พ.ศ. ๒๕๕๐)

เรื่อง ค่าระดับเสียงรบกวน

โดยที่เป็นการสมควร ปรับปรุงค่ามาตรฐานระดับเสียงรบกวน ให้เหมาะสมกับกฎเกณฑ์และหลักฐานทางวิทยาศาสตร์ โดยคำนึงถึงความเป็นไปได้ในเชิงเศรษฐกิจสังคมและเทคโนโลยีที่เกี่ยวข้อง อาศัยอำนาจตามความในมาตรา ๓๔ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ และคำสั่งสำนักนายกรัฐมนตรี ที่ ๑๑/๒๕๕๐ คณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงออกประกาศกำหนดค่าระดับเสียงรบกวน ไว้ดังต่อไปนี้

ข้อ ๑ ให้ยกเลิกประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ ๑๓ (พ.ศ. ๒๕๔๓) ลงวันที่ ๖ มิถุนายน ๒๕๔๓ เรื่อง ค่าระดับเสียงรบกวน

ข้อ ๒ ให้กำหนดระดับเสียงรบกวนเท่ากับ ๑๐ เดซิเบลเอ

หากระดับการรบกวนที่คำนวณได้มีค่ามากกว่าระดับเสียงรบกวนตามวรรคแรก ให้ถือว่าเป็นเสียงรบกวน

ข้อ ๓ วิธีการตรวจวัดระดับเสียงพื้นฐาน ระดับเสียงขณะไม่มีการรบกวน การตรวจวัด และคำนวณระดับเสียงขณะมีการรบกวน การคำนวณค่าระดับการรบกวน และแบบบันทึกการตรวจวัดเสียงรบกวนให้เป็นไปตามที่ คณะกรรมการควบคุมมลพิษประกาศในราชกิจจานุเบกษา

ประกาศ ณ วันที่ ๒๕ มิถุนายน พ.ศ. ๒๕๕๐

โสมิต ปิ่นเปี่ยมรัชฎ์

รองนายกรัฐมนตรี

ประธานกรรมการสิ่งแวดล้อมแห่งชาติ

ภาคผนวก จ-5

ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 8 (พ.ศ. 2537)
ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพ
สิ่งแวดล้อมแห่งชาติ พ.ศ. 2535
เรื่อง กำหนดมาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน
ประกาศในราชกิจจานุเบกษา เล่ม 111 ตอนที่ 16 ง
วันที่ 24 กุมภาพันธ์ พ.ศ. 2537
(แหล่งน้ำประเภทที่ 3)





ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ

ฉบับที่ ๘ (พ.ศ. ๒๕๓๗)

ออกตามความในพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ

พ.ศ. ๒๕๓๕

เรื่อง กำหนดมาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน

อาศัยอำนาจตามความในมาตรา ๓๒ (๑) แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ คณะกรรมการสิ่งแวดล้อมแห่งชาติประกาศกำหนดมาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน ไว้ดังต่อไปนี้

หมวด ๑

บททั่วไป

ข้อ ๑ ในประกาศนี้

“แหล่งน้ำผิวดิน” หมายถึง แม่น้ำ ลำคลอง หนอง บึง ทะเลสาบ อ่างเก็บน้ำ และแหล่งน้ำสาธารณะอื่นๆ ที่อยู่ภายในพื้นแผ่นดิน ซึ่งหมายความรวมถึงแหล่งน้ำสาธารณะที่อยู่ภายในพื้นแผ่นดินบนเกาะด้วย แต่ไม่รวมถึงน้ำบาดาล และในกรณีที่แหล่งน้ำนั้นอยู่ติดกับทะเลให้หมายความถึงแหล่งน้ำที่อยู่ในปากแม่น้ำหรือปากทะเลสาบ

ปากแม่น้ำและปากทะเลสาบให้ถือแนวเขตตามที่กรมเจ้าท่ากำหนด

หมวด ๒

ประเภทและมาตรฐานคุณภาพน้ำในแหล่งน้ำผิวดิน

ข้อ ๒ ให้แบ่งแหล่งน้ำผิวดินออกเป็น ๕ ประเภทคือ แหล่งน้ำประเภทที่ ๑ แหล่งน้ำประเภทที่ ๒ แหล่งน้ำประเภทที่ ๓ แหล่งน้ำประเภทที่ ๔ และแหล่งน้ำประเภทที่ ๕

(๑) แหล่งน้ำประเภทที่ ๑ ได้แก่ แหล่งน้ำที่คุณภาพน้ำมีสภาพตามธรรมชาติโดยปราศจากน้ำทิ้งจากกิจกรรมทุกประเภทและสามารถเป็นประโยชน์เพื่อ

(ก) การอุปโภคและบริโภคโดยต้องผ่านการฆ่าเชื้อโรคตามปกติก่อน

(ข) การขยายพันธุ์ตามธรรมชาติของสิ่งมีชีวิตระดับพื้นฐาน

(ค) การอนุรักษ์ระบบนิเวศน์ของแหล่งน้ำ

(๒) แหล่งน้ำประเภทที่ ๒ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ

(ก) การอุปโภคและบริโภคโดยต้องผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำทั่วไปก่อน

(ข) การอนุรักษ์สัตว์น้ำ

(ค) การประมง

(ง) การว่ายน้ำและกีฬาทางน้ำ

(๓) แหล่งน้ำประเภทที่ ๓ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ

(ก) การอุปโภคและบริโภคโดยต้องผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำทั่วไปก่อน

(ข) การเกษตร

(๔) แหล่งน้ำประเภทที่ ๔ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภทและสามารถเป็นประโยชน์เพื่อ

(ก) การอุปโภคและบริโภคโดยต้องผ่านการฆ่าเชื้อโรคตามปกติและผ่านกระบวนการปรับปรุงคุณภาพน้ำเป็นพิเศษก่อน

(ข) การอุตสาหกรรม

(๕) แหล่งน้ำประเภทที่ ๕ ได้แก่ แหล่งน้ำที่ได้รับน้ำทิ้งจากกิจกรรมบางประเภท และสามารถเป็นประโยชน์เพื่อการคมนาคม

ข้อ ๓ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๑ ต้องมีสภาพตามธรรมชาติ และสามารถใช้ประโยชน์ได้ตามข้อ ๒ (๑)

ข้อ ๔ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๒ ต้องมีมาตรฐานดังต่อไปนี้

(๑) ไม่มีวัตถุหรือสิ่งของที่เกิดจากการกระทำของมนุษย์ซึ่งจะทำให้ สี กลิ่น และรสของน้ำเปลี่ยนไปตามธรรมชาติ

(๒) อุณหภูมิ (Temperature) ไม่สูงกว่าอุณหภูมิตามธรรมชาติเกิน 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) แบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม (Fecal Coliform Bacteria) มีค่าไม่เกินกว่า ๑,๐๐๐ เอ็ม.พี.เอ็น. ต่อ ๑๐๐ มิลลิลิตร

(๘) ไนเตรต (NO_3) ในหน่วยไนโตรเจน มีค่าไม่เกินกว่า ๕.๐ มิลลิกรัมต่อลิตร

(๙) แอมโมเนีย (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 CaCO_3 ไม่เกินกว่า ๑๐๐ มิลลิกรัมต่อลิตร มีค่าไม่เกินกว่า ๐.๐๐๕ มิลลิกรัมต่อลิตร และในน้ำที่มีความกระด้างในรูปของ CaCO_3 เกินกว่า ๑๐๐ มิลลิกรัมต่อลิตร มีค่าไม่เกินกว่า ๐.๐๕ มิลลิกรัมต่อลิตร

(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 ๑.๐ ไมโครกรัมต่อลิตร

(๒๔) บีเอชซีชนิดแอลฟา (Alpha-BHC) มีค่าไม่เกินกว่า ๐.๐๒ ไมโครกรัมต่อลิตร

(๒๕) ดิลดริน (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 เว้นแต่

(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

(๒) บีโอดี มีค่าไม่เกินกว่า ๔.๐ มิลลิกรัมต่อลิตร

ข้อ ๙ คุณภาพน้ำในแหล่งน้ำประเภทที่ ๕ ต้องมีมาตรฐานต่ำกว่าคุณภาพน้ำ ในแหล่งน้ำประเภทที่ ๔

ข้อ ๙ การกำหนดให้แหล่งน้ำผิวดินแหล่งใดแหล่งหนึ่งเป็นประเภทใดตามข้อ ๒ ให้เป็นไปตามที่กรมควบคุมมลพิษประกาศในราชกิจจานุเบกษา

หมวด ๓

วิธีการเก็บตัวอย่างและตรวจสอบคุณภาพน้ำในแหล่งน้ำผิวดิน

ข้อ ๕ การเก็บตัวอย่างน้ำเพื่อตรวจสอบคุณภาพตามข้อ ๓ ถึง ข้อ ๙ ให้ใช้วิธีการดังต่อไปนี้

(๑) แหล่งน้ำไหล ซึ่งได้แก่ แม่น้ำ ลำคลอง เป็นต้น ให้เก็บที่จุดกึ่งกลางความกว้างของแหล่งน้ำที่ระดับกึ่งกลางความลึก ณ จุดตรวจสอบ เว้นแต่แบบที่เรียกกลุ่มโคลิฟอร์มทั้งหมดและแบบที่เรียกกลุ่มฟีคอลโคลิฟอร์ม 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 เว้นแต่แบบที่เรียกกลุ่มโคลิฟอร์มทั้งหมดและแบบที่เรียกกลุ่มฟีคอลโคลิฟอร์ม ให้เก็บที่ระดับความลึก ๓๐ เซนติเมตร ณ จุดตรวจสอบ

จุดตรวจสอบตาม (๑) และ (๒) ของแหล่งน้ำที่กำหนดตามข้อ ๘ ให้เป็นไปตามที่กรมควบคุมมลพิษกำหนด

ข้อ ๑๐ การตรวจสอบคุณภาพน้ำตามข้อ ๓ ถึงข้อ ๙ ให้ใช้วิธีการดังต่อไปนี้

(๑) การตรวจสอบอุณหภูมิ ให้ใช้เครื่องวัดอุณหภูมิ (Thermometer) วัดขณะทำการเก็บตัวอย่างน้ำ

(๒) การตรวจสอบค่าความเป็นกรดและด่าง ให้ใช้เครื่องวัดความเป็นกรดและด่างของน้ำ (pH meter) ตามวิธีการหาค่าแบบอิเล็กโตรเมตริก (Electrometric)

(๓) การตรวจสอบค่าออกซิเจนละลาย ให้ใช้วิธีอะไซด์โมดิฟิเคชัน (Azide Modification)

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

(๕) การตรวจสอบค่าแบคทีเรียกลุ่มโคลิฟอร์มทั้งหมดและค่าแบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม ให้ใช้วิธีมัลติเพิล ทิวบ์ เฟอร์เมนเตชัน เทคนิค (Multiple Tube Fermentation Technique)

(๖) การตรวจสอบค่าไนเตรตในหน่วยไนโตรเจน ให้ใช้วิธีแคดเมียมรีดักชัน (Cadmium Reduction)

(๗) การตรวจสอบค่าแอมโมเนียในหน่วยไนโตรเจน ให้ใช้วิธีดิสทิลเลชัน เนสสเลอร์ไรเซชัน (Distillation Nesslerization)

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

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

(๑๐) การตรวจสอบค่าปรอททั้งหมด ให้ใช้วิธีอะตอมมิก แอ็บซอร์ปชัน คอลด์ เวปอร์ เทคนิค (Atomic Absorption-Cold Vapour Technique)

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

(๑๒) การตรวจสอบค่าไซยาไนด์ ให้ใช้วิธีไพรีดิน บาร์บิตูริก แอซิด (Pyridine - Barbituric Acid)

(๑๓) การตรวจสอบค่ากัมมันตภาพรังสี ให้ใช้วิธีโลว์ แบ็กกราวนด์ พร็อพพอร์ชันนอล เคาน์เตอร์ (Low Background Proportional Counter)

(๑๔) การตรวจค่าสารฆ่าศัตรูพืชและสัตว์ชนิดที่มีคลอรีนทั้งหมด ดีดีที บีเอชซีชนิดแอลฟา ดีลดริน อัลดริน เฮปตาคลอโรอีพอกไซด์ และเอนดริน ให้ใช้วิธีแก๊ส - โครมาโตกราฟี (Gas - Chromatography)

ข้อ ๑๑ การตรวจสอบค่าออกซิเจนละลายให้ใช้ค่าเปอร์เซ็นต์ไทล์ที่ ๒๐ (20th Percentile Value) ส่วนการตรวจสอบค่าบีไอดี แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด และแบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม ให้ใช้ค่าเปอร์เซ็นต์ไทล์ที่ ๘๐ โดยจำนวนและระยะเวลาสำหรับการเก็บตัวอย่างน้ำดังกล่าว ให้เป็นไปตามที่กรมควบคุมมลพิษกำหนด

ข้อ ๑๒ การเก็บตัวอย่างน้ำตามข้อ ๕ 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. ๒๕๓๗

ชวน หลีกภัย

นายกรัฐมนตรี

ประธานคณะกรรมการสิ่งแวดล้อมแห่งชาติ

(ประกาศในราชกิจจานุเบกษา เล่ม ๑๑๑ ตอนที่ ๑๖ ง วันที่ ๒๔ กุมภาพันธ์ ๒๕๓๗)

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

CERTIFICATE OF CALIBRATION

Certificate No. : COF-013-67

MEASUREMENT ITEM

MANUFACTURER : Top Load Office
MODEL/TYPE : TISCH
SERIAL NUMBER : TE-5028A
ID NUMBER : 2926
CONDITION AS-RECEIVED :
CUSTOMER : Integrated Research Center Company Limited,
122 Moo 2, Thatoom, Srirachaphote,
Prachinburi 25140, Thailand.

RECEIVED DATE : 10 May 2024
MEASUREMENT DATE : 05 Jun 2024
ISSUE DATE : 06 Jun 2024

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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 22.9 °C and 53.2 %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.

Calibrated by:

☒ Mr. Sorawit Thachalaad
☐ Miss Jitragorn Lertsomphol

Approved signatory:

Mr. Pannya Booncharoen
Calibration Department Manager



(Signature)

Continuation of Certificate of Calibration Number COF-013-67

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Δp_meter mmHg	Δp_orifice InH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.703	754.942	22.82	22.17	58.515	1.094	1.046	0.651
2	1.001	754.951	22.99	22.44	44.435	2.340	1.530	0.944
3	1.117	754.835	23.23	22.73	38.752	2.948	1.716	1.060
4	1.170	754.975	23.31	22.88	35.376	3.257	1.804	1.116
5	1.411	755.078	23.55	23.13	24.261	4.921	2.216	1.365

Slope (m): 1.63522

Intercept (b): -0.01711

Correlation coefficient (r): 0.99975

Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Δp_meter mmHg	Δp_orifice InH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.703	754.942	22.82	22.17	58.515	1.094	0.655	0.650
2	1.001	754.951	22.99	22.44	44.435	2.340	0.958	0.944
3	1.117	754.835	23.23	22.73	38.752	2.948	1.076	1.061
4	1.170	754.975	23.31	22.88	35.376	3.257	1.131	1.117
5	1.411	755.078	23.55	23.13	24.261	4.921	1.391	1.367

Slope (m): 1.02416

Intercept (b): -0.01068

Correlation coefficient (r): 0.99975

Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration





Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01243398
Model:	BSA224S-CW	Issued Date:	06 November 2024
Serial No. (or ID.):	34490341	Job No.:	WO-00047130
Manufacturer:	Sartorius	Page:	1 of 2

Certificate No.: C01243398

Issued Date: 06 November 2024

Job No.: WO-00047130

Page: 1 of 2

Condition: In condition

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:

Temperature	24 °C	± 0.4 °C
Humidity	60 %RH	± 3.3 %RH

Calibration Place:
Double A (1991) Public Company Limited,
(Water Laboratory IP1 (Balance Room))
1 Moo 2, Thatoom, Sriramahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Pivapat Saidoung

Calibration Date: 30 October 2024

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02231944

(Mr. Piyapat Saiduong)

Authorized signatory

This certificate is issued 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.

บริษัท ดีเคเอส อีทีเอ จำกัด
DKSH Technology Limited
2533 หมู่บ้านมิตรไมตรี ถนนสุขุมวิท 101/10
2533 Sukhumvit Road, Bangkok, Phra Khanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.cabral@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022



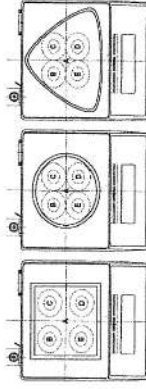
Certificate No.: C01243398

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be $1/3$ or $1/2$ of Maximum capacity, taken from the center of the pan as a zero reference.



Reference Points (g)				
A	B	C	D	E
-	0.0001	0.0001	-0.0001	-0.0001

Repeatability: Determination of the standard deviation of weighing balance. Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Error of indication from nominal or conventional mass value., Readability	0.0001	(g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.1	0.10001	0.1000	0.0000	0.00011	2.04
0.2	0.20001	0.2000	0.0000	0.00011	2.04
0.5	0.50001	0.5000	0.0000	0.00011	2.04
1	1.00001	1.0000	0.0000	0.00011	2.04
2	2.00002	2.0000	0.0000	0.00011	2.04
5	5.00002	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	20.00001	20.0000	0.0000	0.00012	2.03
50	50.00001	50.0000	0.0000	0.00013	2.02
100	100.00003	100.0000	0.0000	0.00017	2.01
200	200.00000	200.0000	0.0000	0.00030	2.00

The End of Certificate

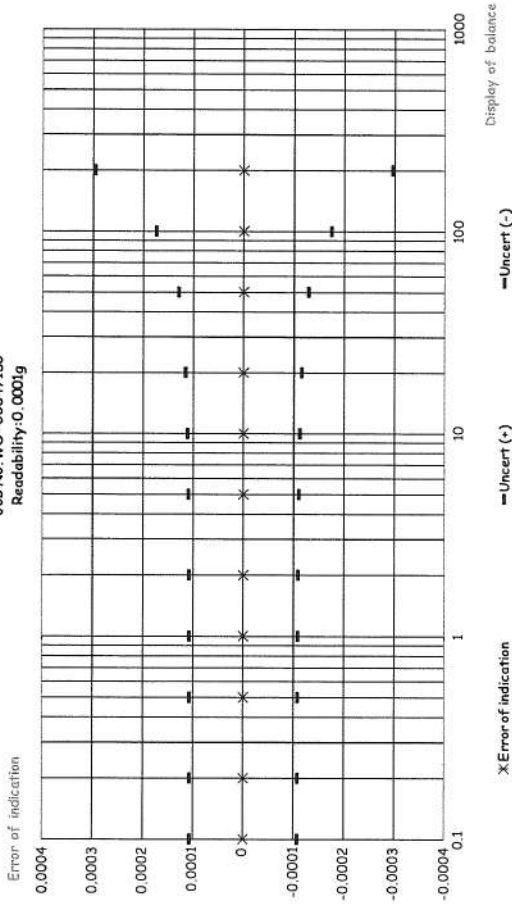
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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CAL-FM-C01-14: 12 Sep 2022



Without Adjustment
Job No. WO-00047130
Readability: 0.0001g



ใบตรวจสอบสภาพเครื่องชั่ง

ชื่อนี้เครื่องมือ: Balance รุ่น: BSA224S-CW เลขที่ใบงาน: WO-00047130
หมายเลขเครื่อง: 34490341

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2024	ไม่ปกติ		30 Oct 2024	ไม่ปกติ	
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระบอกกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตอบสนองของไม่กด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานตั้ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Piyapat Saidoung
Service Engineer



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-68/0221

MTC.No.23-68/0221

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : PERSONAL AIR PUMP SAMPLING PUMP CALIBRATION

Manufacturer : MesaLabs

Serial No.: 210155

Model : Defender 510

Scale range : 50 ml/min to 5000 ml/min

Subdivision : (0.00001, 0.0001) l/min

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED.

122 T.Thatoom A.Srinahaphote,

Prachinburi 25140, Thailand.

Received date : 15 January 2025 Condition of measured item : Normal

Calibration date : 3 February 2025

Standard :	Standard	Certificate No.	Date due	Traceability
	RTD Thermometer	PSL-T 0811/67	3-Jul-26	TISTR
	Molbox/Pressure Transducer/UpStream	MP-0076-23	2-Apr-25	NIMT
	Primary Flow Calibrator S/N 119521	MW-0033-23	6-Jun-25	NIMT

Calibrated by : *Terasak Panna*

(Mr.Terasak Panna)

Approved by : *Kirana Luanghirun*

(Ms.Kirana Luanghirun)

Director
Mechanical Engineering Standards Laboratory

Ref. 2013268011500202001

Issued Date 5 February 2025

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

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(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-68/0221

2/2

MTC.No.23-68/0221

Calibration point : (0.05, 0.5, 1, 1.5, 2) l/min

Ambient condition : Temperature (23 ± 3) °C, Relative humidity (55 ± 15) %

Atmospheric pressure (1010±13) hPa

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

Measurement data :

UUC Value	Standard Value	Temperature	Pressure	Deviation	Uncertainty
(l/min)	(l/min)	(°C)	(hPa)	(%)	(%)
0.05043	0.049841	24.718	1007.90	+1.19	1.4
0.50136	0.49651	24.716	1008.19	+0.98	0.90
1.0045	0.9973	24.693	1008.53	+0.73	0.89
1.5020	1.5012	24.688	1009.04	+0.06	0.89
1.9995	2.0036	24.668	1009.48	-0.20	0.89

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor $k=2$, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.5

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 80/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2, T. Thatoom, A. Srimahaphote, Pachinburi, 25140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Calibrator
Manufacturer : ACO
Model : 2127
Serial No. : 100012
Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 21 Jan. 2025

1 / 2

The results relate only to the items tested/calibrated or value assigned.
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FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 80/0168

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

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	93.91	-0.09	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1000.0	0.0	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.50	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :



Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011268011400184001

End of Certificate

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FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 82/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2, T.Thatoom, A.Srinahaphote, Pachinburi, 25140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Delta Ohm
Model : HD9102
Serial No. : 10038483

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure : CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 22 Jan. 2025

1 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 82/0168

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ$ C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	93.88	-0.12	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	988.3	-11.7	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	1.00	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 22 Jan. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 82/0168

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	113.86	-0.14	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	988.4	-11.6	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	0.21	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Khuaypa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Jan. 2025

Date of Issue : 23 Jan. 2025

Ref : 2011268011400184003

End of Certificate

3 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 81/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinaphoth, Pachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-74

Serial No. : 35046798

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942:2003. The sound pressure level generated by sound

calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards

Laboratory (EEL), which are traceable to the International System of Units through the National Institute of

Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the

measured values only.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 22 Jan. 2025

1 / 2

The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 81/0168

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

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjær 4180	93.91	-0.09	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjær 4180	1001.5	1.5	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjær 4180	1.35	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from manual.

Calibrated by :

Approved by :

(Mr. Weerachai Deechaiyae)

(Mr. Pavate Klunpa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Jan. 2025

Date of Issue : 23 Jan. 2025

Ref : 2011268011400184002

End of Certificate

2 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoon, A.Srinahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6226

Serial No. : 100144

Microphone : Type 7052 No.79844

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

The results relate only to the items tested/calibrated or value assigned.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Before adjust	After adjust				
93.99	93.7	94.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
18.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	16.3	0.10	N/A
C-Weight	24.7	0.10	N/A
Flat	26.7	0.10	N/A

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	-0.3	0.2	1.5	0.45	0.6
1 000	-0.1	-0.1	1.0	0.45	0.6
8 000	-4.8	-4.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.2	0.1	2.0	0.20	0.6
125	0.1	0.2	1.5	0.20	0.6
250	0.2	0.1	1.5	0.20	0.6
500	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.4	-0.2	3.0	0.20	0.6
8 000	-0.4	-0.2	5.0	0.20	0.7

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	122.0	0.0	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.1	0.1	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.1	0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.1	0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
32	32.1	0.1	1.1	0.30	0.3
31	31.3	0.3	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.5	0.5	1.1	0.30	0.3
20-100	25	25.5	0.5	1.1	0.30	0.3
20-90	25	25.4	0.4	1.1	0.30	0.3
20-80	25	25.4	0.4	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.6	-0.4	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
131.1	131.1	0.0	1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : *Pannasit Phasingst*
(Mr. Pannasit Phasingst)

Approved by :

Dr. P. P. P.
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185007

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T. Thatoom, A.Srimahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter
Manufacturer : ACO
Model : 6226
Serial No. : 100145
Microphone : Type 7052NR No.78402
Preamplifier : -

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	92.9	94.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 117.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
25.3	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	24.5	0.10	N/A
C-Weight	26.7	0.10	N/A
Flat	31.3	0.10	N/A

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.4	0.1	-0.1	0.45	0.6
1 000	0.1	0.2	0.2	0.45	0.6
8 000	-4.2	-3.6	-4.4	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.1	0.1	0.1	0.20	0.6
125	0.1	0.1	0.1	0.20	0.6
250	0.1	0.1	0.1	0.20	0.6
500	0.1	0.0	0.0	0.20	0.6
1 000	0.0	0.0	0.0	0.20	0.6
2 000	-0.1	0.0	0.1	0.20	0.6
4 000	-0.3	-0.1	0.0	0.20	0.6
8 000	-0.3	-0.1	-0.1	0.20	0.7

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	121.9	-0.1	1.1	0.30	0.3
121	120.9	-0.1	1.1	0.30	0.3
120	119.9	-0.1	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	108.9	-0.1	1.1	0.30	0.3
104	103.9	-0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.2	0.2	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.4	0.4	1.1	0.30	0.3
20-100	25	25.5	0.5	1.1	0.30	0.3
20-90	25	25.6	0.6	1.1	0.30	0.3
20-80	25	25.5	0.5	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.6	-0.4	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
	200	109.9	-0.1	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 90/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
131.1	131.1	0.0	1.5	0.20
		0.0	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by: 
(Mr. Pannasit Phasingrui)

Approved by: 
(Mr. Prawate Kluyyap)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025
Date of Issue : 24 Feb. 2025

Ref : 2011268011400185008

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter
Manufacturer : ACO
Model : 6226
Serial No. : 100146
Microphone : Type 7052NR No.78402
Preamplifier : -

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Before adjust	After adjust				
93.99	92.7	94.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 95.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
23.1	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	22.5	0.10	N/A
C-Weight	27.6	0.10	N/A
Flat	30.1	0.10	N/A

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.7	0.5	1.5	0.45	0.6
1 000	0.2	0.1	1.0	0.45	0.6
8 000	-4.4	-4.2	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.3	0.1	2.0	0.20	0.6
125	0.1	0.1	1.5	0.20	0.6
250	0.1	0.1	1.5	0.20	0.6
500	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.4	-0.2	3.0	0.20	0.6
8 000	-0.3	-0.2	5.0	0.20	0.7

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	121.8	-0.2	1.1	0.30	0.3
121	120.9	-0.1	1.1	0.30	0.3
120	119.9	-0.1	1.1	0.30	0.3
119	118.9	-0.1	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	108.9	-0.1	1.1	0.30	0.3
104	103.9	-0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	78.9	-0.1	1.1	0.30	0.3
74	73.9	-0.1	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.8	-0.2	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.2	0.2	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
32	32.3	0.3	1.1	0.30	0.3
31	31.4	0.4	1.1	0.30	0.3
30	30.4	0.4	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.8	0.8	1.1	0.30	0.3
20-100	25	25.8	0.8	1.1	0.30	0.3
20-90	25	25.6	0.6	1.1	0.30	0.3
20-80	25	25.7	0.7	1.1	0.30	0.3

9. Tone burst response

Time	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.6	-0.4	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
	200	109.9	-0.1	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 91/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
131.1	131.1	0.0	1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :
(Mr. Pannasit Phasingstri)

Approved by :
(Mr. Prawale Kludypa)

Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185009

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan. 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Temperature	: (23 ± 3) °C
Manufacturer	: Delta OHM	Relative Humidity	: (50 ± 15) %
Model	: HD 2010UC	Ambient Pressure	: (101.325 ± 1.5) kPa

Serial No. : 11040842479

Microphone : Type UC-52 No.114674

Preamplifier : Delta Type HD2010PNE2 No.11001018

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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Pm

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

10. Digital Multimeter Agilent 34401A S/N MY44005560.

11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.95	93.3	94.0	0.1	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.6	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting			
A-Weight	18.3	0.10	N/A
C-Weight	24.5	0.20	N/A
Flat	26.9	0.30	N/A

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.4	0.3	0.2	1.5	0.45	0.6
1 000	-0.5	-0.5	-0.5	1.0	0.45	0.6
8 000	-4.0	-3.9	-4.0	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	-0.2	-0.3	2.0	0.20	0.6
125	-0.1	-0.1	-0.2	1.5	0.20	0.6
250	0.0	-0.1	-0.1	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.1	0.1	2.0	0.20	0.6
4 000	0.1	0.1	0.1	3.0	0.20	0.6
8 000	0.1	0.1	0.1	5.0	0.20	0.7



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Weighting					
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Weighting					
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
43	43.0	0.0	1.1	0.30	0.3
42	42.1	0.1	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
41	41.1	0.1	1.1	0.30	0.3
40	40.1	0.1	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
60-140	94.0	94.0	0.0	1.1	0.30	0.3
50-130	94.0	94.0	0.0	1.1	0.30	0.3
40-120	94.0	94.0	0.0	1.1	0.30	0.3
30-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
60-140	65	65.0	0.0	1.1	0.30	0.3
50-130	55	55.0	0.0	1.1	0.30	0.3
40-120	45	45.0	0.0	1.1	0.30	0.3
30-110	35	35.2	0.2	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.6	-0.4	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
	200	109.9	-0.1	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.3	-0.1	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Acceptance limit		Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Deviated value (dB)	class 2 (±dB)		
Positive one-half cycle	140.5	0.0	1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by : 
(Mr. Pannasit Phasingst)

Approved by : 
(Mr. Prawat Kiatyapa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025
Date of Issue : 24 Feb. 2025

Ref : 2011268011400185012

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 00433730
Microphone : Type UC-52 No.144953
Preamplifier : Type NH-24 No.33780

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Before adjust	After adjust				
93.95	93.8	113.9	20.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
17.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	14.3	0.70	N/A
C-Weight	19.4	0.70	N/A
Flat	25.1	0.30	N/A

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.1	0.3	1.5	0.45	0.6
1 000	0.1	0.0	1.0	0.45	0.6
8 000	-4.6	-4.4	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.0	2.0	0.20	0.6
125	0.0	0.1	1.5	0.20	0.6
250	0.0	0.1	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.1	2.0	0.20	0.6
4 000	0.0	0.1	3.0	0.20	0.6
8 000	0.1	0.1	5.0	0.20	0.7

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
137	137.1	0.1	1.1	0.64	0.3
136	136.1	0.1	1.1	0.69	0.3
135	135.0	0.0	1.1	0.58	0.3
133	133.0	0.0	1.1	0.64	0.3
132	132.0	0.0	1.1	0.64	0.3
131	131.0	0.0	1.1	0.64	0.3
130	130.0	0.0	1.1	0.64	0.3
129	129.0	0.0	1.1	2.90	0.3
124	124.0	0.0	1.1	2.90	0.3
119	119.0	0.0	1.1	2.90	0.3
114	114.0	0.0	1.1	2.90	0.3
109	109.0	0.0	1.1	2.90	0.3
104	104.0	0.0	1.1	2.90	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	135.4	0.0	1.5
135.4				
			0.0	0.55
			1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : *Pannasit Phasingstri*
(Mr. Pannasit Phasingstri)

Approved by :

Mr. Pravee Kiatyapa
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185010

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Ambient Environment
Manufacturer	: Rion	Temperature : $(23 \pm 3) ^\circ\text{C}$
Model	: NL-42	Relative Humidity : $(50 \pm 15) \%$
Serial No.	: 00646442	Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Microphone : Type UC-52 No.142301

Preamplifier : Type NH-24 No.22410

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

10. Digital Multimeter Agilent 34401A S/N MY44005560.

11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.95	93.6	113.9	20.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.9	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting			
A-Weight	13.1	0.10	N/A
C-Weight	18.5	0.10	N/A
Flat	24.4	0.10	N/A

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.8	0.2	0.0	1.5	0.45	0.6
1 000	0.0	0.0	0.0	1.0	0.45	0.6
8 000	-2.0	-2.0	-2.1	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	0.0	0.0	0.0	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
137	136.6	-0.4	1.1	0.30	0.3
136	135.6	-0.4	1.1	0.30	0.3
135	134.7	-0.3	1.1	0.30	0.3
133	132.8	-0.2	1.1	0.30	0.3
132	131.8	-0.2	1.1	0.30	0.3
131	130.9	-0.1	1.1	0.30	0.3
130	129.9	-0.1	1.1	0.30	0.3
129	128.9	-0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	78.9	-0.1	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
54	54.0	0.0	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	200	126.0	0.0	± 1.0	0.20	0.3
	2	108.9	-0.1	$+1.0; -2.5$	0.20	0.3
	0.25	100.0	0.0	$+1.5; -5.0$	0.20	0.3
Slow	200	119.5	-0.1	± 1.0	0.20	0.3
	2	100.0	0.0	$+1.0; -5.0$	0.20	0.3

Date of Calibration : 17-18 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 93/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
135.4	135.4	0.0	1.5	0.55	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by: 
(Mr. Pamasit Phasingst)

Approved by: 
(Mr. Prawate Kluyapa)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025
Date of Issue : 24 Feb. 2025

End of Certificate

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Ref : 2011268011400185011

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192014

Microphone : 7052NR No.73303

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 24-27 Feb 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
93.99	94.0	0.0	1.0	0.48	N/A

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
20.8	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	13.3	0.10	N/A
C-Weight	18.4	0.10	N/A
Flat	22.4	0.10	N/A

Date of Calibration : 24-27 Feb 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.2	0.3	1.5	0.45	0.6
1 000	0.1	0.1	1.0	0.45	0.6
8 000	-1.6	-1.5	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.0	2.0	0.20	0.6
125	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.4	-0.4	3.0	0.20	0.6
8 000	-0.6	-0.7	5.0	0.20	0.7

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
122	122.0	0.0	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.1	0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 85/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.2	0.2	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.3	0.3	1.1	0.30	0.3
20-100	25.0	25.2	0.2	1.1	0.30	0.3
20-90	25.0	25.2	0.2	1.1	0.30	0.3
20-80	25.0	25.2	0.2	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.3	-0.7	+1.0; -2.5	0.20	0.3
	0.25	89.2	-0.8	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.7	-0.3	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 24-27 Feb. 2025

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.7	0.3	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Acceptance limit		Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive one-half cycle	Negative one-half cycle		
132.5	132.5	0.0	1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

.....

(Mr. Tawikiat Iamsamran)

Approved by :

.....

(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb. 2025

Date of Issue : 28 Feb. 2025

Ref : 2011268011400185003

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 84/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment	
Description : Sound Level Meter	Temperature : (23 ± 3) °C
Manufacturer : ACO	Relative Humidity : (50 ± 15) %
Model : 6236	Ambient Pressure : (101.325 ± 1.5) kPa
Serial No. : 192015	
Microphone : 7052NR No.73304	
Preamplifier : -	

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 84/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

10. Digital Multimeter Agilent 34401A S/N MY44005560.

11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 24-27 Feb.2025

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FM.BL.MTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
93.99	93.9	-0.1	1.0	0.48	N/A

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
22.0	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	15.7	0.10	N/A
C-Weight	21.5	0.10	N/A
Flat	26.0	0.10	N/A

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.4	0.4	1.5	0.45	0.6
1 000	-0.4	-0.4	1.0	0.45	0.6
8 000	-0.8	-1.0	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.1	0.0	2.0	0.20	0.6
125	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.4	-0.4	3.0	0.20	0.6
8 000	-0.6	-0.6	5.0	0.20	0.7

Request No. 21-68/0160

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 84/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb.2025

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Request No. 21-68/0160

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 84/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
122	122.1	0.1	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.2	0.2	1.1	0.30	0.3
69	69.2	0.2	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.1	0.1	1.1	0.30	0.3
54	54.1	0.1	1.1	0.30	0.3
49	49.1	0.1	1.1	0.30	0.3
44	44.1	0.1	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3
34	34.2	0.2	1.1	0.30	0.3
33	33.3	0.3	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 84/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.3	0.3	1.1	0.30	0.3
31	31.4	0.4	1.1	0.30	0.3
30	30.4	0.4	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.5	0.5	1.1	0.30	0.3
20-100	25.0	25.4	0.4	1.1	0.30	0.3
20-90	25.0	25.4	0.4	1.1	0.30	0.3
20-80	25.0	25.2	0.2	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.6	-0.4	+1.0; -2.5	0.20	0.3
	0.25	89.0	-1.0	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 24-27 Feb 2025

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Date of Calibration : 24-27 Feb 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 84/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	132.5	0.0	1.5	0.20
132.5					

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prawate Klauyap) Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185002

End of Certificate

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FM.BL.MTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192016

Microphone : 7052NR No.73305

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

8. Power Amplifier Britel&Kjaer 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tanagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
93.99	93.3	-0.7	1.0	0.48	N/A

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
23.6	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	15.5	0.10	N/A
C-Weight	20.5	0.10	N/A
Flat	25.1	0.10	N/A

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.5	0.6	1.5	0.45	0.6
1 000	-0.9	-0.9	1.0	0.45	0.6
8 000	-1.3	-1.1	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.1	0.0	2.0	0.20	0.6
125	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.4	-0.1	3.0	0.20	0.6
8 000	-0.7	-0.6	5.0	0.20	0.7

Date of Calibration : 24-27 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	121.9	-0.1	1.1	0.30	0.3
121	120.9	-0.1	1.1	0.30	0.3
120	119.9	-0.1	1.1	0.30	0.3
119	118.9	-0.1	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.2	0.2	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.1	0.1	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.1	0.1	1.1	0.30	0.3
44	44.1	0.1	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3
34	34.2	0.2	1.1	0.30	0.3
33	33.3	0.3	1.1	0.30	0.3

Date of Calibration : 24-27 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 83/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
32	32.4	0.4	1.1	0.30	0.3
31	31.5	0.5	1.1	0.30	0.3
30	30.6	0.6	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 24-27 Feb. 2025

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	44.9	-0.1	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.7	0.7	1.1	0.30	0.3
20-100	25.0	25.6	0.6	1.1	0.30	0.3
20-90	25.0	25.5	0.5	1.1	0.30	0.3
20-80	25.0	25.4	0.4	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.6	-0.4	+1.0; -2.5	0.20	0.3
	0.25	89.5	-0.5	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 24-27 Feb.2025

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.1	-0.3	3.0	0.20	0.35
Positive half cycle	124.4	122.4	-2.0	2.0	0.20	0.35
Negative half cycle	124.4	124.6	0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	132.5	0.0	1.5	0.20
132.5					

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

.....
(Mr. Tawikiat Iamsamran)

Approved by :

.....
(Mr. Prawate Khuayapa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185001

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 86/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	Sound Level Meter	Ambient Environment
Manufacturer	: ACO	Temperature : (23 ± 3) °C
Model	: 6236	Relative Humidity : (50 ± 15) %
Serial No.	: 212014	Ambient Pressure : (101.325 ± 1.5) kPa
Microphone	: 7052NR No.76235	
Preamplifier	: -	

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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Request No. 21-68/0160

MTC No. EEL. BP. 86/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

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Date of Calibration : 24-27 Feb.2025

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	94.2	94.0	0.0	1.0	0.48	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.7	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	13.7	0.10	N/A
C-Weight	19.0	0.10	N/A
Flat	23.9	0.10	N/A

Date of Calibration : 24-27 Feb.2025

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.5	0.5	0.3	1.5	0.45	0.6
1 000	-0.1	-0.2	0.0	1.0	0.45	0.6
8 000	-1.3	-1.1	-0.8	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.2	0.0	-0.1	2.0	0.20	0.6
125	0.1	0.0	0.0	1.5	0.20	0.6
250	0.1	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	-0.1	2.0	0.20	0.6
4 000	-0.4	-0.3	-0.1	3.0	0.20	0.6
8 000	-0.6	-0.6	-0.2	5.0	0.20	0.7

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 86/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 86/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	122.1	0.1	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.1	0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 86/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.2	0.2	1.1	0.30	0.3
31	31.3	0.3	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.3	0.3	1.1	0.30	0.3
20-100	25.0	25.3	0.3	1.1	0.30	0.3
20-90	25.0	25.2	0.2	1.1	0.30	0.3
20-80	25.0	25.2	0.2	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.7	-0.3	+1.0; -2.5	0.20	0.3
	0.25	89.2	-0.8	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
	200	109.9	-0.1	±1.0	0.20	0.3
SEL	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

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Request No. 21-68/0160

MTC No. EEL. BP. 86/0168



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Request No. 21-68/0160

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.0	-0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive one-half cycle	Negative one-half cycle			
132.5	132.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prawate Khuyapra)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration

: 24-27 Feb.2025

Date of Issue

: 28 Feb.2025

Ref : 2011268011400185004

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 87/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srinaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : ACO
Model : 6236
Serial No. : 212015
Microphone : 7052NR No.76236
Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt

: 14 Jan.2025

Date of Calibration

: 24-27 Feb.2025

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 24-27 Feb.2025

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**1. Absolute Sensitivity**

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Before adjust	After adjust				
93.99	94.4	94.0	0.0	1.0	0.48	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.0 dB.

2. Self-generated noise**2.1 Normal test**

Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
20.7	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-Weight	15.1	0.10	N/A
C-Weight	19.9	0.10	N/A
Flat	24.7	0.10	N/A

Date of Calibration : 24-27 Feb.2025

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.4	0.6	1.5	0.45	0.6
1 000	-0.1	-0.1	1.0	0.45	0.6
8 000	-0.7	-0.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	1.5	0.20	0.6
250	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.4	-0.4	3.0	0.20	0.6
8 000	-0.6	-0.6	5.0	0.20	0.7

Date of Calibration : 24-27 Feb. 2025

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5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb. 2025

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Request No. 21-68/0160

MTC No. EEL. BP. 87/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
122	122.0	0.0	1.1	0.30	0.3
121	121.0	0.0	1.1	0.30	0.3
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.1	0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 87/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.2	0.2	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 24-27 Feb.2025

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.3	0.3	1.1	0.30	0.3
20-100	25.0	25.2	0.2	1.1	0.30	0.3
20-90	25.0	25.1	0.1	1.1	0.30	0.3
20-80	25.0	24.9	-0.1	1.1	0.30	0.3

9. Tone burst response

Time	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.0	-1.0	+1.5; -5.0	0.20	0.3
Slow	200	109.3	-0.3	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 24-27 Feb.2025

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
132.5	132.5	0.0	1.5	0.20
		0.0	1.5	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0				
End	129.0	0.0	0.3	0.10	0.1

Calibrated by :

(Mr. Tawikiat Jamsamran)

Approved by :

(Mr. Pravee Klayyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011268011400185005

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Ambient Environment	: (23 ± 3) °C
Manufacturer	: ACO	Relative Humidity	: (50 ± 15) %
Model	: 6236	Ambient Pressure	: (101.325 ± 1.5) kPa

Serial No. : 212016

Microphone : 7052NR No.76237

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

10. Digital Multimeter Agilent 34401A S/N MY44005560.

11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 24-27 Feb.2025

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FM.BL.MTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
93.99	94.0	0.0	1.0	0.48	N/A

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
21.3	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14.4	0.10	N/A
C-Weight	19.1	0.10	N/A
Flat	23.5	0.10	N/A

Date of Calibration : 24-27 Feb.2025

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.5	0.5	1.5	0.45	0.6
1 000	-0.1	-0.1	1.0	0.45	0.6
8 000	-1.5	-1.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.1	0.0	2.0	0.20	0.6
125	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	2.0	0.20	0.6
4 000	-0.4	-0.3	3.0	0.20	0.6
8 000	-0.6	-0.6	5.0	0.20	0.7

Date of Calibration : 24-27 Feb.2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 24-27 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
122	122.1	0.1	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	83.9	-0.1	1.1	0.30	0.3
79	78.9	-0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.2	0.2	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.1	0.1	1.1	0.30	0.3
44	44.1	0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.2	0.2	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3

Date of Calibration : 24-27 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.2	0.2	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.5	0.5	1.1	0.30	0.3
20-100	25.0	25.4	0.4	1.1	0.30	0.3
20-90	25.0	25.3	0.3	1.1	0.30	0.3
20-80	25.0	25.2	0.2	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.9	-0.1	±1.0	0.20	0.3
	2	98.1	-0.9	+1.0; -2.5	0.20	0.3
	0.25	89.2	-0.8	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 24-27 Feb.2025

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Date of Calibration : 24-27 Feb.2025

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03NI99E80A0020
Cylinder Number: LL193324
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: NO NOX, SO₂, BALN

Reference Number: 82-401285019-1
Cylinder Volume: 83.4 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Sep 05, 2018

Expiration Date: Sep 05, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume 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	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.71 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
NITRIC OXIDE	50.00 PPM	50.67 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
SULFUR DIOXIDE	50.00 PPM	50.00 PPM	G1	+/- 1.0% NIST Traceable	08/27/2018, 09/05/2018
NITROGEN	Balance	50.54 PPM	G1	+/- 1.0% NIST Traceable	08/27/2018, 09/05/2018

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NITRM	16080625	CC442585	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12368	5604119	29.86 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
GNIS	7042010104	CC503941	5.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NITRM	14010327	KAL004376	49.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Apr 17, 2024

The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 6700 APW1100391 SO2	FTIR	Aug 30, 2018

Triad Data Available Upon Request

NOTES: PO# 5218003935

Net weight: 2736 grams
Gross weight: 17393 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol. Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



ACCREDITED

TESTING CERT No. 3082.05

Approved for Release

Page 1 of 82-401285019-1

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 88/0168

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
132.5	132.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prawate Klunypa)

Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185006

End of Certificate

9 / 9

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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(66) 08 1889 6827

FM.BLMTC.002 Rev.5

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E80A0020
Cylinder Number: LL193324
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: NO, NOX, SO2, BALN
Reference Number: 82-401285019-1
Cylinder Volume: 83.4 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Sep 05, 2018
Expiration Date: Sep 05, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume 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	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.71 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
NITRIC OXIDE	50.00 PPM	50.67 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
SULFUR DIOXIDE	50.00 PPM	50.54 PPM	G1	+/- 1.0% NIST Traceable	08/27/2018, 09/05/2018
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060625	CC442585	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12368	5604119	29.86 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
GMIS	7042010104	CC503941	5.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NTRM	14010327	KAL004376	49.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Apr 17, 2024

The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 6700 APW1100391 SO2	FTIR	Aug 30, 2018

Triad Data Available Upon Request

NOTES: PO# 5218003935

Net weight: 2736 grams
Gross weight: 17393 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol. Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

[Signature]
Approved for Release

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES

Preventive Maintenance

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.



Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- **Need to place a service call?** Flexible Repair Options | Agilent



Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- **Ask the customer to sign the Service Verification section including the customer's and your signature.**



Instrument Maintenance

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	5110 ICP-OES
Instrument System Site and Location	Integrated Research Center

List System Component	Product Numbers	List the Serial Numbers of each Component
1. G8015 A		MY 19351008
2. G3242 A		1907 - 00426
3.		
4.		
5.		
6.		
7.		
8.		
9.		

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	(See Spray) OneNeb Contikal Other
Spray Chamber	Cyclonic Single Pass (Cyclonic Double Pass) Other
Torch	Radial (Dual View) Other
Torch Type	One Piece (Semi Demountable) Fully Demountable Other
Injector Diameter	2.4mm (1.8mm) 1.4mm 0.8mm Other
Injector Material	(Quartz) Ceramic Other



Preparation

- (N/A) ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.
- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.



Preventive Maintenance Procedures

Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- (N/A) ☐ Replace high capacity air inlet dust filter element if installed.
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- ☐ **Service not applicable**
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.



SPS 3 Auto Sampler

- ☒ **Service not applicable**
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

- ☒ **Service not applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☒ **Service not applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks



ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM Instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
 - ☒ Subsystem Communications Test
 - ☒ Air Flow
 - ☒ Water Flow
 - ☒ Gas Flows
 - ☒ RF Generator
 - ☒ Camera Test
 - ☒ Optics Test
 - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table



Restore Instrument

- (N/A) ☐ For HF applications, ask the customer to reinstall their sample introduction system.
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ **Complete the Signature Page with both Service Engineer and Customer signatures.**

Test Results

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1503.1	4353.1	1878.3	6963.0
Mn 257.610 nm SRBR	7167.4	25078.8	8949.6	38366.4
Al 396.152 nm SBR	7.7	19.1	9.0	35.3
K 766.491 nm SBR	7.2	101.4	5.7	118.7

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	231.221	VAC 228.140
Mains Current	0.033	A 0.103
Instrument Temperature	24.2	°C 24.4
RF Air Flow (sensor speed)	15.0	Hz 17.0
Plasma Exhaust Temperature	No measurement	°C 56.7
Water Flow Oscillator	No measurement	L/min 1.43
Water Flow Detector	0.00	L/min 1.14
Water Inlet Temperature	21.3	°C 20.5
Polychromator Temperature	35.6	°C 35.0
CCD Temperature	26.7	°C -39.5
Thermal Stabilizer	35.0	°C 35.0
Argon Supply Pressure	634.52	kPa 574.57
Purge Gas Supply Pressure*1	633.28	kPa 598.40
Option Gas Supply Pressure*1	—	kPa —
Nebulizer Flow	No measurement	L/min 0.70
Nebulizer Back Pressure	No measurement	kPa 297.12
Plasma Gas Flow	No measurement	L/min 14.89
Auxiliary Gas Flow	No measurement	L/min 1.20
RF Power	No measurement	W 1196.4
RF Supply Current	No measurement	A 8.100
RF Supply Voltage	No measurement	V 198.790

*1 If option installed



Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	1
Purge Gas Filter	G8010-60136	All	1
Air Inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	1
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	

Consumed Parts Reference
(Purchased by customer, not included as part of PM)☒ Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed
------------------	-------------	------------------------------	-------------------



Calibration Report of Mettler Toledo SEVEN EASY Conductivity Meter

MPC Control #: EV3701 Serial Number: 1232025828
Asset ID: WL-058/11 Calibration Date: October 31, 2024

Measurement Results

Nominal	Unit	Temp.	STD. Test Point @ Temp	Lower Limit	UUC Reading	Upper Limit	Result	Uncertainty (±)
1413	µS/cm	25.0°C	1413	1403	As Found 1412 As Left 1412	1423	PASS ²	16

Note : Accuracy by Customer : ± 0.5 %

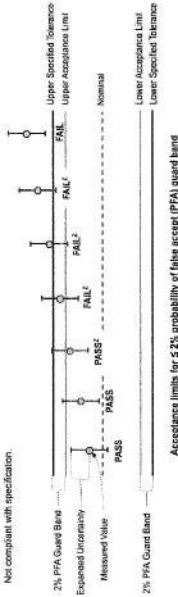
Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification.

All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2005

The status of compliance with the acceptance criteria is reported as:

PASS	Compliant with specification.
PASS ²	The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
FAIL ²	The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
FAIL	Not compliant with specification.



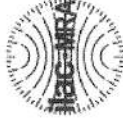
The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2005, Method 6 - Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report



MICRO PRECISION
MICRO PRECISION CALIBRATION LABORATORY (THAILAND) CO., LTD.
413 BONDSTREET ROAD, TAMBOL BANGPOODAMPHOE PAKKRED, NONTABURI
NONTABURI 11120 THAILAND
02-983-9534



Certificate of Calibration

Date: Nov 11, 2024

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Cert No. 5523631031362694

Work Order #: THAIPT-00735

MPC Control #: EV3702
Asset ID: WL-PHM03
Gage Type: PH/DO METER
Manufacturer: METTLER TOLEDO
Model Number: SEVEN GO DUO
Size: N/A
Temp/RH: 25.0°C / 52.0%
Location: Calibration performed at Customer's facility
Serial Number: B932068736
Department: N/A
Performed By: CHANKIAT PHOLKAM
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 31, 2024
Cal. Interval: 12 MONTHS
Cal. Due Date: October 31, 2025

Calibration Notes:

Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AW2318	PH BUFFER SOLUTION	PH 4.00	1040525C	REAGECON	Aug 28, 2026	4C23H1 / REAGECON
AW2319	PH BUFFER SOLUTION	PH 7.00	1070525C	REAGECON	Jul 28, 2025	725C23G1 / REAGECON
AW2320	PH BUFFER SOLUTION	PH 10.00	1100525C	REAGECON	May 28, 2025	1125C23E1 / REAGECON

Procedures Used in this Event

Procedure Name
MPC-PHM-001 Rev. 06
Description
pH Meters, General, Rev.06, May-24-2024

Calibrating Technician:

Chankiat P.
CHANKIAT PHOLKAM

QC Approval:

S. Padung

PADUNG SRASUAY

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2005.

THE CALIBRATION REPORT STATES:

PASS¹ - Item used with compliance statement is given, and the measurement result is reported as PASS¹.

PASS² - Item used with compliance statement is given, and the measurement result is reported as PASS².

FAIL¹ - Item used with compliance statement is given, and the measurement result is reported as FAIL¹.

FAIL² - Item used with compliance statement is given, and the measurement result is reported as FAIL².

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.

UNTESTED - Item used with compliance statement is given, and the measurement result is reported as UNTESTED.



Calibration Report of Mettler Toledo SEVEN GO DUO PH/DO Meter

MPC Control #: EV3702 Serial Number: B932068736
Asset ID: WL-PHM/03 Calibration Date: October 31, 2024

Measurement Results

Buffer Solution

STD Test Point @ 25°C	Lower Limit	Measured Value		Upper Limit	Result	Uncertainty (±)
		AS Found	AS Left			
4.01 pH	3.91 pH	4.00 pH	4.00 pH	4.11 pH	PASS	0.013 pH
7.01 pH	6.91 pH	6.95 pH	6.95 pH	7.11 pH	PASS	0.013 pH
10.01 pH	9.91 pH	10.00 pH	10.00 pH	10.11 pH	PASS	0.013 pH

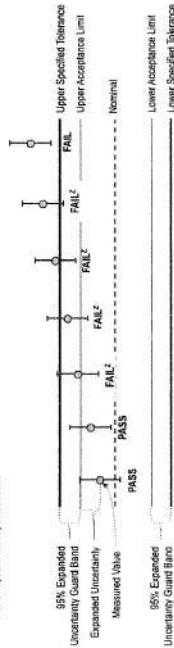
Note : Accuracy by Customer : ± 0.10 pH

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 2540.3-2006

The status of compliance with the acceptance criteria is reported as:

- PASS — Compliant with specification.
FAIL¹ — The measured value is not within the acceptance limits.
 — However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
FAIL — Not compliant with specification.



Acceptance limits set using the 95% expanded uncertainty

The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 2540.3-2006, Method S — Guard Bands Based on Expanded Uncertainty.

End of Calibration Report

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Page 1 of 1

TODG-FM-002 rev05



Certificate of Calibration

Date: Nov 11, 2024

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Cert No. 5523631031362695

Work Order #: THAI-PT-00735

MPC Control #: EV3703
Asset ID: WL-WTB/02
Gage Type: WATER BATH
Manufacturer: MEMMERT
Model Number: WNB22
Size: N/A
Temp/RH: 25.0°C / 52.0%
Location: Calibration performed at Customer's facility
Serial Number: L518.0690
Department: N/A
Performed By: CHANKIAT PHOLKAM
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 31, 2024
Cal. Interval: 12 MONTHS
Cal. Due Date: October 31, 2025

Calibration Notes:

Please refer to the attached Calibration Report (2 pages)

Standards Used to Calibrate Equipment

I.D. Description. Model
E08188 DATA ACQUISITION SWITCH UNIT 34970A

Procedures Used in this Event

Procedure Name
THAI LAB ACC G-20

Description
Guidelines for Calibration and Checks of Temperature Controlled Enclosures
Publication Reference

Manufacturer Cal. Due Date Traceability #
AGILENT Mar 13, 2025 5523631030779306 / MP-TH

Calibrating Technician:

Chankiat P.

QC Approval:

S. Padung

CHANKIAT PHOLKAM

PADUNG SRASUAY

STATEMENT OF WORK FOR CALIBRATION: The customer of measurement has been fully advised when discussing capabilities and specifications. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 2540.3-2006.

THE CALIBRATION REPORT STATUS:

PASS: This report indicates that the measurement is within the specified tolerance limits.

FAIL: This report indicates that the measurement is outside the specified tolerance limits.

FAIL¹: This report indicates that the measurement is outside the specified tolerance limits, but a portion of the expanded uncertainty is within the specified tolerance limits.

REPORT OF VALUE: This report indicates that the measurement is outside the specified tolerance limits, and the expanded uncertainty is outside the specified tolerance limits.

ADDITIONAL: These statements are made to inform the customer of the status of the measurement and the expanded uncertainty.

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Calibration Report of Memmert WNB22 Water Bath

MPC Control #: EV3703Serial Number: L518.0690

Asset ID: WL-WTB/02Calibration Date: October 31, 2024

Measurement Results

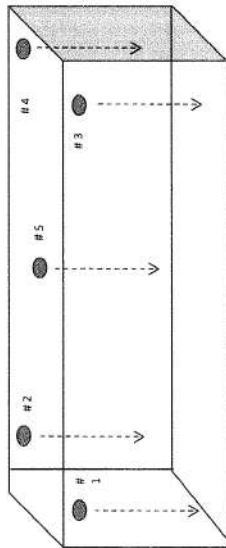
Section 1 : Temperature Distribution
Temperature @ 85 °C

Sensor No.	UUC Setting (°C)	Lower Limit (°C)	STD Reading (°C)	As Found	As Left	Upper Limit (°C)	Result	Uncertainty (°C)
Sensor#1	85.00	84.00	84.79	84.79	84.79	86.00	PASS	± 0.35
Sensor#2	85.00	84.00	84.91	84.91	84.91	86.00	PASS	± 0.35
Sensor#3	85.00	84.00	85.13	85.13	85.13	86.00	PASS	± 0.35
Sensor#4	85.00	84.00	85.16	85.16	85.16	86.00	PASS	± 0.35
Sensor#5	85.00	84.00	85.26	85.26	85.26	86.00	PASS	± 0.35

Section 2 : Chamber Performance

Setting Temp (°C)	Indicating Temp (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
85.0	85.0	1.40	0.9	1.9

Accuracy By : Customer Specification ± 1 °C



Calibration Report of Memmert WNB22 Water Bath

MPC Control #: EV3703Serial Number: L518.0690

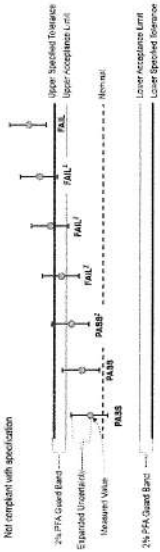
Asset ID: WL-WTB/02Calibration Date: October 31, 2024

Statements of Pass or Fail Conformance

The accuracy of measurement has been taken into account when determining conformance with specification.
All measurements and test results guard banded to ensure the probability of false accept does not exceed 2% in compliance with ANSI/ISO 25013:2006

The status of compliance with the acceptance criteria is reported as:

- PASS** - Compliant with specification
- PASS?** - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance
- FAIL?** - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance
- FAIL** - Not compliant with specification



Acceptance limits for 2% probability of false accept (PFA) guard band

The expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 25013:2006, Method B - Guard Bands Based on the Uncertainty Ratio

End of Calibration Report



MICRO PRECISION
MICRO PRECISION CALIBRATION LABORATORY (THAILAND) CO., LTD.
413 BONDSTREET ROAD, TAMBOL, BANPOODUAPHOE PAKKRED, NONTABURI
NONTABURI 11120 THAILAND
08 2 583 8834

Calibration Report of Memmert WNB22 Water Bath

MPC Control #:	EV3704	Serial Number:	L508 0973
Asset ID:	WL-WTB01	Calibration Date:	October 31, 2024

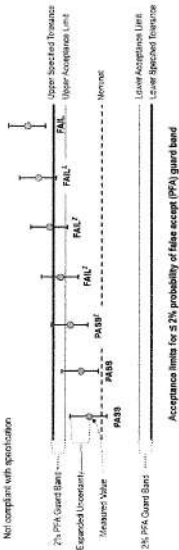
Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification.

All measurements and test results guard banded to ensure the probability of false accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

The status of compliance with the acceptance criteria is reported as:

PASS	Compliant with specification
PASS?	The measured value is within acceptance limits, however, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance
FAIL?	The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance
FAIL	Not compliant with specification



The expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017 Method 6 - Guard Bands Based on Test Uncertainty Ratio

End of Calibration Report

Certificate of Calibration

Date: Nov 11, 2024

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Cert No. 5523631031362700

Work Order #: THAI-PT-00735

MPC Control #: EV3706
Asset ID: DARC-TE15028
Gage Type: COOL ROOM
Manufacturer: DIXELL
Model Number: XR06CX-5N0C2
Size: N/A
Temp/RH: 28.7°C / 58.0%
Location: Calibration performed at Customer's facility

Serial Number: LIOGBXB500
Department: N/A
Performed By: JAKRAPONG ARYACHAT
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 31, 2024
Cal. Interval: 12 MONTHS
Cal. Due Date: October 31, 2025

Calibration Notes:

Please refer to the attached Calibration Report (2 pages)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
EG6188	DATA ACQUISITION/SWITCH UNIT	34970A	MY345289	ASILENT	Mar 13, 2025	5523631030779306 / MP-TH

Procedures Used in this Event

Procedure Name	Description
THAI LAB ACC G-20	Guidelines for Calibration and Checks of Temperature Controlled Enclosures
	Publication Reference

Calibrating Technician:

QC Approval:

JAKRAPONG ARYACHAT

PADUNG SRASUAY

STATEMENTS OF PASS OR FAIL CONFORMANCE: The probability of nonconformance when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

THE CALIBRATION REPORT STATUS:

PASS: The measured value is within acceptance limits, and the measurement result is PASS.

PASS?: The measured value is within acceptance limits, however, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.

FAIL?: The measured value is not within the acceptance limits, however, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.

FAIL: The measured value is not within the acceptance limits, and the measurement result is FAIL.

REPORT OF VALUE: The value is reported as measured, but the measurement result is not within the acceptance limits.

LIMITED: When an instrument has exceeded its calibration interval, it is not used in a future service.

The expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017 Method 6 - Guard Bands Based on Test Uncertainty Ratio.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017 Method 6 - Guard Bands Based on Test Uncertainty Ratio.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017 Method 6 - Guard Bands Based on Test Uncertainty Ratio.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017 Method 6 - Guard Bands Based on Test Uncertainty Ratio.



Calibration Report of Dixell XR06CX-5N0C2 Cool Room

MPC Control #: EV3708Serial Number: LIOGBXB500Asset ID: DARC-TE15028Calibration Date: October 31, 2024

Measurement Results

Section 1 : Temperature Distribution
Temperature @ 4 °C

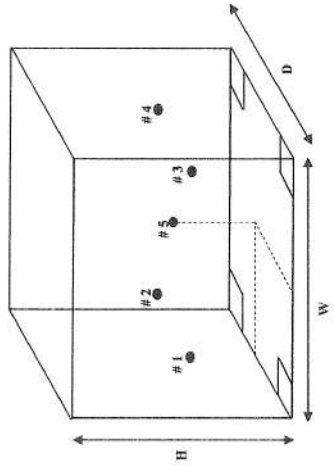
Sensor No.	UUC Setting (°C)	Lower Limit (°C)	STD Reading (°C)		Upper Limit (°C)	Result	Uncertainty (°C)
			As Found	As Left			
Sensor#1	4.00	2.00	4.53	4.53	6.00	PASS	± 0.35
Sensor#2	4.00	2.00	4.66	4.66	6.00	PASS	± 0.35
Sensor#3	4.00	2.00	4.61	4.61	6.00	PASS	± 0.35
Sensor#4	4.00	2.00	4.67	4.67	6.00	PASS	± 0.35
Sensor#5	4.00	2.00	4.62	4.62	6.00	PASS	± 0.35

Section 2 : Chamber Performance

Setting Temp (°C)	Indicating Temp (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	0.29	1.2	2.5

Accuracy By : Customer Specification ± 2 °C

Sensor Installation Location



Calibration Report of Dixell XR06CX-5N0C2 Cool Room

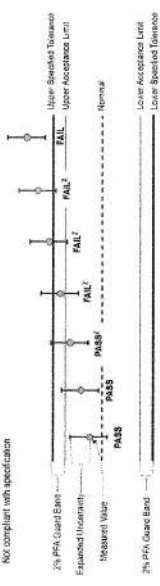
MPC Control #: EV3706Serial Number: LIOGBXB500Asset ID: DARC-TE15028Calibration Date: October 31, 2024

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2018.

The status of compliance with the acceptance criteria is reported as:

- PASS - Compliant with specification
- PASS¹ - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL² - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL - Not compliant with specification.



Acceptance limits for 5.2% probability of false accept (PFA) guard band

The expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2018, Method 6 - Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report



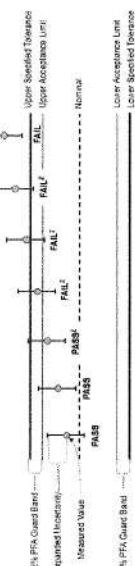
Calibration Report of Accuplus I250 Incubator

MPC Control #: EV3705 Serial Number: 0213-0004
Asset ID: WL-INC02 Calibration Date: October 31, 2024

Statements of Pass or Fail Conformance

The status of compliance with the acceptance criteria is reported as:	
PASS	Compliant with specification
PASS?	<p>The measured value is within acceptance limits.</p> <p>However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.</p>
FAIL?	<p>The measured value is not within the acceptance limits.</p> <p>However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.</p>
FAIL	Not compliant with specification

The measured value is not within the acceptance limits.
However, a portion of the expanded uncertainty of measurement at 65% is within the specified tolerance.

Acceptance limits for $\leq 2\%$ probability of false accept (PFA) guard band

Measurement is stated at the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a 95% confidence interval, unless otherwise stated.

End of Calibration Report

Certificate of Calibration

Date: Nov 7, 2024 Cert No. 5523631031354527

Customer:
DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-32288995

MPC Control #:	EV3395	Serial Number:	N/A
Asset ID:	WL-DTH/01	Department:	N/A
Gage Type:	DIGITAL HYGRO - THERMOMETER	Performed By:	KHOMSAN SAENGKAEW
Manufacturer:	N/A	Received Condition:	IN TOLERANCE
Model Number:	N/A	Returned Condition:	IN TOLERANCE
Size:	N/A	Cal. Date:	November 06, 2024
Temp/RH:	23.0°C / 50.0%	Cal. Interval:	12 MONTHS
Location:	Calibration performed at MPC facility	Cal. Due Date:	November 06, 2025

Calibration Notes:
Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AS941	PLATINUM RESISTANCE THERMOMETER	182C	957	ROSEMOUNT ANALYTICAL INC.	Jun 3, 2026	5523631031246251 / MP-GV
EA0537	HYGROLOG	HL-NT2-DHC2A-S	61290374/6077948	ROTRONIC	Mar 7, 2025	551220085460939 / MP-TH

Procedures Used in this Event

Procedure Name
MPC-THD-001 Rev. 03
Temperature, Humidity and Dew Point Devices, General, Rev.03, Jul-15-2024

Calibrating Technician: Khomsan S.
QC Approval: S. Padung.
KHOMSAN SAENGKAEW
PADUNG SRASUAY

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining conformance with specification. All measurements and test results passed limited to ensure the probability of false-acceptance does not exceed 2% in compliance with ANSI/ISO 17025:2017.

THE CALIBRATION REPORT STATUS:
PASS - Item used when conformance statement is given, and the measurement result is PASS.
PASS? - Item used when conformance statement is given, and the measurement result is PASS?
FAIL - Item used when conformance statement is given, and the measurement result is FAIL.
FAIL? - Item used when conformance statement is given, and the measurement result is FAIL?
ADJUSTED - Item used when conformance statement is given, and the measurement result is ADJUSTED.
ADJUSTED? - Item used when conformance statement is given, and the measurement result is ADJUSTED?
ADJUSTED - Item used when conformance statement is given, and the measurement result is ADJUSTED.
ADJUSTED? - Item used when conformance statement is given, and the measurement result is ADJUSTED?

NOTES: When a measurement is made, the expanded uncertainty of measurement is calculated by the formula $U = k \cdot u$, which for a normal distribution corresponds to a coverage probability of approximately 95%. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance. The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance. Not compliant with specification.

This calibration report complies with ISO/IEC 17025:2017, ANSI/ISO 17025:2017, and ANSI/ISO 17025:2017. Calibration cycles should be based on frequency of use, environmental conditions and customer's established general accuracy. All measurements and test results passed limited to ensure the probability of false-acceptance does not exceed 2% in compliance with ANSI/ISO 17025:2017. The expanded uncertainty of measurement is calculated by the formula $U = k \cdot u$, which for a normal distribution corresponds to a coverage probability of approximately 95%. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance. The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance. Not compliant with specification.

Calibration Report of Digital Hygro - Thermometer

MPC Control #: EV3395 Serial Number: N/A
Asset ID: WL-DTH/01 Calibration Date: November 6, 2024

Measurement Results

Section 1 - Temperature Measurement

STD Reading (°C)	Lower Limit (°C)	UUC Reading (°C)		Upper Limit (°C)	Result	Uncertainty (°C)
		As Found	As Left			
20.00	19.00	19.8	19.8	21.00	PASS	± 0.051
25.00	24.00	24.6	24.6	26.00	PASS	± 0.055

Section 2 - Humidity Measurement

STD Reading (%RH)	Lower Limit (%RH)	UUC Reading (%RH)		Upper Limit (%RH)	Result	Uncertainty (%RH)
		As Found	As Left			
30.00	28.00	29	29	32.00	PASS	± 0.75
50.00	48.00	50	50	52.00	PASS	± 1.2
70.00	68.00	70	70	72.00	PASS	± 1.3

UUC : Unit Under Calibration, Temperature @ 25 °C

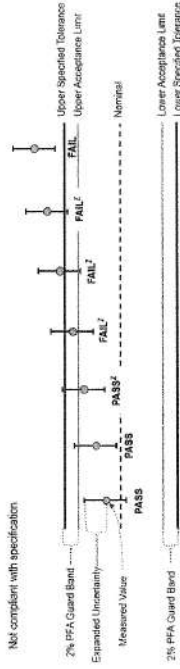
Accuracy By Manufacturer Specification , Temperature : ± 1 °C, Humidity : ± 2 %RH

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results passed limited to ensure the probability of false-acceptance does not exceed 2% in compliance with ANSI/ISO 17025:2017.

The status of compliance with the acceptance criteria is reported as:

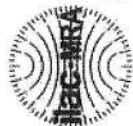
PASS	Compliant with specification
PASS?	The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance. The measured value is not within the acceptance limits.
FAIL?	The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
FAIL	Not compliant with specification



The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance. The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance. Not compliant with specification.

This calibration report complies with ISO/IEC 17025:2017, ANSI/ISO 17025:2017, and ANSI/ISO 17025:2017. Calibration cycles should be based on frequency of use, environmental conditions and customer's established general accuracy. All measurements and test results passed limited to ensure the probability of false-acceptance does not exceed 2% in compliance with ANSI/ISO 17025:2017. The expanded uncertainty of measurement is calculated by the formula $U = k \cdot u$, which for a normal distribution corresponds to a coverage probability of approximately 95%. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance. The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance. Not compliant with specification.

End of Calibration Report



Calibration Report of Digital Hygro - Thermometer

Cert No. 5523631031354528

Date: Nov 7, 2024

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-32268995

MPC Control #:	E13396	Serial Number:	N/A
Asset ID:	WL-DTH/02	Department:	N/A
Gage Type:	DIGITAL HYGRO - THERMOMETER	Performed By:	KHOMSAN SAENGKAEW
Manufacturer:	N/A	Received Condition:	IN TOLERANCE
Model Number:	N/A	Returned Condition:	IN TOLERANCE
Size:	23.0°C / 50.0%	Cal. Date:	November 06, 2024
Temp/RH:		Cal. Interval:	12 MONTHS
Location:	Calibration performed at MPC facility	Cal. Due Date:	November 06, 2025

Calibration Notes:
Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AS9541	PLATINUM RESISTANCE THERMOMETER	162C	957	ROSEMOUNT ANALYTICAL INC	Jun 3, 2028	5523631031246251 / MP-GV
EA0537	HYGROLOG	HL-NT2-DHC2A-S	612903746077948 6	ROTRONIC	Mar 7, 2025	551220085460939 / MP-TH

Procedures Used in this Event

Procedure Name	Description
MPC-THD-001 Rev. 03	Temperature, Humidity and Dew Point Devices, General Rev 03, Jul-15-2024

Calibrating Technician:

QC Approval:

KHOMSAN SAENGKAEW

PADUNG SRASUAY

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results were rounded to ensure the probability of false-acceptance does not exceed 2%.

THE CALIBRATION REPORT STATUS:

ASS: Term used when compliance statement is given, and the measurement result is PASS.

ASS²: Term used when compliance statement is given, and the measurement result is PASS².

FAIL: Term used when compliance statement is given, and the measurement result is FAIL.

FAIL²: Term used when compliance statement is given, and the measurement result is FAIL².

REPORT OF VALUE: Term used when compliance statement is not required compliance statement is given.

DISASTED: When adjustments are made to an instrument which changes the value of measurement results.

[illegible]

Page 1 of 1

(CERT. Rev 9)

Measurement Results

Section 1 - Temperature Measurement

STD Reading (°C)	Lower Limit (°C)	UUC Reading (°C)		Upper Limit (°C)	Result	Uncertainty (°C)
		As Found	As Left			
20.00	19.00	20.0	20.0	21.00	PASS	± 0.051
25.00	24.00	25.1	25.1	26.00	PASS	± 0.055

Section 2 - Humidity Measurement

STD Reading (%RH)	Lower Limit (%RH)	UUC Reading (%RH)		Upper Limit (%RH)	Result	Uncertainty (%RH)
		As Found	As Left			
30.00	28.00	29	29	32.00	PASS	± 0.75
50.00	48.00	48	48	52.00	FAIL	± 1.2
70.00	68.00	69	69	72.00	FAIL	± 1.3

UUC : Unit Under Calibration, Temperature @ 25 °C

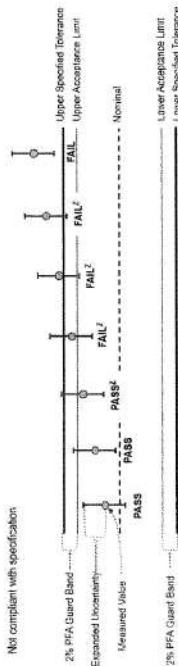
Accuracy By Manufacturer Specification, Temperature : $\pm 1^{\circ}\text{C}$, Humidity : $\pm 2\% \text{RH}$

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification (measurements and test results quantified to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 7540-3:2006).

The status of compliance with the acceptance criteria is reported as:

PASS	Compliant with specification.
PASS ¹	The measured value is within acceptance limits.
PASS ²	However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
FAIL ¹	The measured value is not within the acceptance limits.
FAIL ²	However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
FAIL	Not compliant with specification.

Acceptance limits for $\leq 2\%$ probability of false accept (PFA) guard band

The expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/NCCL Z540.3-2006. Method 6 — Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report



Certificate of Calibration

Equipment: Balance
Model: BSA224S-CW
Serial No. (or ID.): 34490341
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01243398
Issued Date: 06 November 2024
Job No.: WO-00047130
Page: 1 of 2

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 24 °C ± 0.4 °C
Humidity 60 %RH ± 3.3 %RH

Calibration Place: Double A (1991) Public Company Limited.
(Water Laboratory IP1 (Balance Room))
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
Calibration Date: 30 October 2024

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02231944

(Mr. Piypat Saidoung)

Person in charge

(Mr. Adisai Maknoi)

Authorized signatory

This certificate is issued 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 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.

UKSH Technology Co., Ltd. ๕/๑๙
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CAL-FM-C01-14; 12 Sep 2022



Certificate No.: C01243398

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value	Reference Points (g)				
	A	B	C	D	E
-	-	0.0001	0.0001	-0.0001	-0.0001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Error of Indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.1	0.10001	0.1000	0.0000	0.00011	2.04
0.2	0.20001	0.2000	0.0000	0.00011	2.04
0.5	0.50001	0.5000	0.0000	0.00011	2.04
1	1.00001	1.0000	0.0000	0.00011	2.04
2	2.00002	2.0000	0.0000	0.00011	2.04
5	5.00002	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	20.00001	20.0000	0.0000	0.00012	2.03
50	50.00001	50.0000	0.0000	0.00013	2.02
100	100.00003	100.0000	0.0000	0.00017	2.01
200	200.00000	200.0000	0.0000	0.00030	2.00

The End of Certificate

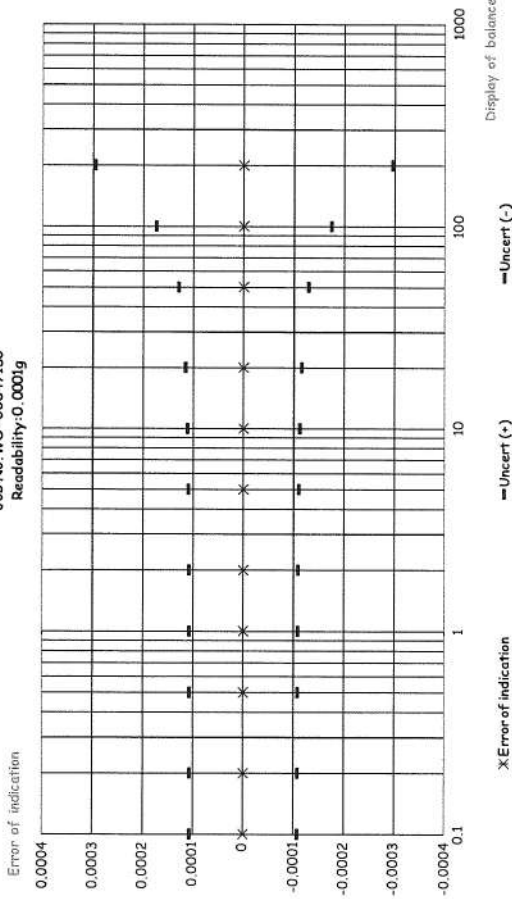
UKSH Technology Co., Ltd. ๕/๑๙
DKSH Technology Limited
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CAL-FM-C01-14; 12 Sep 2022



Without Adjustment
Job No. WO-00047130
Readability: 0.0001g



ใบตรวจสอบสภาพเครื่องชั่ง

ชั่งได้เครื่องมือ: Balance รุ่น: BSA224S-CW เลขที่ใบงาน: WO-00047130
หมายเลขเครื่อง: 34490341

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2024	ไม่ปกติ		30 Oct 2024	ไม่ปกติ	
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระบอกแก๊ส (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตอบสนองของไม่กด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Piyapat Saidoung
Service Engineer



Certificate of Calibration



Equipment: SPECTROPHOTOMETER
Model: DR3900
Serial No. (or ID.): 1918120
Manufacturer: HACH
Condition: In Condition
Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand
Environment Condition: Temperature 24.8 °C ± 0.2 °C
Humidity 67.2 %RH ± 1.7 %RH
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.
Calibration By: Mr.Piyapat Saidoung
Calibration Date: 29 October 2024
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Siarna Scientific Limited.
The standard for Wavelength Certificate No. 121284 and 121285
The standard for Photometric Certificate No. 121289
The standard for Stray light Certificate No. 121282

(Mr. Piyapat Saidoung)

Person in charge

(Miss Kaewkan Suradech)

Authorized signatory

This certificate is issued 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.

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CAL-FM-C06-16: 11 Mar 2024



Certificate No.: C06240473 Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.40	418.0	0.40	0.13	
459.30	459.0	0.30	0.13	
638.00	638.0	0.00	0.13	
585.56	586.0	-0.44	0.13	
747.61	748.0	-0.39	0.13	
807.04	807.0	0.04	0.13	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5895	0.588	0.0015	0.0045
	0.7610	0.761	0.0000	0.0045
440 nm	1.0253	1.023	0.0023	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5783	0.578	0.0003	0.0045
465 nm	0.7430	0.743	0.0000	0.0045
	1.0022	1.000	0.0022	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5280	0.530	-0.0020	0.0045
	0.6851	0.687	-0.0019	0.0045
	0.9509	0.952	-0.0011	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5446	0.545	-0.0004	0.0045
	0.6932	0.695	-0.0018	0.0045
635 nm	0.9952	0.995	0.0002	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5824	0.582	0.0004	0.0045
	0.7208	0.721	-0.0002	0.0045
	1.0917	1.090	0.0017	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5660	0.566	0.0000	0.0045
	0.6882	0.688	0.0002	0.0045
	1.0846	1.084	0.0006	0.0045

บริษัท ดีเคเอส อีซี จำกัด
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CAL-FM-C06-16: 11 Mar 2024



Certificate No.: C06240473

Page 3 of 3

Calibration Results:
Without Adjustment

Stray light *			
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.57 +/- 0.11 nm	392	3.9	1.409

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00047130

หมายเลขเครื่อง: 1918120

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR3900

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2024			29 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<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 ปิด – เปิด 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. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	807nm=807.2nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" 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 type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input 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. ฝาปิดกับปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
		17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 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. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr. Piypat Saidoung
Service Engineer



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR3900
Serial No. (or ID.): 2008400
Manufacturer: HACH
Condition: In Condition
Certificate No.: C06240474
Issued Date: 06 November 2024
Job No.: WO-00047130
Page: 1 of 3
Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 23.4 °C ± 0.3 °C
Humidity 68.2 %RH ± 0.4 %RH

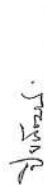
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr.Piyapat Saidoung
Calibration Date: 29 October 2024
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Siama Scientific Limited.

The standard for Wavelength Certificate No. 121284 and 121285

The standard for Photometric Certificate No. 121289

The standard for Stray light Certificate No. 121282


(Mr. Piyapat Saidoung)
Person in charge


(Miss Kaewkan Suradech)
Authorized signatory

This certificate is issued 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.

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CAL-FM-C06-16: 11 Mar 2024



Certificate No.: C06240474

Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm			
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418.0	0.40	0.13
459.30	459.0	0.30	0.13
638.00	638.0	0.00	0.13
585.56	586.0	-0.44	0.13
747.61	748.0	-0.39	0.13
807.04	807.0	0.04	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5895	0.588	0.0015	0.0045
	0.7610	0.759	0.0020	0.0045
440 nm	1.0253	1.022	0.0033	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5783	0.577	0.0013	0.0045
465 nm	0.7430	0.741	0.0020	0.0045
	1.0022	0.999	0.0032	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5280	0.529	-0.0010	0.0045
	0.6851	0.686	-0.0009	0.0045
	0.9509	0.951	-0.0001	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5446	0.544	0.0006	0.0045
	0.6932	0.694	-0.0008	0.0045
635 nm	0.9952	0.994	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5824	0.582	0.0004	0.0045
	0.7208	0.721	-0.0002	0.0045
	1.0917	1.090	0.0017	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5660	0.565	0.0010	0.0045
	0.6882	0.688	0.0002	0.0045
	1.0846	1.084	0.0006	0.0045

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CAL-FM-C06-16: 11 Mar 2024



Calibration Results:
Without Adjustment

Stray light *			
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.57 +/- 0.11 nm	392	4.6	1.337

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00047130
หมายเลขเครื่อง: 2008400

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR3900

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2024	ไม่ปกติ		29 Oct 2024	ไม่ปกติ	
ปกติ			ปกติ		
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<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 ปิด - เปิด 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. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	807nm=806.7nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" 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 type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input 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 type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ในเกิน 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. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr. Piypat Saidoung
Service Engineer



Certificate of Calibration



Equipment: pH METER
Model: Seven2Go S2
Serial No. (or ID.): B633886757
Manufacturer: Mettler Toledo
Electrode Serial No.: 3474864
Condition: In Condition

Customer: Integrated Research Center Co., Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 24.7 °C ± 0.1 °C
Humidity 65.6 %RH ± 0.2 %RH

Calibration Place: Double A (1991) Public Company Limited, (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
Calibration Date: 30 October 2024
The Method used: In house method, CAL-WI-58, base on ASTM E 70-07
Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harmed cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 980701, 980704, 938378 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20240349EA

Person in charge

(Mr. Piypat Saidoung)
Authorized signatory

(Miss Kaewkan Suradech)
This certificate is issued 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 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.



Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(mV)	(pH)		
414.12	414	-0.12	0.02	0.58	2.00
354.96	355	0.04	1.02	0.58	2.00
295.8	295	-0.80	2.02	0.58	2.00
236.64	236	-0.64	3.02	0.58	2.00
177.48	177	-0.48	4.01	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	60	0.84	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.01	0.58	2.00
-236.64	-236	0.64	11.01	0.58	2.00
-295.8	-295	0.80	12.02	0.58	2.00
-354.96	-355	-0.04	13.03	0.58	2.00
-414.12	-414	0.12	14.03	0.58	2.00

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.986 and pH 9.997

-During calibration, display of pH meter reading; pH 4.01 , pH 7.00 and pH 10.01

The practical slope of the pH electrode; 58.34 (mV/pH), 98.61%

The zero point of the pH electrode; 7.12 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.01	0.002	0.0079	2.00
6.986	7.00	0.014	0.010	2.00
9.997	10.01	0.013	0.014	2.00

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: pH METER

รุ่น: Seven2Go S2

หมายเลขเครื่อง: B633886757

ตรวจสอบ (รับ)	รายการตรวจสอบ		ตรวจสอบ (ส่ง)	หมายเหตุ
	30 Oct 2024	30 Oct 2024		
ปกติ	ปกติ	ปกติ	ปกติ	
General				
<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer				
<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	7. ตัวหน่วงเลือกความยาวคลื่น (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. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<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"/>	12. อิเล็กโทรด (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 checked="" type="checkbox"/>	14. ฝาปิดกันฝน Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter				
<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator				
<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. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr. Piypat Saidoung
Service Engineer



Certificate of Calibration

Equipment : Digital Thermometer with Probe

Model : Seven2Go S2

Serial No. : B633886757

Manufacturer : Mettler Toledo

ID No. : -

Certificate No. : C15241037

Issued Date : 06 November 2024

Job No. : WO-00047130

Page : 1 of 2

Condition : In Condition

Customer : Integrated Research Center Co.,Ltd. (Pulp Laboratory)

122 Moo 2, Tambol Thatoom,

Amphur Simahaphote, Prachinburi 25140 Thailand

Environment Condition : Temperature: 30 °C ± 10 °C
Humidity: 55 %RH ± 25 %RH
Voltage: 220 VAC ± 10 %

Calibration Place : Double A (1991) Public Company Limited. (Water Laboratory IP1)

1 Moo 2, Thatoom, Srimahaphot,

Prachinburi 25140 Thailand.

Calibration By : Mr. Piypat Saidoung

Calibration Date : 30 October 2024

The Method used : In house method, CAL-WI-69, by comparison with standard thermometer

Traceability : This certificate is traceable to the International System of Unit maintained by:

Quality Reborn Co.,Ltd. (QR)

(Mr. Piypat Saidoung)

Person in charge

This certificate is issued 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.

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C15-14: 06 Dec 2022



Certificate No.: C15241037

Page: 2 of 2

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-2043	21 August 2024	21 August 2025

Calibration Results:

Without Adjustment

Sensor Type: RTD

Diameter (mm): 12

Length (mm): 120

Electrode Serial No.: 3474864

Channel: -

Immersion (mm): 110

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C15-14: 06 Dec 2022



ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment : Digital Thermometer with Probe
Certificate No. : C15241037
Serial No. : B633886757
Model : Seven2Go S2

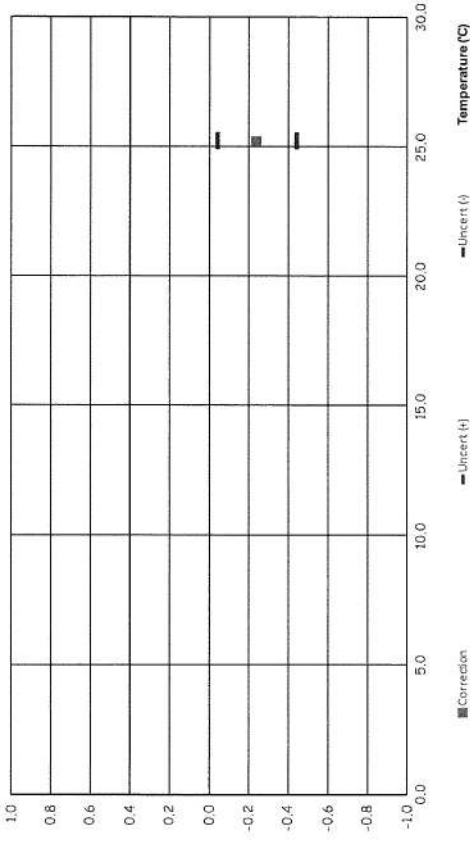
ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
30-Oct-2024			30-Oct-2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Battery	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Sensor (In / Ex)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr. Piyaapat Saidoung
Service Engineer



C15241037
Without Adjustment





Certificate of Calibration

Certificate No.: C17240184

Page: 2 of 5

Equipment: COD Reactor
Model: DRB200
Serial No. (or ID.): 19070C0337
Manufacturer: Hach
Condition: In Condition
Covers: Open (Max)
Locations healing Block: Left and Right

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.7 °C
Humidity: 60 %RH ± 5.0 %RH
Voltage: 231 VAC ± 2.2 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khammonphoem
Calibration Date: 29 October 2024
The Method used: In house method, CAL-VI-59, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

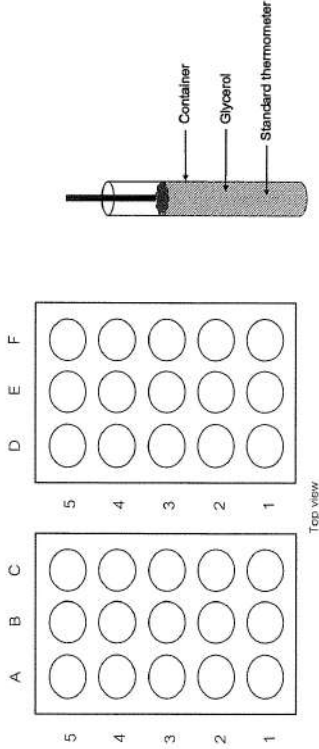
(Mr. Suphanimit Khammonphoem)
Person in charge
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty 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.

(Mr. Udon Srichana)
Authorized signatory

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi 10250
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C17-08: 20 Jul 2022



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature:

The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature:

The average reading of standards at any positions or location.

Measured Stability:

The one-half of greatest maximum difference of measured temperatures at any one probe.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi 10250
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C17-08: 20 Jul 2022

D3	151.07	1.07	0.65
D4	151.12	1.12	0.65
D5	148.79	-1.21	0.65



Characterization of the unit under calibration:

Locations heating Block	Desired	Unit Under Calibration (°C)		Measured Temperature (°C)
	(°C)	Setting	Reading	Stability (±°C)
Left	150	150	150	0.11
Right	150	150	150	0.13

The End of Certificate



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่องมือ: COD Reactor
หมายเลขเครื่อง: 19070C0337

รุ่น: DRB200

เลขที่ใบงาน: WO-00047130

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2024			29 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สกอฟ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สกอฟฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	7. สกอฟตัวเครื่อง	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สกาวเวดลอม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : *สภาพตัวเครื่องมีรอยแตกบริเวณตัวเครื่อง

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration

Certificate No.: C17240185

Page: 2 of 5

Equipment: COD Reactor
Model: DRB200
Serial No. (or ID.): 19050C0191
Manufacturer: Hach
Condition: In Condition
Covers: Open (Max)
Locations heating Block: Left and Right

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.7 °C
Humidity: 60 %RH ± 5.0 %RH
Voltage: 231 VAC ± 2.2 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory (P1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khammonphoem
Calibration Date: 29 October 2024
The Method used: In house method, CAL-VI-59, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

(Mr. Suphanimit Khammonphoem)

Person in charge

This certificate is issued 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.

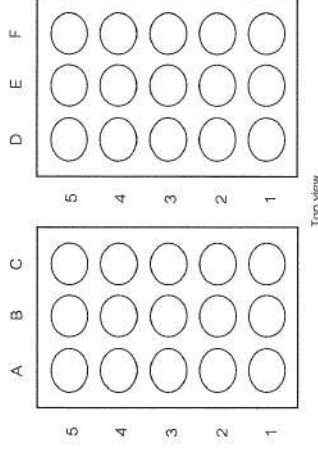
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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.

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Delivering Growth – in Asia and Beyond.

CAL-FM-C17-08: 20 Jul 2022



Location of standard

Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature:

The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature:

The average reading of standards at any positions or location.

Measured Stability:

The one-half of greatest maximum difference of measured temperatures at any one probe.

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

CAL-FM-C17-08: 20 Jul 2022



Certificate No.: C17240185

Page: 3 of 5

Calibration Results:
Pre-Calibration

Locations heating Block:		Setting (°C)	Unit Under Calibration (°C)	
Left		150	150	

Location heating Block:		A1	A2	A3	A4	A5
Measured Temperature (°C)		151.75	150.99	151.10	151.04	150.79

Location heating Block:		B1	B2	B3	B4	B5
Measured Temperature (°C)		152.46	151.03	152.21	151.03	151.05

Location heating Block:		C1	C2	C3	C4	C5
Measured Temperature (°C)		151.41	152.96	152.96	152.22	151.47



Certificate No.: C17240185

Page: 4 of 5

Calibration Results:
Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:		Setting (°C)	Unit Under Calibration (°C)	
Left		150	150	
Right		150	150	

Location heating Block:		Measured Temperature (°C)		Correction of UUC (°C)		Uncertainty (± °C)	
A1		149.69		-0.31		0.66	
A2		148.90		-1.10		0.66	
A3		148.97		-1.03		0.66	
A4		148.92		-1.08		0.66	
A5		148.73		-1.27		0.66	
B1		150.43		0.43		0.66	
B2		148.95		-1.05		0.66	
B3		150.11		0.11		0.66	
B4		148.97		-1.03		0.66	
B5		148.97		-1.03		0.66	
C1		149.36		-0.64		0.66	
C2		150.93		0.93		0.66	
C3		150.93		0.93		0.66	
C4		150.14		0.14		0.65	
C5		149.42		-0.58		0.66	
D1		150.97		0.97		0.66	
D2		151.80		1.80		0.65	
D3		153.05		3.05		0.66	
D4		150.80		0.80		0.66	
D5		149.19		-0.81		0.66	
E1		150.85		0.85		0.65	
E2		149.43		-0.57		0.66	
E3		150.20		0.20		0.67	
E4		149.08		-0.92		0.67	
E5		149.16		-0.84		0.66	
F1		148.97		-1.03		0.69	
F2		149.54		-0.46		0.66	
F3		149.20		-0.80		0.67	
F4		149.17		-0.83		0.68	
F5		149.94		-0.06		0.66	



Characterization of the unit under calibration:

Locations heating Block	Desired (°C)	Unit Under Calibration (°C)		Measured Temperature (°C)
		Setting	Reading	
Left	150	150	150	Stability (±°C) 0.11
Right	150	150	150	0.21

The End of Certificate



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: COD Reactor

รุ่น: DRB200

หมายเลขเครื่อง: 19050C0191

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2024			29 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	7. สภาพตัวเครื่อง	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : "สภาพตัวเครื่องมีรอยแตกบริเวณตัวเครื่อง"

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration

Equipment: Oven
Model: ED 115
Serial No.(or ID): 950360
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 2

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Certificate No.: C31242209
Issued Date: 05 November 2024
Job No.: WO-00047130
Page: 1 of 4
Ventilation Valve: Closed

Environment Condition: Temperature: 24 °C ± 0.6 °C
Humidity: 63 %RH ± 4.5 %RH
Voltage: 231 VAC ± 2.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 30 October 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued for 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.

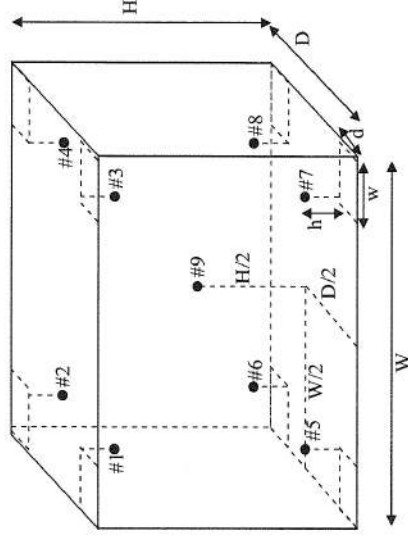
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2539 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31242209 Page: 2 of 4



Standard Installation Locations

Volume (Calibration Zone)= 55 (Liters)

Inside chamber: W = 60 (cm) D = 40 (cm) H = 48 (cm)
Standard Locations (#1, #2, #3, #4): w = 6 (cm) d = 5 (cm) h = 5 (cm)
Standard Locations (#5, #6, #7, #8): w = 6 (cm) d = 5 (cm) h = 5 (cm)
#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the

measured temperature at the reference location which are observed at same time or at close observation time as

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2539 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022

Calibration Results: Pre-Calibration

Setting: 181
Indicating: #1: 178.50 #2: 178.97 #3: 178.64 #4: 178.89 #5: 178.84 #6: 178.97 #7: 178.44 #8: 178.43 #9: 178.26

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	103.92	-0.08	0.67
#2	103.86	-0.14	0.67
#3	104.13	0.13	0.68
#4	104.05	0.05	0.67
#5	103.75	-0.25	0.67
#6	103.82	-0.18	0.75
#7	103.49	-0.51	0.67
#8	103.57	-0.43	0.69
#9	103.83	-0.17	0.67

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104	104	104	103.92	103.86	104.13	104.05	103.75	103.82	103.49	103.57	103.83	0.75

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	0.41	0.31	0.88

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 182 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	179.50	-2.50	0.71
#2	179.97	-2.03	0.71
#3	179.64	-2.36	0.71
#4	179.89	-2.11	0.74
#5	179.84	-2.16	0.70
#6	179.97	-2.03	0.79
#7	179.44	-2.56	0.70
#8	179.43	-2.57	0.72
#9	179.26	-2.74	0.72

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180	182	182	179.50	179.97	179.64	179.89	179.84	179.97	179.44	179.43	179.26	0.79

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
182	1.07	0.32	1.18

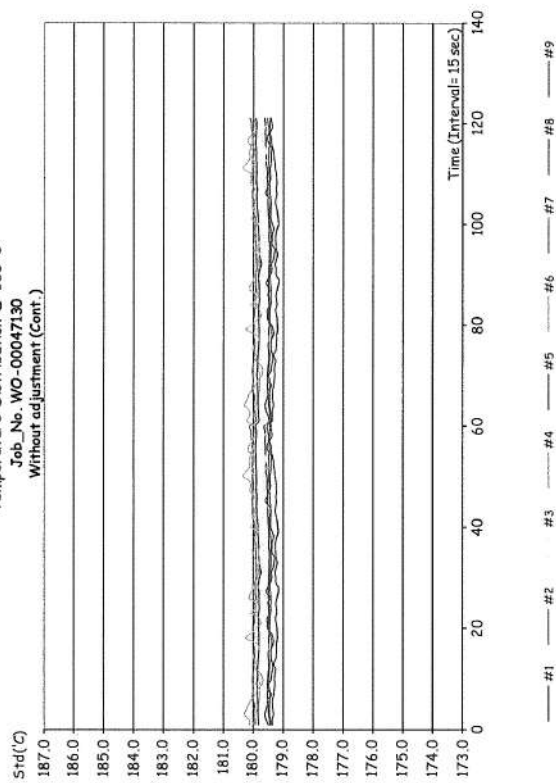
Note: * Maximum uncertainty of the each position

The End of Certificate

Temperature Distribution @ 180°C
Job_No. WO-00047130
Without adjustment (Cont.)

Job_No. WO-00047130
Without adjustment (Cont.)

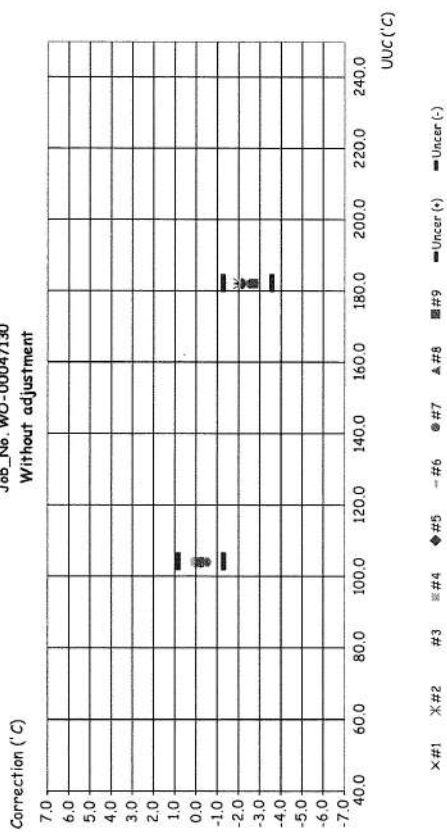
Without adjustment (Cont.)



Corr_Distribution & Max_Measurement Uncertainty

Job_No. WO-00047130

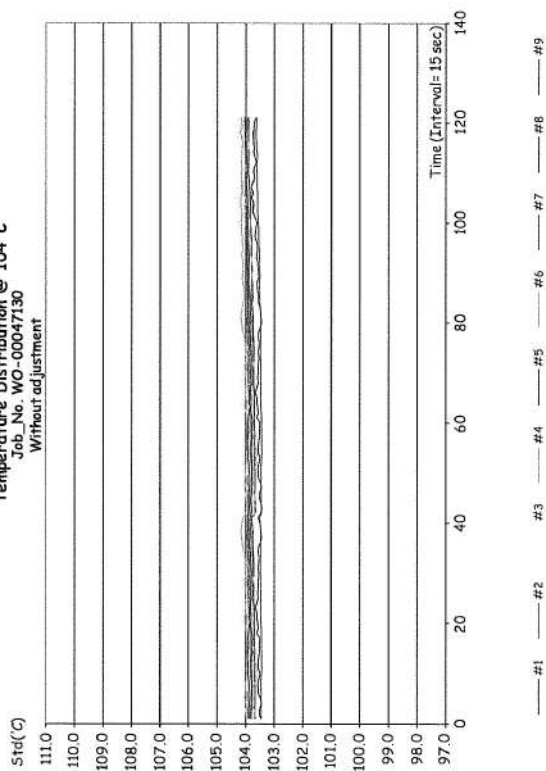
Without adjustment



Temperature Distribution @ 104°C

Job_No. WO-00047130

Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: Oven

รุ่น: ED 115

หมายเลขเครื่อง: 950360

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2024	ไม่ปกติ		30 Oct 2024	ไม่ปกติ	
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สลัก Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลัก Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลัก Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความชื้น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input checked="" type="checkbox"/>	12. สลักตัวเครื่อง	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สลักแวนดอลัม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : * สลักตัวเครื่อง: พื้นหมักภายในเครื่องโค้ง

Mr. Suphanimit Khamnonphoem
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
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Certificate of Calibration

Equipment: Oven
Model: ED 115
Serial No.(or ID): 20190000012946
Manufacturer:
Condition: In Condition
Shelves(pc.): 2
Certificate No.: C31242210
Issued Date: 05 November 2024
Job No.: WO-00047130
Page: 1 of 4
Ventilation Valve: Closed

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.8 °C
Humidity: 63 %RH ± 4.5 %RH
Voltage: 231 VAC ± 2.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued 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 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).

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บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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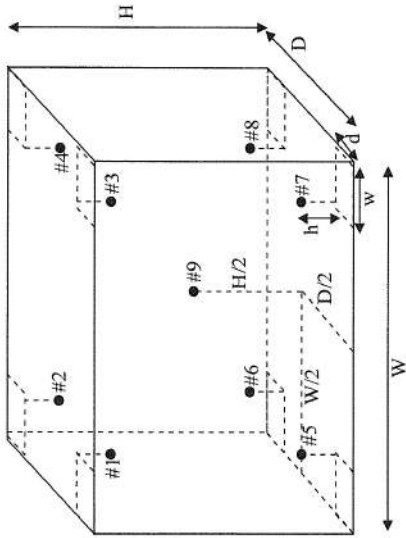
Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	105.54	1.54	0.82
#2	105.79	1.79	0.82
#3	105.77	1.77	0.82
#4	106.02	2.02	0.82
#5	104.16	0.16	0.82
#6	104.08	0.08	0.87
#7	103.95	-0.05	0.86
#8	103.88	-0.12	0.83
#9	103.93	-0.07	0.83

Standard Installation Locations

Volume (Calibration Zone)= 48 (Liters)



Inside chamber: W = 52 (cm) D = 40 (cm) H = 48 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104	104	104	#1	#2	#3	#4	#5	#6	#7	#8	#9	
			105.54	105.79	105.77	106.02	104.16	104.08	103.95	103.88	103.93	0.87

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	2.16	0.24	2.35

Note: * Maximum uncertainty of the each position



Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180 °C

Locations	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty (± °C)
#1	180.52	0.52	0.91
#2	181.41	1.41	0.91
#3	180.98	0.98	0.91
#4	181.63	1.63	0.91
#5	180.23	0.23	0.94
#6	180.20	0.20	0.94
#7	179.15	-0.85	0.95
#8	179.03	-0.97	0.96
#9	179.12	-0.88	0.95

Temperature Distribution

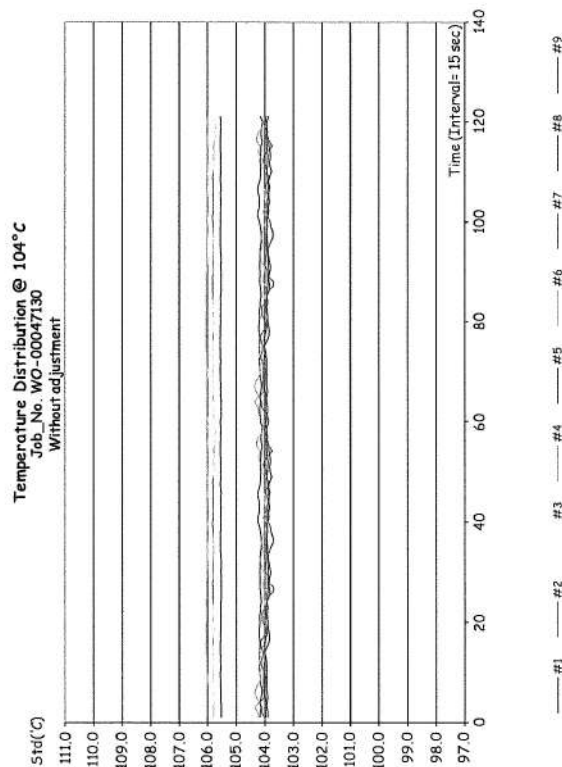
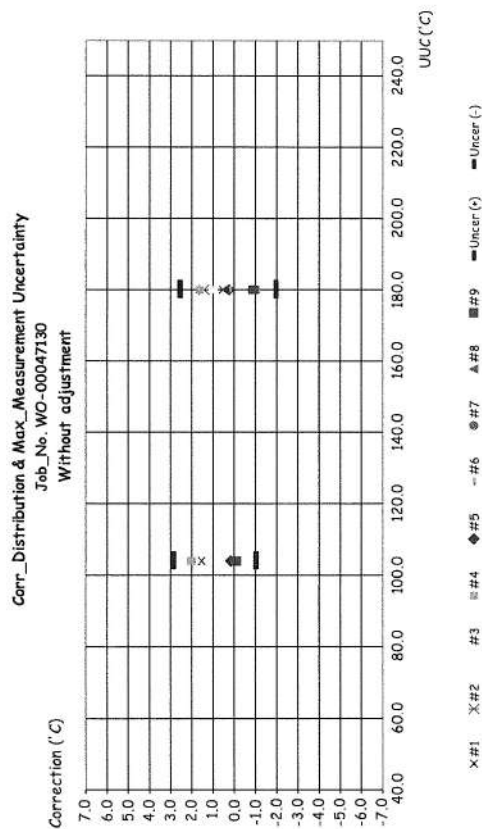
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180	180	180	180.52	181.41	180.98	181.63	180.23	180.20	179.15	179.03	179.12	0.96

Chamber Characterization

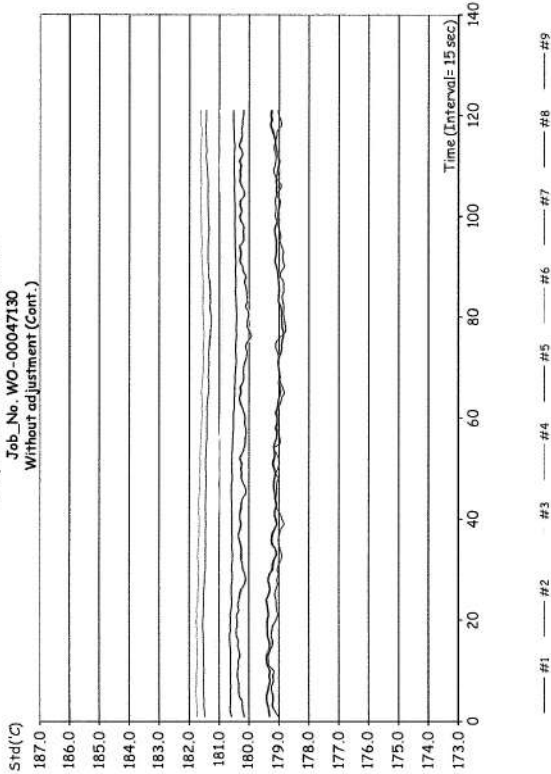
Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180	2.67	0.29	3.01

Note: * Maximum uncertainty of the each position

The End of Certificate



Temperature Distribution @ 180°C
Job_No. WO-00047130
Without adjustment (Cont.)



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: Oven

รุ่น: ED 115

หมายเลขเครื่อง: 20190000012946

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2024	ไม่ปกติ		31 Oct 2024	ไม่ปกติ	
ปกติ	ไม่ปกติ	General	ปกติ	ไม่ปกติ	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาวะ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาวะ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาวะตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Suphanimit Khammonphoem
Service Engineer



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF110
Serial No.(or ID): B417-1014
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31242211
Issued Date: 05 November 2024
Job No.: WO-00047130
Page: 1 of 4
Ventilation Valve: Closed

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Simahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.9 °C
Humidity: 63 %RH ± 4.5 %RH
Voltage: 231 VAC ± 2.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2024
The Method used: In house method, CAL-WJ-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

Person in charge
(Mr. Suphanimit Khamnonphoem)
Authorized signatory
(Mr. Udon Srichana)

This certificate is issued 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.
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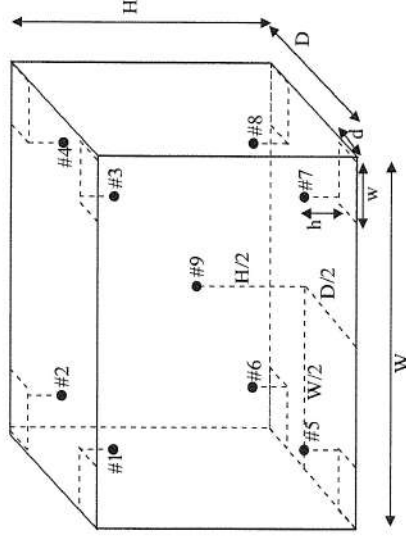
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31242211 Page: 2 of 4



Standard Installation Locations

Volume (Calibration Zone)= 48 (Liters)

Inside chamber:
W = 52 (cm) D = 40 (cm) H = 48 (cm)
Standard Locations (#1, #2, #3, #4):
w = 5 (cm) d = 5 (cm) h = 5 (cm)
Standard Locations (#5, #6, #7, #8):
w = 5 (cm) d = 5 (cm) h = 5 (cm)
#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the

measured temperature at the reference location which are observed at same time or at close observation time as

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

DKSH Technology Limited
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CAL-FM-C31-10: 12 Sep 2022

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
#1	104.55	0.55	0.39
#2	104.30	0.30	0.39
#3	104.40	0.40	0.39
#4	103.95	-0.05	0.39
#5	103.70	-0.30	0.39
#6	103.80	-0.20	0.39
#7	103.40	-0.60	0.39
#8	104.49	0.49	0.39
#9	103.84	-0.16	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.55	104.30	104.40	103.95	103.70	103.80	103.40	104.49	103.84	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.76	0.10	1.26

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
#1	180.98	0.98	0.59
#2	180.32	0.32	0.60
#3	181.27	1.27	0.60
#4	179.67	-0.33	0.58
#5	179.05	-0.95	0.59
#6	179.19	-0.81	0.59
#7	178.67	-1.33	0.59
#8	179.99	-0.01	0.59
#9	179.34	-0.66	0.59

Temperature Distribution

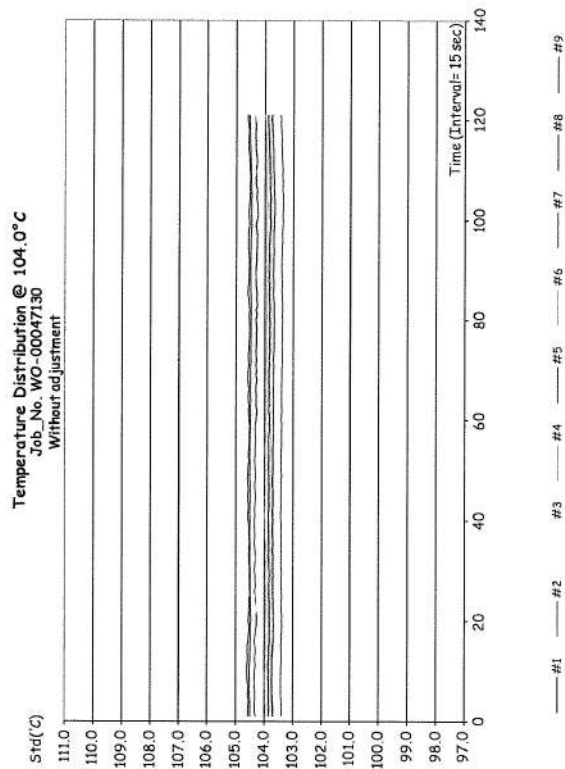
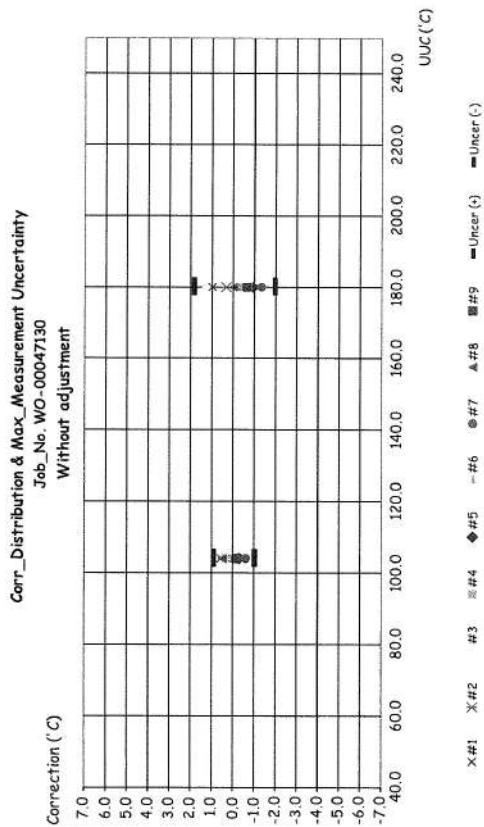
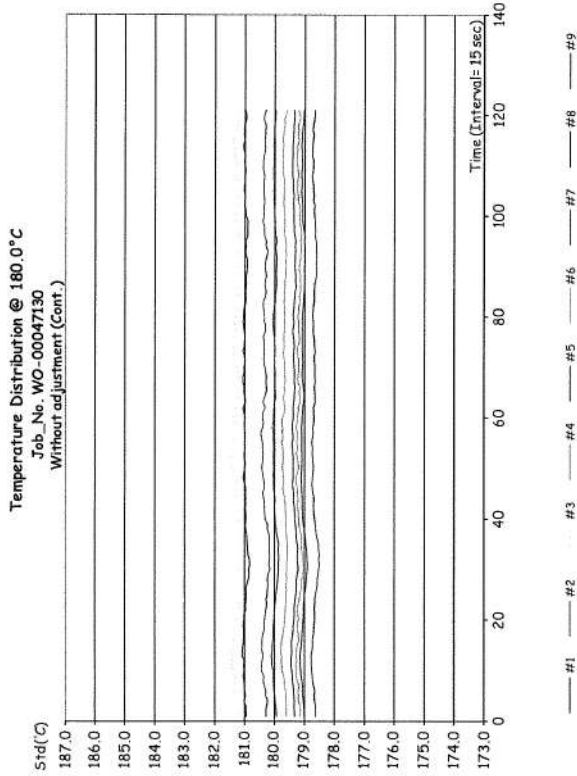
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.98	180.32	181.27	179.67	179.05	179.19	178.67	179.99	179.34	0.60

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	2.07	0.17	2.94

Note: * Maximum uncertainty of the each position

The End of Certificate





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่องมือ: Hot Air Oven
หมายเลขเครื่อง: B417.1014
รุ่น: UF110
เลขที่ใบงาน: WO-00047130

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2024	31 Oct 2024		ปกติ	ไม่ปกติ	
ปกติ	ไม่ปกติ				
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สลัก Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลัก Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลัก Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สลักตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สลักแวนดลม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ :

Mr. Suphanimit Khamnonphoom
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Equipment: Block Digestion Unit
Model: SC2100-35V/240
Serial No. (or ID.): 2021CEP296
Manufacturer: Environmental Express
Condition: In Condition
Certificate No.: C29240033
Issued Date: 05 November 2024
Job No.: WO-00047130
Page: 1 of 4
Digestion Block: 18 holes.

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.7 °C
Humidity: 60 %RH ± 5.2 %RH
Voltage: 231 VAC ± 2.5 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoom
Calibration Date: 31 October 2024
The Method used: In house method, base on by comparison with standard
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.: TC24/0061

(Mr. Suphanimit Khamnonphoom)
Person in charge

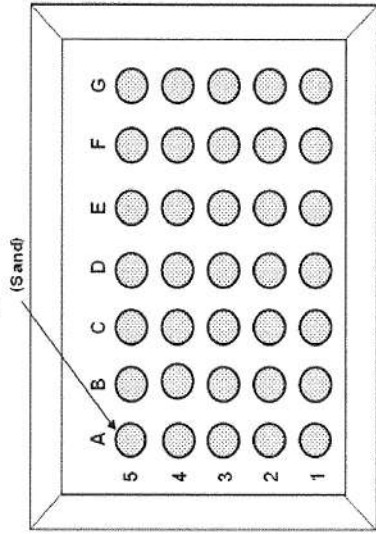
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued 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.

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Fig. 1.: Top view



Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

Calibration Results:

Before adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	104.0	104.0	104.0	102.2	-1.8	1.4
A3				102.8	-1.2	1.4
A5				102.4	-1.6	1.4
B2				101.9	-2.1	1.4
B4				101.7	-2.3	1.4
C1				101.9	-2.1	1.4
C3				101.7	-2.3	1.4
C5				102.9	-1.1	1.4
D2				102.7	-1.3	1.4
D4				101.8	-2.2	1.4
E1				102.0	-2.0	1.4
E3				102.1	-1.9	1.4
E5				102.8	-1.2	1.4
F2				103.1	-0.9	1.4
F4				102.9	-1.1	1.4
G1				102.5	-1.5	1.4
G3				101.8	-2.2	1.4
G5				102.2	-1.8	1.4

The End of Certificate

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Calibration Results:

After adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	95.0	95.0	95.0	95.5	0.5	1.4
A3				94.8	-0.2	1.4
A5				96.0	1.0	1.4
B2				94.9	-0.1	1.4
B4				95.1	0.1	1.4
C1				95.0	0.0	1.4
C3				95.0	0.0	1.4
C5				95.4	0.4	1.4
D2				95.2	0.2	1.4
D4				94.9	-0.1	1.4
E1				95.1	0.1	1.4
E3				95.6	0.6	1.4
E5				95.5	0.5	1.4
F2				95.7	0.7	1.4
F4				95.2	0.2	1.4
G1				95.0	0.0	1.4
G3				94.7	-0.3	1.4
G5				94.9	-0.1	1.4

The End of Certificate

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Calibration Results:

After adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	104.0	104.0	104.0	104.2	0.2	1.4
A3				104.8	0.8	1.4
A5				104.4	0.4	1.4
B2				103.9	-0.1	1.4
B4				103.7	-0.3	1.4
C1				103.9	-0.1	1.4
C3				103.7	-0.3	1.4
C5				104.9	0.9	1.4
D2				104.7	0.7	1.4
D4				103.8	-0.2	1.4
E1				104.0	0.0	1.4
E3				104.1	0.1	1.4
E5				104.8	0.8	1.4
F2				105.1	1.1	1.4
F4				104.9	0.9	1.4
G1				104.5	0.5	1.4
G3				103.8	-0.2	1.4
G5				104.2	0.2	1.4

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: Block Digestion Unit รุ่น: SC2100-35V240

หมายเลขเครื่อง: 2021CEP296

ตรวจสอบ (รับ)	รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
			31 Oct 2024	ไม่ปกติ	
31 Oct 2024	ปกติ		ปกติ	ไม่ปกติ	
	General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ:

Mr. Suphanimit Khammonphoom
Service Engineer

Certificate of Calibration

Certificate No.: C29240034

Page: 2 of 3

Equipment: Block Digestion Unit
Model: KT 20s-BS
Serial No. (or ID.): GER5720190108
Manufacturer: Gerhardt
Condition: In Condition
Certificate No.: C29240034
Issued Date: 05 November 2024
Job No.: WO-00047130
Page: 1 of 3
Digestion Block: 20 holes.

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:
Temperature: 25 °C ± 1.0 °C
Humidity: 65 %RH ± 5.1 %RH
Voltage: 230 VAC ± 2.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2024

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.: TC24/0061



(Mr. Suphanimit Khamnonphoem)

Person in charge



(Mr. Udon Srichana)

Authorized signatory

This certificate is issued 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.

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CAL-FM-C29-07: 20 Jul 2022

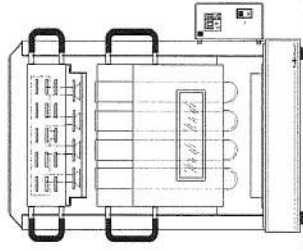


Fig. 1.: Front view

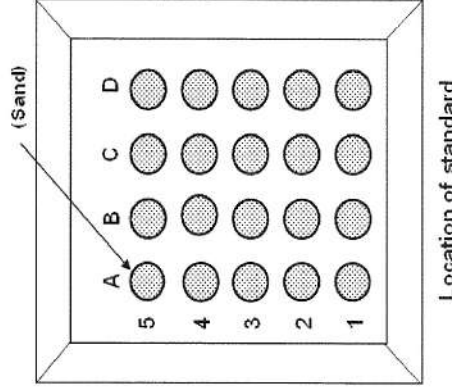


Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

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CAL-FM-C29-07: 20 Jul 2022

Calibration Results:

Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
A1	380	380	380	379.6	-0.4	1.5
A2				380.1	0.1	1.5
A3				381.9	1.9	1.5
A4				382.4	2.4	1.5
A5				382.7	2.7	1.5
B1				380.6	0.6	1.5
B2				382.3	2.3	1.5
B3				382.0	2.0	1.5
B4				379.6	-0.4	1.5
B5				380.4	0.4	1.5
C1				378.3	-1.7	1.5
C2				381.4	1.4	1.5
C3				380.5	0.5	1.5
C4				378.5	-1.5	1.5
C5				379.4	-0.6	1.5
D1				375.6	-4.4	1.5
D2				375.2	-4.8	1.5
D3				379.1	-0.9	1.5
D4				378.7	-1.3	1.5
D5				378.9	-1.1	1.5

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: Block Digestion Unit รุ่น: KT 20s-BS

หมายเลขเครื่อง: GER5720190108

ตรวจสอบ (รับ)	31 Oct 2024	ไม่ปกติ	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
				31 Oct 2024	ไม่ปกติ	
	ปกติ			ปกติ		
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General			
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ:

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration

Equipment: Cooled Incubator
Model: ES5C
Serial No.(or ID): 03021
Manufacturer: OmRon
Condition: In Condition
Shelves(pc.): 9

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Simahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.3 °C
Humidity: 64 %RH ± 4.3 %RH
Voltage: 231 VAC ± 2.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 30 October 2024
The Method used: In house method, CAL-WJ-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240013

Person in charge
(Mr. Suphanimit Khamnonphoem)
Authorized signatory
(Mr. Udon Srichana)
This certificate is issued 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 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.

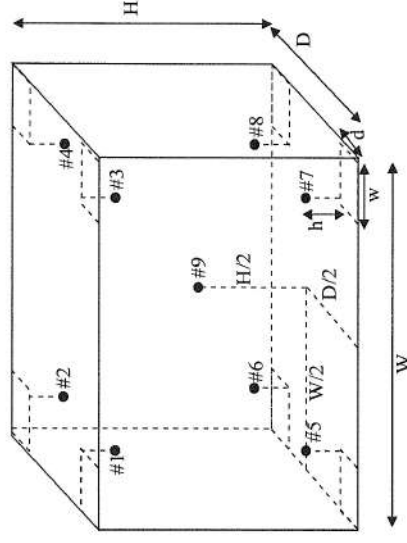
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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31242212 Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone)= 422 (Liters)

Inside chamber: W = 110 (cm) D = 60 (cm) H = 160 (cm)
Standard Locations (#1, #2, #3, #4): w = 11 (cm) d = 6 (cm) h = 30 (cm)
Standard Locations (#5, #6, #7, #8): w = 11 (cm) d = 6 (cm) h = 30 (cm)
#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

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2533 Sukhumvit Road, Bangkok, Prachinburi 10260
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CAL-FM-C31-10: 12 Sep 2022

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20 °C

Locations	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
#1	20.23	0.23	0.67
#2	20.20	0.20	0.68
#3	20.51	0.51	0.66
#4	20.38	0.38	0.66
#5	20.06	0.06	0.77
#6	20.09	0.09	0.70
#7	20.21	0.21	0.73
#8	20.56	0.56	0.67
#9	20.18	0.18	0.73

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*	
			#1	#2	#3	#4	#5	#6	#7	#8	#9		
20	20	20	20.23	20.20	20.51	20.38	20.06	20.09	20.21	20.56	20.18	0.77	

Chamber Characterization

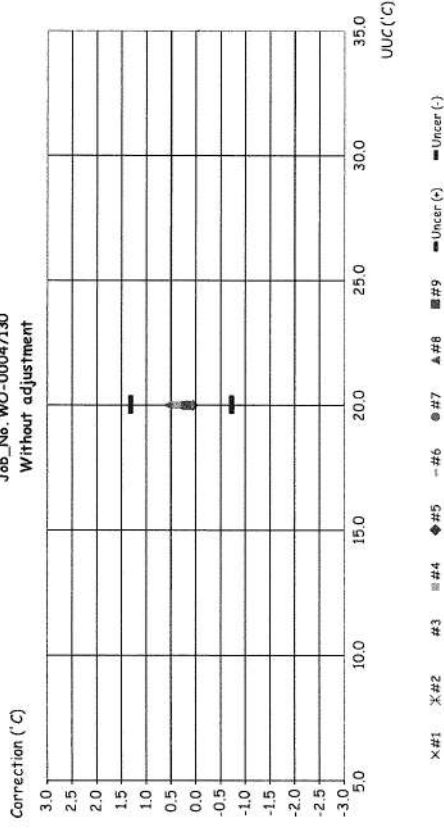
Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20	0.65	0.38	1.08

Note: * Maximum uncertainty of the each position

The End of Certificate

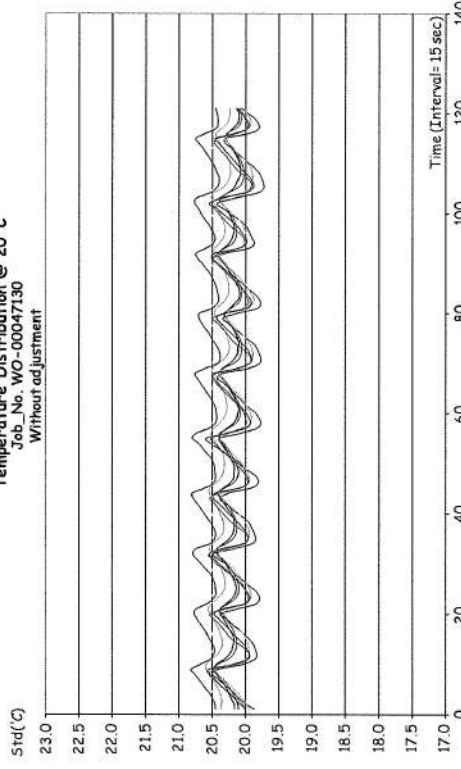
Corr. Distribution & Max. Measurement Uncertainty

Job No. WO-00047130
Without adjustment



Temperature Distribution @ 20 °C

Job No. WO-00047130
Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่องมือ: Cooled Incubator รุ่น: E5CC เลขที่ใบงาน: WO-00047130
หมายเลขเครื่อง: 03021

ตรวจสอบ (รับ)	รายการตรวจสอบ		หมายเหตุ
	30 Oct 2024	30 Oct 2024	
ปกติ	ปกติ	ปกติ	ปกติ
General			
<input checked="" type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	6. สภาวะ Lever of Ventilation valve	<input checked="" type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	7. สภาวะ Lever door open / close	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	8. สภาวะ Door seal	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	11. การทำงานของระบบทำความชื้น	<input checked="" type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	12. สภาวะตัวเครื่อง	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	

ข้อแนะนำ :

Mr. Suphanimit Khamnonphoom
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
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Certificate of Calibration

Equipment: Standard Weight Certificate No.: C02241986
Model: 1 g Issued Date: 5 November 2024
Serial No. (or ID.): Weight 001 Job No.: WO-00047137
Manufacturer: LS Page: 1 of 2
Condition: In condition Class: -

Customer: Integrated Research Center Co., Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
Relative Humidity 50 %RH ± 10 %RH
Atmospheric Pressure 980-1030 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Anusorn Jitborikhon
Calibration Date: 05 November 2024
The Method used: In house method, CAL-WI-48, base on OIML R111-1
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02241986.

Person in charge
(Mr. Anusorn Jitborikhon)

Authorized signatory
(Miss Saowanuk Klayasuwan)

Person in charge

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.

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty (\pm mg)	MPE Class (\pm mg)
1 g	None	1 g + 0.046 mg	0.030	0.10 F1

Note : These MPE Class are only conventional mass.

The End of Certificate



Certificate of Calibration

Equipment: Standard Weight
Model: 100 g
Serial No. (or ID.): Weight 002
Manufacturer: LS
Condition: In condition
Certificate No.: C02241987
Issued Date: 5 November 2024
Job No.: WO-00047137
Page: 1 of 2
Class: -

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:
Temperature 22 °C \pm 2 °C
Relative Humidity 50 %RH \pm 10 %RH
Atmospheric Pressure 980-1030 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited,
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Anusorn Jitborikhon
Calibration Date: 05 November 2024
The Method used: In house method, CAL-WI-48, base on OIML R111-1
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02241980.

Person in charge

(Mr. Anusorn Jitborikhon)

Person in charge

(Miss Saowaruk Kiaysuwan)

Authorized signatory

This certificate is issued 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).
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Certificate No.: C02241987

Page 2 of 2

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty (\pm mg)	MPE Class (\pm mg)
100 g	None	100 g - 0.08 mg	0.16	0.5 F1

Note : These MPE Class are only conventional mass.

The End of Certificate



Certificate of Calibration

Equipment: Standard Weight
Model: 200 g
Serial No. (or I.D.): Weight 003
Manufacturer: LS
Condition: In condition
Certificate No.: C02241988
Issued Date: 5 November 2024
Job No.: WO-00047137
Page: 1 of 2
Class: -

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:
Temperature 22 °C \pm 2 °C
Relative Humidity 50 %RH \pm 10 %RH
Atmospheric Pressure 980-1030 mbar

Calibration Place:
Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Anusorn Jitborikhon
Calibration Date: 05 November 2024
The Method used: In house method, CAL-WI-48, base on OIML R111-1
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02241980.

Person in charge

(Mr. Anusorn Jitborikhon)

Person in charge

Authorized signatory

(Miss Saowaruk Klayusuan)

This certificate is issued 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 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).
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CAL-FM-C02-12: 12 Sep 2022



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Delivering Growth - in Asia and Beyond.

CAL-FM-C02-12: 12 Sep 2022

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty (\pm mg)	MPE Class (\pm mg)
200 g	None	200 g - 0.45 mg	0.30	1.0 F1

Note : These MPE Class are only conventional mass.

The End of Certificate



Certificate of Calibration

Equipment:

Furnace

Certificate No.: C14240250

Model:

CWF 12/5

Issued Date: 05 November 2024

Serial No. (or ID):

2/96/521

Job No.: WO-00047130

Manufacturer:

Carbolite Gero

Page: 1 of 3

Condition:

In Condition

Furnace type: Chamber Furnace

Voltage type:

230 VAC

Customer:

Integrated Research Center Co., Ltd.

122 Moo 2, Tambol Thatoom,

Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:

Temperature: 25 °C \pm 1.0 °CHumidity: 65 %RH \pm 4.8 %RHVoltage: 230 VAC \pm 2.3 VAC

Calibration Place:

Double A (1991) Public Company Limited. (Water Laboratory IP1)

1 Moo 2, Thatoom, Srimahaphot,

Prachinburi 25140 Thailand.

Calibration By:

Mr. Suphanimit Khamnonphoem

Calibration Date:

30 October 2024

The Method used:

In house method, CAL-VI-68, base on BS 4309

This certificate is traceable to the SI Units maintained by National Institute of

Metrology (NIMT), Thailand through N.M. Technical center laboratory Co., Ltd.

Certificate No. TC24/0061

Traceability:

(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued 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.

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CAL-FM-C02-12: 12 Sep 2022

CAL-FM-C14-11: 12 Sep 2022

Calibration Results:

Before Adjustment

Setting	Indicating	#1	#2
550	550	543.8	542.9

After Adjustment

Measured temperature at the spread locations:

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (±°C)*	Cross check (°C)
550	550	550	550.2	0.2	4.0	549.0

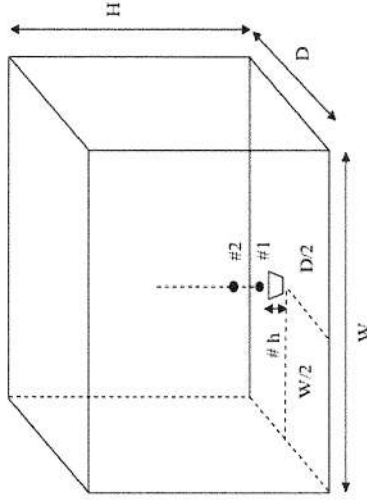
Characterization of the unit under calibration:

Indicating (°C)	Temperature Variation (°C)	Temperature fluctuation (±°C)**
550	1.2	1.1

Note: * Maximum uncertainty of the each position

** Channel 1 is reference temperature.

The End of Certificate



Standard Installation Locations

Volume	6	W	D	H
Inside chamber		15	26	15
Standard Locations		w/2	d/2	h
#1, #2		8	13	4

Note: #1 reference, #2 cross check

Definitions

Indicating Temperature: The temperature indicated by a suitable device installed by the manufacturer or in accordance with his instructions.

Measured Temperature: The arithmetic mean of the average temperature determined over the same specified number of temperature cycles.

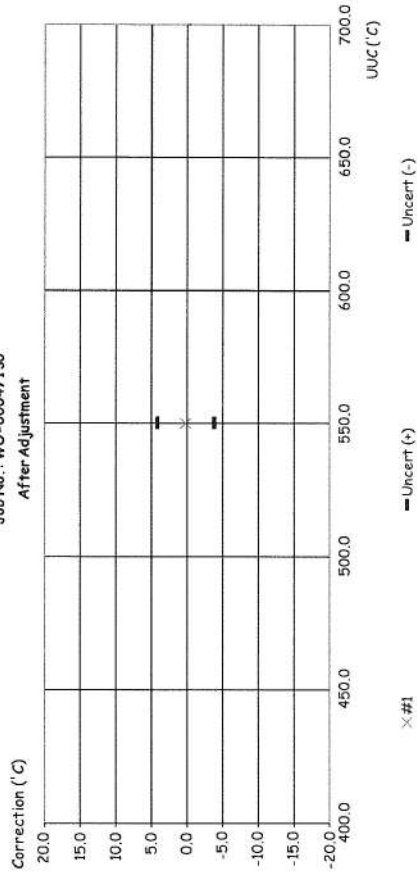
Temperature variation: The difference between the mean temperatures at any two points in the working space, determined over the same specified number of temperature cycles.

Temperature fluctuation: The one-half of difference between maximum temperature and minimum temperatures of reference temperature.

Correction Distribution & Max_Measurement Uncertainty

Job No. : WO-00047130

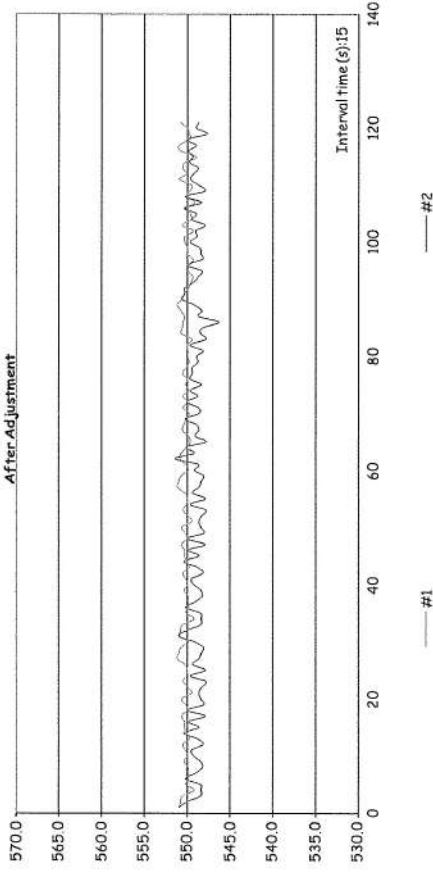
After Adjustment



Temperature Distribution @ 550 °C

Job No. : WO-00047130

After Adjustment



ใบตรวจสอบสภาพเตาเผาควบคุมอุณหภูมิ

ชนิดเครื่องมือ: Chamber Furnace

หมายเลขเครื่อง: 2/96/521

เลขที่ใบงาน: WO-00047130

รุ่น: CWF 12/5

ตรวจสอบ (รับ)		รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2024	ไม่ปกติ			30 Oct 2024	ไม่ปกติ	
ปกติ	ไม่ปกติ	General		ปกติ	ไม่ปกติ	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพตัวเครื่อง		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	6. สภาพหม้อแปลงในตัวเครื่อง		<input type="checkbox"/>	<input checked="" type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพประตูเปิด/ ปิดเครื่อง		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : *สภาพหม้อแปลงในตัวเครื่องมีงัดขึ้นในคู่มือ

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration



Equipment: Moisture Balance
Model: MA35
Serial No. (or ID.): 26303311
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01243399
Issued Date: 06 November 2024
Job No.: WO-00047130
Page: 1 of 2

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 26 °C ± 0.6 °C
Humidity 68 %RH ± 2.4 %RH

Calibration Place: Double A (1991) Public Company Limited, (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
Calibration Date: 31 October 2024
The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02231944

(Mr. Piypat Saidoung)

Person in charge

(Mr. Adisai Maknoi)

Authorized signatory

This certificate is issued 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.

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CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01243399

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value	Reference Points (g)				
	A	B	C	D	E
-	0.000	0.000	0.000	0.000	0.000

Repeatability: Determination of the standard deviation of weighing balance., Readability

0.001 (g)

Nominal test value (g)	Standard Deviation
2	0.0003
20	0.0004

Error of indication from nominal or conventional mass value., Readability

0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.00096	2.02
2	2.0000	2.000	0.000	0.00096	2.02
5	5.0000	5.000	0.000	0.00096	2.02
10	10.0000	10.000	0.000	0.00096	2.02
12	12.0000	12.000	0.000	0.00096	2.02
15	15.0000	15.000	0.000	0.00096	2.02
20	20.0000	20.000	0.000	0.00096	2.02
22	22.0000	22.000	0.000	0.00096	2.02
25	25.0000	25.000	0.000	0.00096	2.02
30	30.0000	30.000	0.000	0.00096	2.02
35	35.0000	35.000	0.000	0.00097	2.02

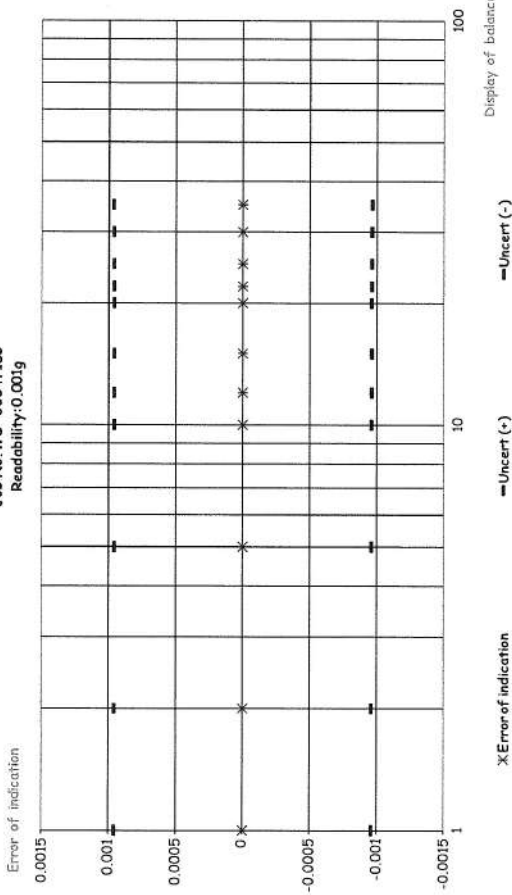
The End of Certificate

DKSH Technology Limited
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Delivering Growth – in Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022

Without Adjustment
Job No. WO-00047130
Readability: 0.001g



ใบตรวจสอบสภาพเครื่องชั่งวิเคราะห์ความชื้น

ชโมโดเครื่องมือ: Moisture Balance รุ่น: MA35 เลขที่ใบงาน: WO-00047130
หมายเลขเครื่อง: 26303311

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2024			31 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General/			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระบอกกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของชั่งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทดสอบของชั่งไม่ปกติ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานตั้ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Piyapat Saldoung
Service Engineer



Certificate of Calibration

Equipment: Moisture Balance
Model: MA35
Serial No. (or ID.): 26303311
Manufacturer: Sartorius
Condition: In condition

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Certificate No.: C30240608

Issued Date: 07 November 2024

Job No.: WO-00047130

Page: 1 of 3

Environment Condition: Temperature 27 °C ± 0.9 °C
Humidity 68 %RH ± 2.4 %RH

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piyapat Saidoung


Calibration Date: 31 October 2024

The Method used: In-house method, CAL-WI-56, temperature measure in the sample chamber
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Co., Ltd. Certificate No. C15240321


(Mr. Piyapat Saidoung)

Person in charge

This certificate is issued 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.


(Mr. Adisai Maknoi)

Authorized signatory

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CAL-FM-C30-12: 12 Sep 2022



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Calibration Results:

Temperature Test

Without Adjustment

Unit Under Calibration		Measurement Temperature (°C)	Error Temperature (°C)	Measurement Uncertainty (±°C)
Desired (°C)	Setting (°C)			
75	75	74.8	0.2	1.6
105	105	104.6	0.4	1.7

Error Temperature = UUC Setting - Measurement Temperature
Black body sensor of STD thermometer size; Ø ~2.5 cm

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Sample Test *

Determination Moisture by Standard Solution (NaCl)

Standard solution for sample test made from salt and distilled water ; 90.00% \pm 0.015%

UUC Setting		UUC Reading		Standard (NaCl)	Error	SD	Measurement Uncertainty (\pm %)
Temperature ($^{\circ}$ C)	End of Analysis Mode	Time (mm.ss)	Moisture (%)**	(%)	(%)	(\pm %)	(\pm %)
160	Automatic	8.48	90.01	90.00	0.01	0.10	0.15

Determination Moisture by Reference Material Sample (RM)

Reference Material Moisture in Flour assigned value ; 12.37% \pm 0.12% Standard deviation ; 0.49

Lot No. RMFF-FL01-2401-III Expired Date: June 2025

UUC Setting		UUC Reading		Standard (RM)	Error	SD	Measurement Uncertainty (\pm %)
Temperature ($^{\circ}$ C)	End of Analysis Mode	Time (mm.ss)	Moisture (%)**	(%)	(%)	(\pm %)	(\pm %)
120	Automatic	8.00	12.56	12.37	0.19	0.04	0.14

* Not TISI Accredited in this Certificate have been included for completeness.

** 1% = 10mg / g

The End of Certificate

Without Adjustment
Job No.: WC-00047130
Tolerance (\pm): $^{\circ}$ C

