

ภาคผนวก 2-1

บันทึกข้อตกลงกรรมสิทธิ์พื้นที่ระหว่าง
บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด
และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า

**บันทึกข้อตกลงการให้กรรมสิทธิ์พื้นที่ และการใช้ประโยชน์พื้นที่เพื่อวางระบบสาธารณูปโภค
เครื่องจักร และท่อส่งก๊าซธรรมชาติภายในพื้นที่โครงการ
บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด**

9 พฤษภาคม 2565

บันทึกข้อตกลงฉบับนี้ทำขึ้นระหว่างบริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด ตั้งอยู่เลขที่ 5 ถนนกรุงเทพกรีฑา แขวงหัวหมาก เขตบางกะปิ กรุงเทพมหานคร 10240 และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด ตั้งอยู่ที่เลขที่ 5 ถนนกรุงเทพกรีฑา แขวงหัวหมาก เขตบางกะปิ กรุงเทพมหานคร 10240

ตามที่ บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด ประกอบกิจการโรงไฟฟ้า ตั้งอยู่ภายในนิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี ตำบลหนองไม้แดง อำเภอเมืองชลบุรี จังหวัดชลบุรี ซึ่งในการประกอบกิจการดังกล่าว นั้น ยินยอมให้กรรมสิทธิ์พื้นที่ และใช้พื้นที่ร่วมกัน โดยมีรายละเอียดดังต่อไปนี้

1. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 และโครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ยินยอมให้ใช้พื้นที่บางส่วน (รายละเอียดตามเอกสารแนบ) ดังนี้

1.1) โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 ให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่ ขนาด 5-1-49 ไร่ ของโฉนดเลขที่ 121202

1.2) โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 ใช้

- พื้นที่ขนาด 1-2-83 ไร่ ของโฉนดเลขที่ 108071

- พื้นที่ขนาด 0-0-63.75 ไร่ ของโฉนดเลขที่ 121204

2. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 97617 ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วาง Cooling Tower, Chemical Dosing for Cooling Tower และ Retention Pit

3. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 121204 (บริเวณพื้นที่ที่ได้กรรมสิทธิ์จาก ABP2) ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วาง Emergency Pit

4. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 210457 ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วาง GT Transformer, ST Transformer

5. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 7164 ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วางบ่อรวบรวมน้ำทิ้ง (T1.2) ก่อนส่งไปยังระบบบำบัดน้ำเสียส่วนกลางของนิคมฯ

6. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 7164, 97617, 108071, 121202 และ 121204 ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วางท่อก๊าซธรรมชาติขนาด 10 นิ้ว และท่อก๊าซขนาด 6 นิ้ว

7. โครงการ ...

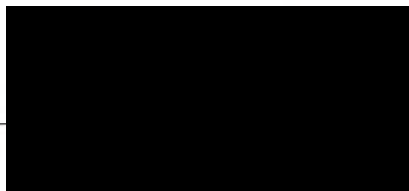
7. โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 โฉนดที่ดินเลขที่ 7164 ยินยอมให้โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP2 ใช้พื้นที่วางสถานีควบคุมและวัดปริมาตรก๊าซธรรมชาติ สำหรับจ่ายก๊าซธรรมชาติไปยังโครงการ ABP2.1

บันทึกข้อตกลงฉบับนี้ทำขึ้นเป็นสองฉบับมีข้อความถูกต้องตรงกัน คู่สัญญาทั้งสองฝ่ายได้อ่านและเข้าใจข้อความในบันทึกข้อตกลงฉบับนี้เป็นที่เรียบร้อยแล้ว ดังนั้นเพื่อเป็นหลักฐานในการนี้คู่สัญญาทั้งสองฝ่ายจึงได้ลงลายมือชื่อไว้ต่อหน้าพยานเป็นสำคัญ

บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด



ลงชื่อ



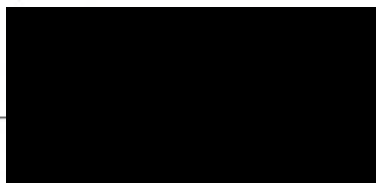
กรรมการ

ลงชื่อ



กรรมการ

ลงชื่อ

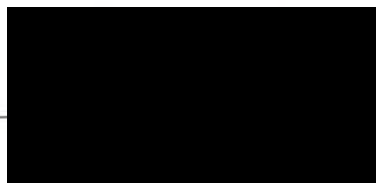


พยาน

บริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด

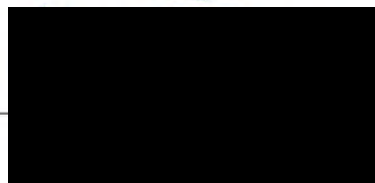


ลงชื่อ



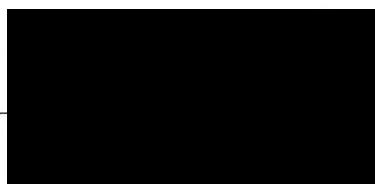
กรรมการ

ลงชื่อ



กรรมการ

ลงชื่อ



พยาน

ภาคผนวก 2-2

บันทึกข้อตกลงการใช้อาคารและ ส่วนสนับสนุนการผลิตร่วมกัน

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า

**บันทึกข้อตกลงการใช้ระบบสาธารณูปโภคระหว่าง
บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด**

9 พฤษภาคม 2565

บันทึกข้อตกลงฉบับนี้ทำขึ้นระหว่างบริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด ตั้งอยู่เลขที่ 5 ถนน
กรุงเทพกรีฑา แขวงหัวหมาก เขตบางกะปิ กรุงเทพมหานคร 10240 และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด
ตั้งอยู่เลขที่ 5 ถนนกรุงเทพกรีฑา แขวงหัวหมาก เขตบางกะปิ กรุงเทพมหานคร 10240

ตามที่ บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด และบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด ประกอบ
กิจการโรงไฟฟ้า ตั้งอยู่ภายในนิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี ตำบลหนองไม้แดง อำเภอเมืองชลบุรี จังหวัดชลบุรี
ซึ่งในการประกอบกิจการดังกล่าวนี้ ยินยอมให้ใช้ระบบสาธารณูปโภคร่วมกัน โดยมีรายละเอียดดังต่อไปนี้

พื้นที่อาคารและระบบสาธารณูปโภค	กรรมสิทธิ์การถือครอง	
	บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด	บริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด
1) อาคารสำนักงาน	✓	
2) อาคารควบคุมการผลิตไฟฟ้า	✓	
3) ลานไถไฟฟ้า (Switch Yard)	✓	
4) สถานีจ่ายไฟฟ้าแรงสูง (Remote Substation)	✓	✓
5) ระบบผลิตน้ำ และอาคารควบคุม	✓	
6) สถานีสูบน้ำดับเพลิง	✓	
7) สถานีควบคุมและวัดปริมาณก๊าซธรรมชาติ	✓	
8) อาคารเก็บสารเคมี	✓	
9) ถังเก็บน้ำใช้ในโครงการ	✓	
10) เครื่องอัดอากาศ (Air Compressor)	✓	
11) เครื่องสูบน้ำสำหรับหล่อเย็น	✓	
12) อาคารซ่อมบำรุง (Workshop & Stores Building)	✓	

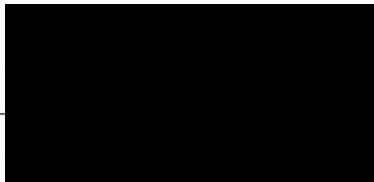
บันทึกข้อตกลง...

บันทึกข้อตกลงฉบับนี้ทำขึ้นเป็นสองฉบับมีข้อความถูกต้องตรงกัน คู่สัญญาทั้งสองฝ่ายได้อ่านและเข้าใจ
ข้อความในบันทึกข้อตกลงฉบับนี้เป็นที่เรียบร้อย ดังนั้นเพื่อเป็นหลักฐานในการนี้คู่สัญญาทั้งสองฝ่ายจึงได้ลงลายมือ
ชื่อไว้ต่อหน้าพยานเป็นสำคัญ

บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด

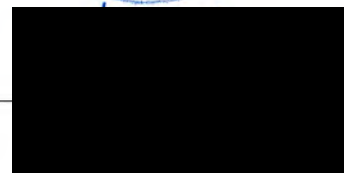


ลงชื่อ



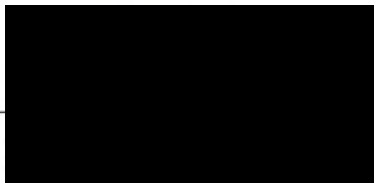
กรรมการ

ลงชื่อ



กรรมการ

ลงชื่อ

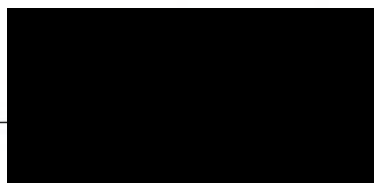


พยาน

บริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด

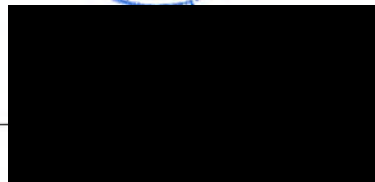


ลงชื่อ



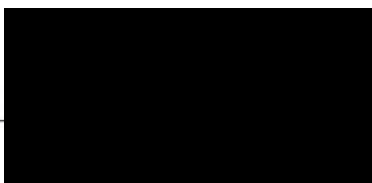
กรรมการ

ลงชื่อ



กรรมการ

ลงชื่อ



พยาน

ภาคผนวก 2-3

การตรวจสอบความมั่นคงแข็งแรงของ Pipe Rack

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า

สรุปรายการตรวจสอบโครงสร้างความมั่นคงแข็งแรง และการรับน้ำหนักที่เพิ่มขึ้นของ Pipe Rack เดิม

โครงการได้ตรวจสอบโครงสร้างความมั่นคงแข็งแรงและการรับน้ำหนักที่เพิ่มขึ้นของ Pipe Rack เดิม โดยมีการตรวจสอบทั้งหมด 17 รายการ ประกอบด้วย

ตรวจสอบความแข็งแรงของโครงสร้างฐานคอนกรีตเสริมเหล็กสำหรับวางท่อ (Pipe Sleeper)

- (1) Pipe Sleeper type D
- (2) Pipe Sleeper type E
- (3) Pipe Sleeper type F

ตรวจสอบความแข็งแรงของโครงสร้างฐานคอนกรีตเสริมเหล็กสำหรับติดตั้ง Pipe Rack (Pipe Rack Foundation)

- (4) บริเวณฐานคอนกรีต Pipe Rack - Q
- (5) บริเวณฐานคอนกรีต Pipe Rack - S
- (6) บริเวณฐานคอนกรีต Pipe Rack - T
- (7) บริเวณฐานคอนกรีต Pipe Rack - W
- (8) บริเวณฐานคอนกรีต Pipe Rack - V
- (9) บริเวณฐานคอนกรีต Pipe Rack - Z

ตรวจสอบความแข็งแรงของโครงสร้าง Pipe Rack (Pipe Rack Structure)

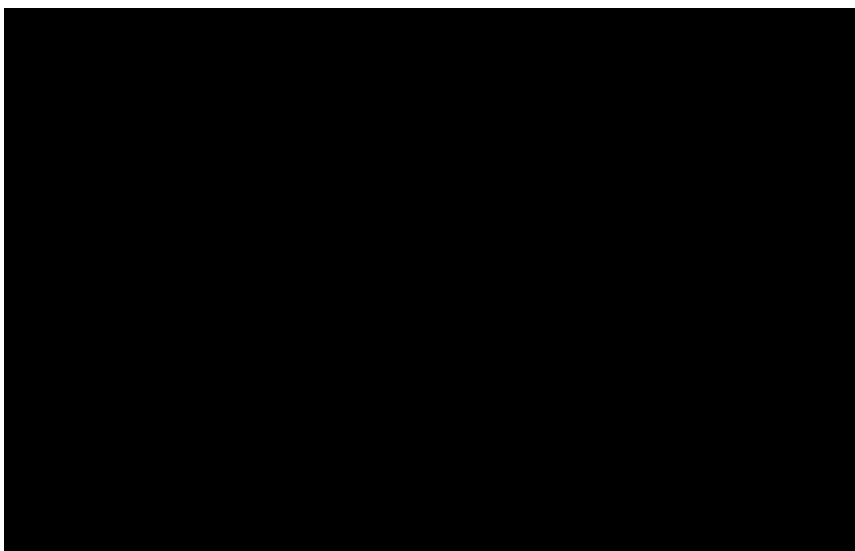
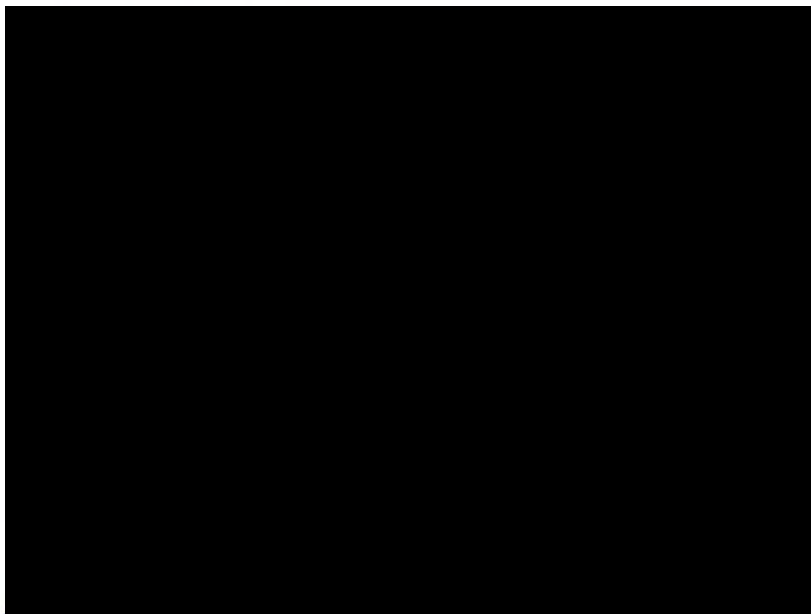
- (10) Pipe Rack - Q
- (11) Pipe Rack - R
- (12) Pipe Rack - S
- (13) Pipe Rack - T
- (14) Pipe Rack - W
- (15) Pipe Rack - V
- (16) Pipe Rack - Z
- (17) Pipe Rack - 1, 2, 3

ซึ่งจากการตรวจสอบ พบว่า โครงสร้าง Pipe Rack ที่มีอยู่เดิมทั้งหมดสามารถรองรับน้ำหนักที่เพิ่มขึ้นจากการติดตั้งท่อใหม่และใช้งานได้ แสดงดังตารางสรุปผลการตรวจสอบ Pipe Rack โดยมีตัวอย่างรายการคำนวณแสดงดังเอกสารแสดงรายการคำนวณการตรวจสอบความแข็งแรงของโครงสร้าง (Pipe Rack - 1, 2, 3)

ตารางสรุปผลการตรวจสอบ Pipe Rack

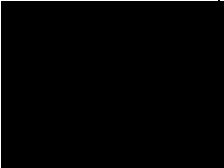
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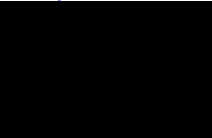
ASP AREA



CONCLUSION TABLE FOR VERIFICATION EXISTING PIPE RACK/PIPE BRIDGE OF ABP AREA

No.	Verification Report No./Name	Pipe Rack / Pipe Sleeper	Steel Structure	Base Plate	Steel Column	Steel Beam	RC Foundation	RC Pile	RC Column	Mat Foundation
1	ABP2.1-C-T-CL-101-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-D	PASSED	-	-	-	-	PASSED	-	PASSED	PASSED
2	ABP2.1-C-T-CL-102-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-E	PASSED	-	-	-	-	PASSED	-	PASSED	PASSED
3	ABP2.1-C-T-CL-103-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-F	PASSED	-	-	-	-	PASSED	-	PASSED	PASSED
4	ABP2.1-C-T-CL-201-A VERIFICATION REPORT FOR PIPE RACK-Q FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
5	ABP2.1-C-T-CL-401-A VERIFICATION REPORT FOR PIPE RACK-S FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
6	ABP2.1-C-T-CL-501-A VERIFICATION REPORT FOR PIPE RACK-T FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
7	ABP2.1-C-T-CL-601-A VERIFICATION REPORT FOR PIPE RACK-W FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
8	ABP2.1-C-T-CL-701-A VERIFICATION REPORT FOR PIPE RACK-V FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
9	ABP2.1-C-T-CL801-A VERIFICATION REPORT FOR PIPE RACK-Z FOUNDATION	PASSED	-	-	-	-	PASSED	PASSED	PASSED	-
10	ABP2.1-C-T-CL-202-A VERIFICATION REPORT FOR PIPE RACK-Q STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
11	ABP2.1-C-T-CL-302-A VERIFICATION REPORT FOR PIPE RACK-R STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
12	ABP2.1-C-T-CL-402-A VERIFICATION REPORT FOR PIPE RACK-S STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
13	ABP2.1-C-T-CL-502-A VERIFICATION REPORT FOR PIPE RACK-T STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
14	ABP2.1-C-T-CL-602-A VERIFICATION REPORT FOR PIPE RACK-W STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
15	ABP2.1-C-T-CL-702-A VERIFICATION REPORT FOR PIPE RACK-V STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
16	ABP2.1-C-T-CL-802-A VERIFICATION REPORT FOR PIPE RACK-Z STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-
17	ABP2.1-C-T-CL-902-A VERIFICATION REPORT FOR PIPE RACK 1, 2, 3 STEEL STRUCTURE	PASSED	PASSED	PASSED	PASSED	PASSED	-	-	-	-

No.	Verification Report No./Name	Pipe Sleeper	Foundation Stability	RC Column	Mat Foundation
1	ABP2.1-C-T-CL-101-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-D	PASSED	<ul style="list-style-type: none"> Factor of Safety (FOS) against overturning is higher than allowable Factor of safety (FOS) against sliding is higher than allowable <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> The bearing load is lower than allowable bearings capacity <p>Therefore, Mat Foundation can Capable all loads from combination load against with new 6" pipeline.</p>
2	ABP2.1-C-T-CL-102-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-E	PASSED	<ul style="list-style-type: none"> Factor of Safety (FOS) against overturning is higher than allowable Factor of safety (FOS) against sliding is higher than allowable <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> The bearing load is lower than allowable bearings capacity <p>Therefore, Mat Foundation can Capable all loads from combination load against with new 6" pipeline.</p>
3	ABP2.1-C-T-CL-103-A VERIFICATION REPORT FOR PIPE SLEEPER TYPE-F	PASSED	<ul style="list-style-type: none"> Factor of Safety (FOS) against overturning is higher than allowable Factor of safety (FOS) against sliding is higher than allowable <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p> 	<ul style="list-style-type: none"> The bearing load is lower than allowable bearings capacity <p>Therefore, Mat Foundation can Capable all loads from combination load against with new 6" pipeline.</p>

No.	Verification Report No./Name	Pipe Rack	RC Foundation	RC Pilecap	RC Column
4	ABP2.1-C-T-CL-201-A VERIFICATION REPORT FOR PIPE RACK-Q FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>
5	ABP2.1-C-T-CL-401-A VERIFICATION REPORT FOR PIPE RACK-S FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>
6	ABP2.1-C-T-CL-501-A VERIFICATION REPORT FOR PIPE RACK-T FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>
7	ABP2.1-C-T-CL-601-A VERIFICATION REPORT FOR PIPE RACK-W FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p> 

No.	Verification Report No./Name	Pipe Rack	RC Foundation	RC Pilecap	RC Column
8	ABP2.1-C-T-CL-701-A VERIFICATION REPORT FOR PIPE RACK-V FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>
9	ABP2.1-C-T-CL801-A VERIFICATION REPORT FOR PIPE RACK-Z FOUNDATION	PASSED	PASSED	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC Pilecap are same as provided reinforcing bar. ○ The beam shear check, pedestal punching shear check and pile punching shear check are lower than allowable. <p>Therefore, Foundation can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The required reinforcing bar in RC column are same as provided reinforcing bar. <p>Therefore, RC Column can to bear all loads from combination load against with new 6" pipeline.</p>



No.	Verification Report No./Name	Pipe Rack	Steel Structure	Steel Column	Steel Beam	Base Plate
10	ABP2.1-C-T-CL-202-A VERIFICATION REPORT FOR PIPE RACK-Q STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>
11	ABP2.1-C-T-CL-302-A VERIFICATION REPORT FOR PIPE RACK-R STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>
12	ABP2.1-C-T-CL-402-A VERIFICATION REPORT FOR PIPE RACK-S STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>

No.	Verification Report No./Name	Pipe Rack	Steel Structure	Steel Column	Steel Beam	Base Plate
13	ABP2.1-C-T-CL-502-A VERIFICATION REPORT FOR PIPE RACK-T STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>
14	ABP2.1-C-T-CL-602-A VERIFICATION REPORT FOR PIPE RACK-W STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>
15	ABP2.1-C-T-CL-702-A VERIFICATION REPORT FOR PIPE RACK-V STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>

No.	Verification Report No./Name	Pipe Rack	Steel Structure	Steel Column	Steel Beam	Base Plate
16	ABP2.1-C-T-CL-802-A VERIFICATION REPORT FOR PIPE RACK-Z STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>
17	ABP2.1-C-T-CL-902-A VERIFICATION REPORT FOR PIPE RACK 1, 2, 3 STEEL STRUCTURE	PASSED	<ul style="list-style-type: none"> ○ The stress ratio of structural steel found that all members have stress ratio lower than as requirement by AISC standard code. <p>Therefore, Steel structure can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel column found that all members have stress ratio lower than as requirement by AISC standard code. ○ The lateral deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ The stress ratio of structural steel beam found that all members have stress ratio lower than as requirement by AISC standard code. ○ The vertical deflection check is lower than allowable. <p>Therefore, Steel structure column can Capable all loads from combination load against with new 6" pipeline.</p>	<ul style="list-style-type: none"> ○ Base plates and anchor bolts calculation found that required thickness of base plate is lower than as provided. <p>Therefore, Base plate and anchor bolt can resist all loads from combination load against with new 6" pipeline.</p>

เอกสารแสดงรายการคำนวณการตรวจสอบความ
แข็งแรงของโครงสร้าง (Pipe Rack - 1, 2, 3)



**AMATA B.GRIMM POWER 1 LIMITED (REPLACEMENT)
AMATA B.GRIMM POWER 2 LIMITED (REPLACEMENT)**

**AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
RELOCATE GAS PIPELINE FOR BLOCK 2.1**

CHANGWAT CHONBURI, THAILAND

VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

ABP2.1-C-T-CL-902

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REV.NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY



REVISION LOG

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AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

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AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

APPENDIX A: – INPUT STRUCTURE DRAWINGS



AMATA B. GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

1.0 GENERAL

1.1 SCOPE OF CALCULATION

The purpose of this document covers the Analysis and Verification of civil/structural work for ABP1R and ABP2R Combined Cycle Cogeneration Plant. The following of the analysis and verification are as below:

- Super Structure for Pipe Rack and Pipe Bridge at ABP2.1 area

1.2 DESIGN CODES AND STANDARDS

The following of the design codes and standards for this calculation as per list below:

PROJECT REFERENCES DRAWINGS / DOCUMENTS		
1	760-024-251	Structures Pipe Rack Plot Plan
2	760-024-252	Structures Pipe Rack View X Y Z
3	760-024-255	Structures Pipe Rack Elevation PD, PF, PI
4	760-024-256	Structures Pipe Rack Elevation-PJ & Section-B, C
5	760-024-257	Structures Pipe Rack Elevation-PM, PN, PO, PP
6	760-024-259	Structures Pipe Rack 1 – Top of Steel Plans
7	760-024-260	Structures Pipe Rack 2 – Top of Steel Plans
8	760-024-261	Structures Pipe Rack 3 – Top of Steel Plans
9	760-073-002	Piping GA – Steam Turbine Generator Area
10	760-073-003	Piping GA – HRSG Area
11	760-073-004	Piping GA – Gas Turbine Generator Area
12	760-073-005	Piping GA – Electrical Building Area
13	760-073-006	Piping GA – Interconnecting Pipe Rack to Block 2

CODES & STANDARDS		
14	ASCE 7-05	Minimum Design Loads for Buildings and Other Structures
15	ACI 318-08	Building Code Requirements for Structural Concrete
10	UBC 1997	Seismic Loads for Design of Structures
11	AISC 360-05	Specification for Structural Steel Building

1.3 UNIT OF MEASUREMENT

All equations and expressions appearing in this calculation are compatible with the following SI units.

Force	:	kN (kilo-Newton), N (Newton) and Ton(T)
Length	:	m (meter) and mm (millimeter)
Area	:	m ² (square meter) and mm ² (square millimeter)
Moment	:	kN-m (kilo-Newton meter), N-m (Newton meter) and Ton(T-m)
Stress	:	MPa (mega-Pascal) and kPa (kilo-Pascal)

1.4 LANGUAGE

All documentation shall be in the English language. Additional documentation in Thai may also be required to apply for permits as requested from government regulatory or body.

2.0 DESIGN AND OPERATING DATA

2.1 MATERIAL PROPERTIES

Material properties are illustrated in the table below;

MATERIAL	PROPERTY	VALUE	UNITS
Concrete, M21	Density	25	kN/m ³
	Characteristic Strength	27.5	N/mm ²
	Modulus of Elasticity	21538	N/mm ²
Concrete, M35 (For bored pile)	Density	25	kN/m ³
	Characteristic Strength	35	N/mm ²
	Modulus of Elasticity	27806	N/mm ²
Steel, SS400	Density	78.5	kN/m ³
	Minimum yield stress	245	N/mm ²
	Tensile stress	400	N/mm ²
Dry earth for filling	Density	18	kN/m ³
Reinforcing SD40	Density	78.5	kN/m ³
	Characteristic Strength	392	N/mm ²

2.2 PLANT SITE INFORMATION

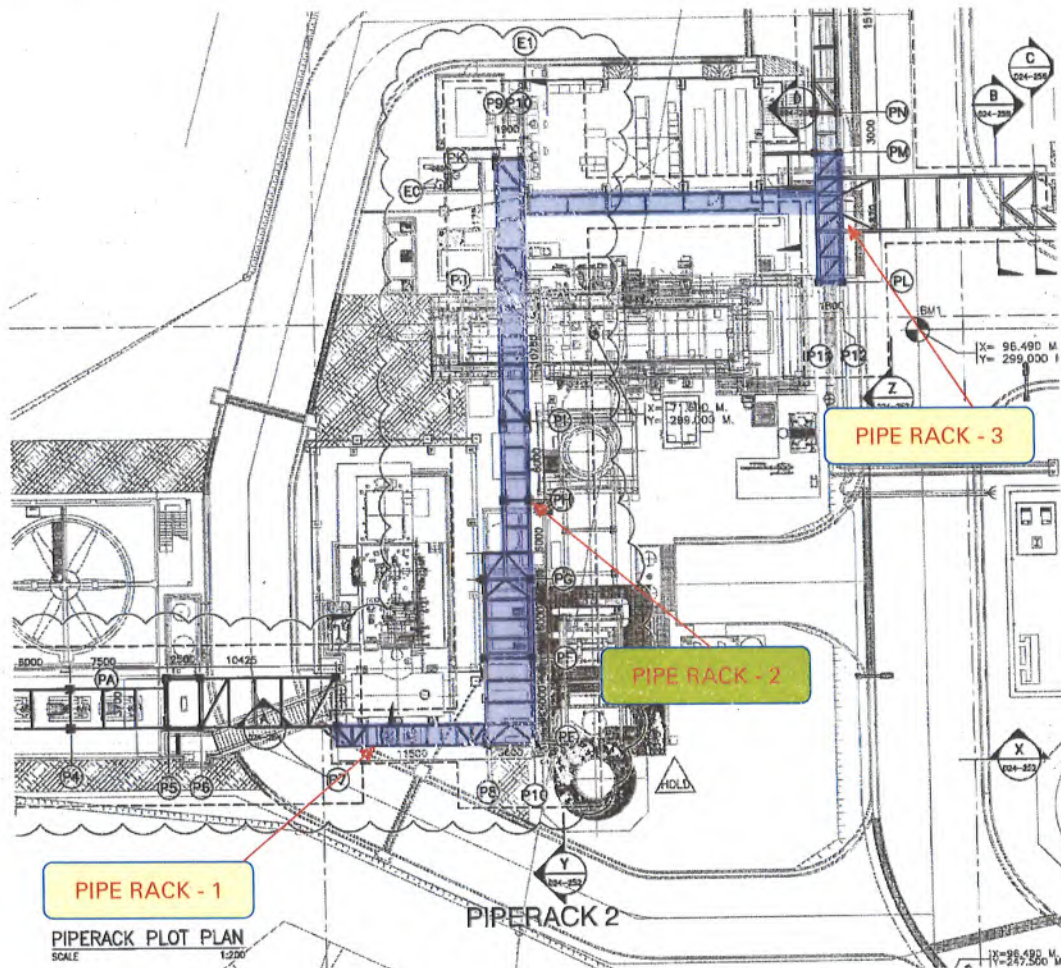
- Location of the site : AMATA CITY Industrial Estate, Chonburi Province
- Seismic Zone : Zone-1 (U.B.C)
- Wind Speed : 50 m/sec
- Elevation of FGL : MSL +2.950m (Which is equal to GL(+0.000))



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

3.0 ASSUMPTION DESCRIPTION OF STRUCTURE AND GEOMETRY

The layout for the above-mentioned pipe rack and pipe bridge is shown in figure below and next page.





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4.0 DESIGN PHILOSOPHY

Pipe rack and pipe bridge is analyzed and designed using the structural analysis software package STAAD Pro. The analysis is performed for self-weight of structural members, Pipe load on the members wind and seismic loads. Various possible load combinations of the above loads are listed in this section.

Structural Configuration & Modelling Assumptions:

1. The stability of the pipe rack and pipe bridge in transverse direction is through combination of moment and bracing system.
2. The longitudinal stability of the pipe pack and pipe bridge is provided through vertical bracings at selected bays.
3. Japanese sections equivalent to Thai standard sections (TIS 1227-1996) are used for design in STAAD Pro.
4. Pipe rack and pipe bridge structural is supported by pinned support to provide reaction forces for foundation design.

4.1 SOFTWARE REFERENCE

STAAD, Research Engineers Inc., Berkeley, USA

The above software's are renowned and well used and accepted internationally for similar type of structural analysis carried out in this document. Even though program input and output is enclosed within this document with relevant notes, it is suggested to refer to user's theory reference manuals for relationship between input data and output results produced by program.

4.2 MODELLING FOR STATIC ANALYSIS

Pipe rack is designed using the structural analysis software package STAAD Pro. The analysis is performed for self-weight of structural members, other dead load on the members, cable tray load, pipe empty and operating loads, pipe lateral loads, wind loads and seismic loads. Various possible load combinations of the above loads are listed in STAAD input file.





AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

5.0 LOAD COMBINATIONS

The summary of load combination for **Serviceability Design**

Load Combination	Description
101	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO
102	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO
103	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO
104	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO
105	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO
106	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO
107	1.0DL+1.0LL+1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO
108	1.0DL+1.0LL+1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO
109	1.0DL+1.0LL -1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO
110	1.0DL+1.0LL -1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO
111	1.0DL+1.0LL -1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO
112	1.0DL+1.0LL -1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO
113	1.0DL+1.0LR+1.0(+PX)+1.0(+PZ)+1.0DO
114	1.0DL+1.0LR+1.0(+PX)+1.0(-PZ)+1.0DO
115	1.0DL+1.0LR+1.0(+PZ)+1.0(-PX)+1.0DO
116	1.0DL+1.0LR+1.0(-PX)+1.0(-PZ)+1.0DO
117	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO
118	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO
119	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO
120	1.0DL+0.75LL+0.75LR+0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO
121	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO
122	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO
123	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO
124	1.0DL+0.75LL+0.75LR -0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO
125	1.0DL+1.0WL+X+0.5WL+Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP+X
126	1.0DL+1.0WL+X+0.5WL+Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP+X
127	1.0DL+1.0WL+X+0.5WL+Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP+X
128	1.0DL+1.0WL+X+0.5WL+Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP+X
129	1.0DL+1.0WL+X+0.5WL-Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP+X
130	1.0DL+1.0WL+X+0.5WL-Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP+X
131	1.0DL+1.0WL+X+0.5WL-Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP+X
132	1.0DL+1.0WL+X+0.5WL-Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP+X
133	1.0DL+0.5WL+X+1.0WL+Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP+Z
134	1.0DL+0.5WL+X+1.0WL+Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP+Z
135	1.0DL+0.5WL+X+1.0WL+Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP+Z
136	1.0DL+0.5WL+X+1.0WL+Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP+Z
137	1.0DL+1.0WL+Z+0.5WL-X+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP+Z
138	1.0DL+1.0WL+Z+0.5WL-X+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP+Z



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

Load Combination	Description
139	1.0DL+1.0WL+Z+0.5WL-X+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP+Z
140	1.0DL+1.0WL+Z+0.5WL-X+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP+Z
141	1.0DL+0.5WL+Z+1.0WL-X+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP-X
142	1.0DL+0.5WL+Z+1.0WL-X+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP-X
143	1.0DL+0.5WL+Z+1.0WL-X+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP-X
144	1.0DL+0.5WL+Z+1.0WL-X+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP-X
145	1.0DL+1.0WL-X+0.5WL-Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP-X
146	1.0DL+1.0WL-X+0.5WL-Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP-X
147	1.0DL+1.0WL-X+0.5WL-Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP-X
148	1.0DL+1.0WL-X+0.5WL-Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP-X
149	1.0DL+0.5WL+X+1.0WL-Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP-Z
150	1.0DL+0.5WL+X+1.0WL-Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP-Z
151	1.0DL+0.5WL+X+1.0WL-Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP-Z
152	1.0DL+0.5WL+X+1.0WL-Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP-Z
153	1.0DL+0.5WL-X+1.0WL-Z+1.0(+PX)+1.0(+PZ)+1.0DO+1.0WP-Z
154	1.0DL+0.5WL-X+1.0WL-Z+1.0(+PX)+1.0(-PZ)+1.0DO+1.0WP-Z
155	1.0DL+0.5WL-X+1.0WL-Z+1.0(+PZ)+1.0(-PX)+1.0DO+1.0WP-Z
156	1.0DL+0.5WL-X+1.0WL-Z+1.0(-PX)+1.0(-PZ)+1.0DO+1.0WP-Z
157	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+0.7EL+X
158	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+0.7EL+X
159	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+0.7EL+X
160	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+0.7EL+X
161	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+0.7EL+Z
162	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+0.7EL+Z
163	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+0.7EL+Z
164	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+0.7EL+Z
165	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+0.7EL-X
166	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+0.7EL-X
167	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+0.7EL-X
168	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+0.7EL-X
169	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+0.7EL-Z
170	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+0.7EL-Z
171	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+0.7EL-Z
172	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+0.7EL-Z
173	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WL+Z+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP+X
174	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WL+Z+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP+X
175	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WL+Z+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP+X
176	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WL+Z+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP+X



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

Load Combination	Description
177	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WLZ+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP+X
178	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WLZ+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP+X
179	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WLZ+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP+X
180	1.0DL+0.75LL+0.75LR+0.75WL+X+0.375WLZ+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP+X
181	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WL+Z+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP+Z
182	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WL+Z+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP+Z
183	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WL+Z+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP+Z
184	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WL+Z+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP+Z
185	1.0DL+0.75LL+0.75LR+0.75WL+Z+0.375WLX+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP+Z
186	1.0DL+0.75LL+0.75LR+0.75WL+Z+0.375WLX+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP+Z
187	1.0DL+0.75LL+0.75LR+0.75WL+Z+0.375WLX+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP+Z
188	1.0DL+0.75LL+0.75LR+0.75WL+Z+0.375WLX+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP+Z
189	1.0DL+0.75LL+0.75LR+0.375WL+Z+0.75WLX+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP-X
190	1.0DL+0.75LL+0.75LR+0.375WL+Z+0.75WLX+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP-X
191	1.0DL+0.75LL+0.75LR+0.375WL+Z+0.75WLX+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP-X
192	1.0DL+0.75LL+0.75LR+0.375WL+Z+0.75WLX+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP-X
193	1.0DL+0.75LL+0.75LR+0.75WLX+0.375WLZ+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP-X
194	1.0DL+0.75LL+0.75LR+0.75WLX+0.375WLZ+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP-X
195	1.0DL+0.75LL+0.75LR+0.75WLX+0.375WLZ+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP-X
196	1.0DL+0.75LL+0.75LR+0.75WLX+0.375WLZ+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP-X
197	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WLZ+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP-Z
198	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WLZ+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP-Z
199	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WLZ+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP-Z
200	1.0DL+0.75LL+0.75LR+0.375WL+X+0.75WLZ+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP-Z



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

Load Combination	Description
201	1.0DL+0.75LL+0.75LR+0.375WLX+0.75WLZ+1.0(+PX)+1.0(+PZ)+1.0DO+0.75WP-Z
202	1.0DL+0.75LL+0.75LR+0.375WLX+0.75WLZ+1.0(+PX)+1.0(-PZ)+1.0DO+0.75WP-Z
203	1.0DL+0.75LL+0.75LR+0.375WLX+0.75WLZ+1.0(+PZ)+1.0(-PX)+1.0DO+0.75WP-Z
204	1.0DL+0.75LL+0.75LR+0.375WLX+0.75WLZ+1.0(-PX)+1.0(-PZ)+1.0DO+0.75WP-Z
205	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(+PZ)+1.0DO+0.525EL+X
206	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(-PZ)+1.0DO+0.525EL+X
207	1.0DL+0.75LL+0.75LR+1.0(+PZ)+1.0(-PX)+1.0DO+0.525EL+X
208	1.0DL+0.75LL+0.75LR+1.0(-PX)+1.0(-PZ)+1.0DO+0.525EL+X
209	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(+PZ)+1.0DO+0.525EL+Z
210	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(-PZ)+1.0DO+0.525EL+Z
211	1.0DL+0.75LL+0.75LR+1.0(+PZ)+1.0(-PX)+1.0DO+0.525EL+Z
212	1.0DL+0.75LL+0.75LR+1.0(-PX)+1.0(-PZ)+1.0DO+0.525EL+Z
213	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(+PZ)+1.0DO+0.525EL-X
214	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(-PZ)+1.0DO+0.525EL-X
215	1.0DL+0.75LL+0.75LR+1.0(+PZ)+1.0(-PX)+1.0DO+0.525EL-X
216	1.0DL+0.75LL+0.75LR+1.0(-PX)+1.0(-PZ)+1.0DO+0.525EL-X
217	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(+PZ)+1.0DO+0.525EL-Z
218	1.0DL+0.75LL+0.75LR+1.0(+PX)+1.0(-PZ)+1.0DO+0.525EL-Z
219	1.0DL+0.75LL+0.75LR+1.0(+PZ)+1.0(-PX)+1.0DO+0.525EL-Z
220	1.0DL+0.75LL+0.75LR+1.0(-PX)+1.0(-PZ)+1.0DO+0.525EL-Z
221	0.6DL+1.0WL+X+0.5WL+Z+1.0WP+X
222	0.6DL+1.0WL+X+0.5WL-Z+1.0WP+X
223	0.6DL+0.5WL+X+1.0WL+Z+1.0WP+Z
224	0.6DL+1.0WL+Z+0.5WL-X+1.0WP+Z
225	0.6DL+0.5WL+Z+1.0WL-X+1.0WP-X
226	0.6DL+1.0WL-X+0.5WL-Z+1.0WP-X
227	0.6DL+0.5WL+X+1.0WL-Z+1.0WP-Z
228	0.6DL+0.5WL-X+1.0WL-Z+1.0WP-Z
229	0.6DL+1.0EL+X
230	0.6DL+1.0EL+Z
231	0.6DL+1.0EL-X
232	0.6DL+1.0EL-Z
233	0.6DL+0.7EL+X
234	0.6DL+0.7EL+Z
235	0.6DL+0.7EL-X
236	0.6DL+0.7EL-Z
237	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
238	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

Load Combination	Description
239	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
240	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
241	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
242	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)
243	1.0DL+1.0LL+1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
244	1.0DL+1.0LL+1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
245	1.0DL+1.0LL -1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
246	1.0DL+1.0LL -1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)
247	1.0DL+1.0LL -1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
248	1.0DL+1.0LL -1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
249	1.0DL+1.0LR+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
250	1.0DL+1.0LR+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)
251	1.0DL+1.0LR+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
252	1.0DL+1.0LR+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
253	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
254	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)
255	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
256	1.0DL+0.75LL+0.75LR+0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
257	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(+Su)
258	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(+Su)
259	1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(+Su)
260	1.0DL+0.75LL+0.75LR -0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(+Su)
261	1.0DL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)
262	1.0DL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)
263	1.0DL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)
264	1.0DL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)
265	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)
266	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)
267	1.0DL+1.0LL+1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)
268	1.0DL+1.0LL+1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)
269	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)
270	1.0DL+1.0LL+1.0TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)
271	1.0DL+1.0LL+1.0TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)
272	1.0DL+1.0LL+1.0TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)
273	1.0DL+1.0LR+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)
274	1.0DL+1.0LR+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)
275	1.0DL+1.0LR+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)
276	1.0DL+1.0LR+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)
277	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)
278	1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT

VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

Load Combination	Description
279	$1.0DL+0.75LL+0.75LR+0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)$
280	$1.0DL+0.75LL+0.75LR+0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)$
281	$1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(+PZ)+1.0DO+1.0(-Su)$
282	$1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PX)+1.0(-PZ)+1.0DO+1.0(-Su)$
283	$1.0DL+0.75LL+0.75LR -0.75TL+1.0(+PZ)+1.0(-PX)+1.0DO+1.0(-Su)$
284	$1.0DL+0.75LL+0.75LR -0.75TL+1.0(-PX)+1.0(-PZ)+1.0DO+1.0(-Su)$



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

The summary of load combination for **Strength Design**

Load Combination	Description
301	1.4DL+1.4(+PX)+1.4(+PZ)+1.4DO
302	1.4DL+1.4(+PX)+1.4(-PZ)+1.4DO
303	1.4DL+1.4(+PZ)+1.4(-PX)+1.4DO
304	1.4DL+1.4(-PX)+1.4(-PZ)+1.4DO
305	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO
306	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO
307	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO
308	1.2DL+1.6LL+0.5LR+1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO
309	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO
310	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO
311	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO
312	1.2DL+1.6LL+0.5LR -1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO
313	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(+PZ)+1.2DO
314	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(-PZ)+1.2DO
315	1.2DL+1.0LL+1.6LR+1.2(+PZ)+1.2(-PX)+1.2DO
316	1.2DL+1.0LL+1.6LR+1.2(-PX)+1.2(-PZ)+1.2DO
317	1.2DL+1.6LR+0.8WL+X+0.4WL+Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP+X
318	1.2DL+1.6LR+0.8WL+X+0.4WL+Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP+X
319	1.2DL+1.6LR+0.8WL+X+0.4WL+Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP+X
320	1.2DL+1.6LR+0.8WL+X+0.4WL+Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP+X
321	1.2DL+1.6LR+0.8WL+X+0.4WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP+X
322	1.2DL+1.6LR+0.8WL+X+0.4WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP+X
323	1.2DL+1.6LR+0.8WL+X+0.4WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP+X
324	1.2DL+1.6LR+0.8WL+X+0.4WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP+X
325	1.2DL+1.6LR+0.4WL+X+0.8WL+Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP+Z
326	1.2DL+1.6LR+0.4WL+X+0.8WL+Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP+Z
327	1.2DL+1.6LR+0.4WL+X+0.8WL+Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP+Z
328	1.2DL+1.6LR+0.4WL+X+0.8WL+Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP+Z
329	1.2DL+1.6LR+0.8WL+Z+0.4WL-X+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP+Z
330	1.2DL+1.6LR+0.8WL+Z+0.4WL-X+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP+Z
331	1.2DL+1.6LR+0.8WL+Z+0.4WL-X+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP+Z
332	1.2DL+1.6LR+0.8WL+Z+0.4WL-X+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP+Z
333	1.2DL+1.6LR+0.4WL+Z+0.8WL-X+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP-X
334	1.2DL+1.6LR+0.4WL+Z+0.8WL-X+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP-X
335	1.2DL+1.6LR+0.4WL+Z+0.8WL-X+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP-X
336	1.2DL+1.6LR+0.4WL+Z+0.8WL-X+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP-X
337	1.2DL+1.6LR+0.8WL-X+0.4WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP-X
338	1.2DL+1.6LR+0.8WL-X+0.4WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP-X
339	1.2DL+1.6LR+0.8WL-X+0.4WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP-X
340	1.2DL+1.6LR+0.8WL-X+0.4WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP-X



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Load Combination	Description
341	1.2DL+1.6LR+0.4WL+X+0.8WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP-Z
342	1.2DL+1.6LR+0.4WL+X+0.8WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP-Z
343	1.2DL+1.6LR+0.4WL+X+0.8WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP-Z
344	1.2DL+1.6LR+0.4WL+X+0.8WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP-Z
345	1.2DL+1.6LR+0.4WL-X+0.8WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+0.8WP-Z
346	1.2DL+1.6LR+0.4WL-X+0.8WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+0.8WP-Z
347	1.2DL+1.6LR+0.4WL-X+0.8WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+0.8WP-Z
348	1.2DL+1.6LR+0.4WL-X+0.8WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+0.8WP-Z
349	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL+Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP+X
350	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL+Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP+X
351	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL+Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP+X
352	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL+Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP+X
353	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP+X
354	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP+X
355	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP+X
356	1.2DL+1.0LL+0.5LR+1.6WL+X+0.8WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP+X
357	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL+Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP+Z
358	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL+Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP+Z
359	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL+Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP+Z
360	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL+Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP+Z
361	1.2DL+1.0LL+0.5LR+1.6WL+Z+0.8WL-X+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP+Z
362	1.2DL+1.0LL+0.5LR+1.6WL+Z+0.8WL-X+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP+Z
363	1.2DL+1.0LL+0.5LR+1.6WL+Z+0.8WL-X+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP+Z
364	1.2DL+1.0LL+0.5LR+1.6WL+Z+0.8WL-X+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP+Z
365	1.2DL+1.0LL+0.5LR+0.8WL+Z+1.6WL-X+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP-X
366	1.2DL+1.0LL+0.5LR+0.8WL+Z+1.6WL-X+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP-X
367	1.2DL+1.0LL+0.5LR+0.8WL+Z+1.6WL-X+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP-X
368	1.2DL+1.0LL+0.5LR+0.8WL+Z+1.6WL-X+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP-X
369	1.2DL+1.0LL+0.5LR+1.6WL-X+0.8WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP-X
370	1.2DL+1.0LL+0.5LR+1.6WL-X+0.8WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP-X



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Load Combination	Description
371	1.2DL+1.0LL+0.5LR+1.6WL-X+0.8WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP-X
372	1.2DL+1.0LL+0.5LR+1.6WL-X+0.8WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP-X
373	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP-Z
374	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP-Z
375	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP-Z
376	1.2DL+1.0LL+0.5LR+0.8WL+X+1.6WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP-Z
377	1.2DL+1.0LL+0.5LR+0.8WL-X+1.6WL-Z+1.2(+PX)+1.2(+PZ)+1.2DO+1.6WP-Z
378	1.2DL+1.0LL+0.5LR+0.8WL-X+1.6WL-Z+1.2(+PX)+1.2(-PZ)+1.2DO+1.6WP-Z
379	1.2DL+1.0LL+0.5LR+0.8WL-X+1.6WL-Z+1.2(+PZ)+1.2(-PX)+1.2DO+1.6WP-Z
380	1.2DL+1.0LL+0.5LR+0.8WL-X+1.6WL-Z+1.2(-PX)+1.2(-PZ)+1.2DO+1.6WP-Z
381	1.2DL+1.0LL+1.2(+PX)+1.2(+PZ)+1.2DO+1.0EL+X
382	1.2DL+1.0LL+1.2(+PX)+1.2(-PZ)+1.2DO+1.0EL+X
383	1.2DL+1.0LL+1.2(+PZ)+1.2(-PX)+1.2DO+1.0EL+X
384	1.2DL+1.0LL+1.2(-PX)+1.2(-PZ)+1.2DO+1.0EL+X
385	1.2DL+1.0LL+1.2(+PX)+1.2(+PZ)+1.2DO+1.0EL+Z
386	1.2DL+1.0LL+1.2(+PX)+1.2(-PZ)+1.2DO+1.0EL+Z
387	1.2DL+1.0LL+1.2(+PZ)+1.2(-PX)+1.2DO+1.0EL+Z
388	1.2DL+1.0LL+1.2(-PX)+1.2(-PZ)+1.2DO+1.0EL+Z
389	1.2DL+1.0LL+1.2(+PX)+1.2(+PZ)+1.2DO+1.0EL-X
390	1.2DL+1.0LL+1.2(+PX)+1.2(-PZ)+1.2DO+1.0EL-X
391	1.2DL+1.0LL+1.2(+PZ)+1.2(-PX)+1.2DO+1.0EL-X
392	1.2DL+1.0LL+1.2(-PX)+1.2(-PZ)+1.2DO+1.0EL-X
393	1.2DL+1.0LL+1.2(+PX)+1.2(+PZ)+1.2DO+1.0EL-Z
394	1.2DL+1.0LL+1.2(+PX)+1.2(-PZ)+1.2DO+1.0EL-Z
395	1.2DL+1.0LL+1.2(+PZ)+1.2(-PX)+1.2DO+1.0EL-Z
396	1.2DL+1.0LL+1.2(-PX)+1.2(-PZ)+1.2DO+1.0EL-Z
397	0.9DL+1.6WL+X+0.8WL+Z+1.6WP+X
398	0.9DL+1.6WL+X+0.8WL-Z+1.6WP+X
399	0.9DL+0.8WL+X+1.6WL+Z+1.6WP+Z
400	0.9DL+1.6WL+Z+0.8WL-X+1.6WP+Z
401	0.9DL+0.8WL+Z+1.6WL-X+1.6WP-X
402	0.9DL+1.6WL-X+0.8WL-Z+1.6WP-X
403	0.9DL+0.8WL+X+1.6WL-Z+1.6WP-Z
404	0.9DL+0.8WL-X+1.6WL-Z+1.6WP-Z
405	0.9DL+1.0EL+X
406	0.9DL+1.0EL+Z
407	0.9DL+1.0EL-X
408	0.9DL+1.0EL-Z
409	1.4DL+1.4(+PX)+1.4(+PZ)+1.4DO+1.4(+Su)
410	1.4DL+1.4(+PX)+1.4(-PZ)+1.4DO+1.4(+Su)



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Load Combination	Description
411	1.4DL+1.4(+PZ)+1.4(-PX)+1.4DO+1.4(+Su)
412	1.4DL+1.4(-PX)+1.4(-PZ)+1.4DO+1.4(+Su)
413	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(+Su)
414	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(+Su)
415	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(+Su)
416	1.2DL+1.6LL+0.5LR+1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(+Su)
417	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(+Su)
418	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(+Su)
419	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(+Su)
420	1.2DL+1.6LL+0.5LR -1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(+Su)
421	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(+Su)
422	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(+Su)
423	1.2DL+1.0LL+1.6LR+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(+Su)
424	1.2DL+1.0LL+1.6LR+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(+Su)
425	1.4DL+1.4(+PX)+1.4(+PZ)+1.4DO+1.4(-Su)
426	1.4DL+1.4(+PX)+1.4(-PZ)+1.4DO+1.4(-Su)
427	1.4DL+1.4(+PZ)+1.4(-PX)+1.4DO+1.4(-Su)
428	1.4DL+1.4(-PX)+1.4(-PZ)+1.4DO+1.4(-Su)
429	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(-Su)
430	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(-Su)
431	1.2DL+1.6LL+0.5LR+1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(-Su)
432	1.2DL+1.6LL+0.5LR+1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(-Su)
433	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(-Su)
434	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(-Su)
435	1.2DL+1.6LL+0.5LR -1.2TL+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(-Su)
436	1.2DL+1.6LL+0.5LR -1.2TL+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(-Su)
437	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(+PZ)+1.2DO+1.2(-Su)
438	1.2DL+1.0LL+1.6LR+1.2(+PX)+1.2(-PZ)+1.2DO+1.2(-Su)
439	1.2DL+1.0LL+1.6LR+1.2(+PZ)+1.2(-PX)+1.2DO+1.2(-Su)
440	1.2DL+1.0LL+1.6LR+1.2(-PX)+1.2(-PZ)+1.2DO+1.2(-Su)

6.0 PIPE RACK-1, 2, 3 SUPER STRUCTURE LOADING



PIPE RACK STRUCTURE 3D RENDERED VIEW

6.1 DEAD LOAD

6.1.1 Dead Load of Structure (DS)

Weight of structural steel members are generated by STAAD as self-weight

6.1.2 Dead Load of Pipe Empty Weight (DE)

Pipe dead weight is taken from vertical empty load (Appendix A).

6.1.3 Dead Load of Cable Tray (DC)

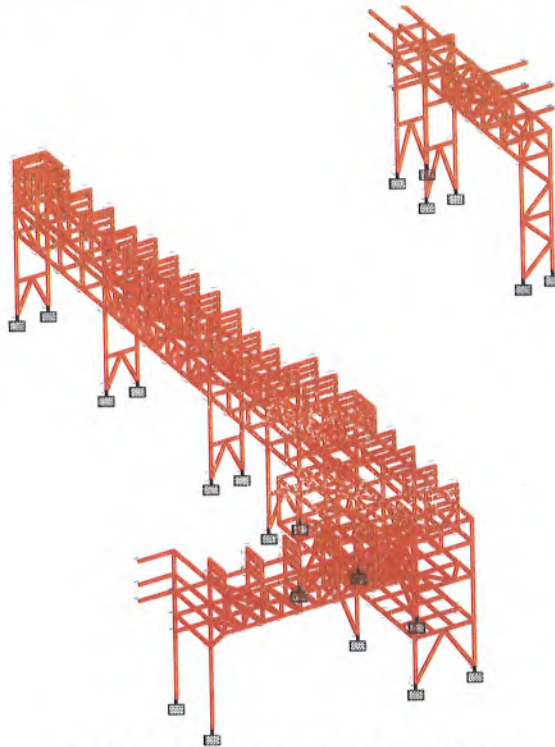
Cable tray dead weight is taken from vertical empty load (Appendix A).

6.1.4 Pipe Operating Load (DO)

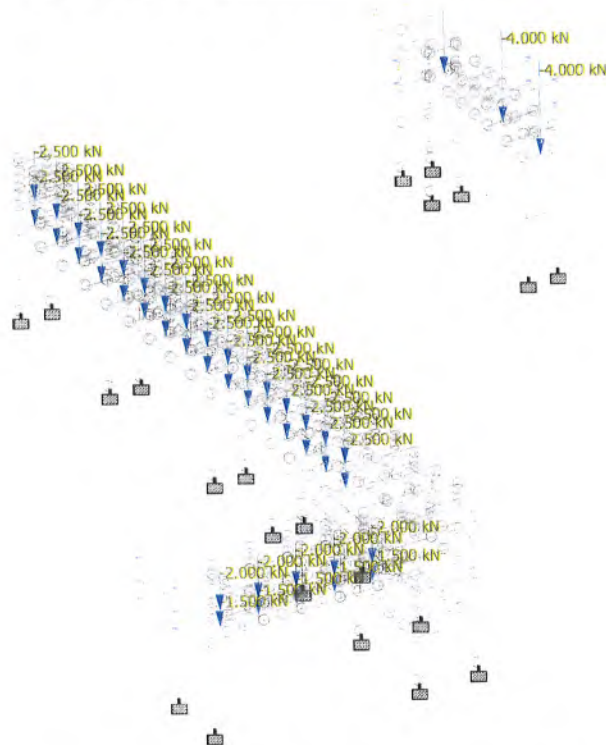
Pipe operating load is taken from vertical load – vertical empty load (Appendix A).



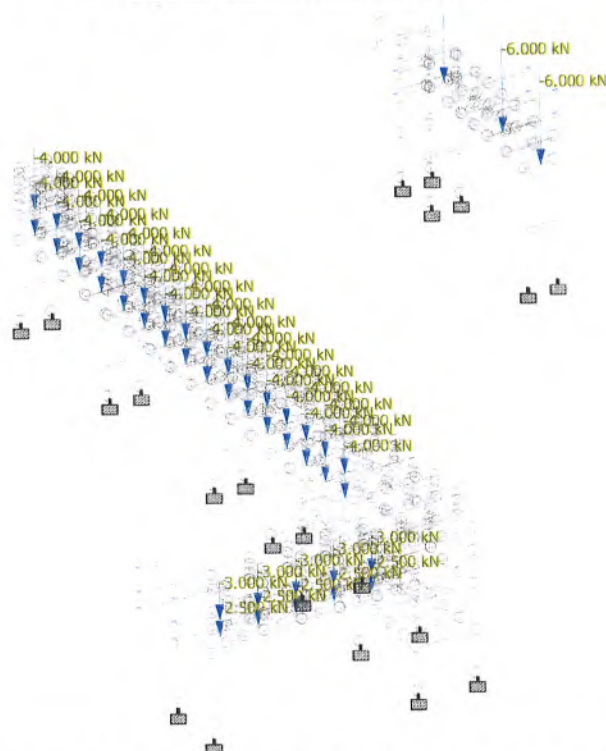
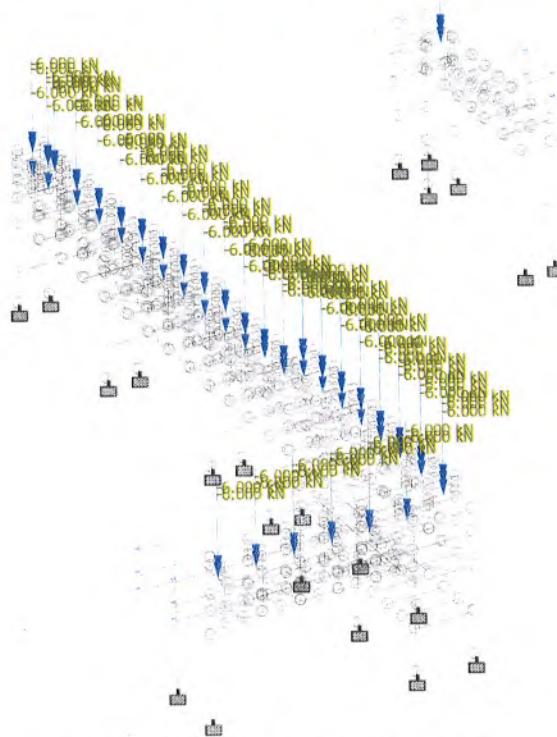
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DEAD LOAD ON SUPERSTRUCTURE



DEAD LOAD OF PIPE EMPTY WEIGHT (DE)





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6.2 LIVE LOAD

Not Applicable

6.3 PIPE LATERAL LOADS (FX & FZ)

Not Applicable



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6.4 WIND LOAD

WIND LOAD PARAMETERS

Conditions & Definitions as per ASCE 7-05

- Basic wind speed at 10 m aboveground, V = 50 m/s
- Open structure height, h = 14.4 m
- Pipe rack structure, occupancy category = III
- Exposure category = C
- Velocity pressure exposure coefficient, Kz = 0.849 at 1.44 m.height
 = 0.929 at 7.00 m.height
 = 0.987 at 9.35 m.height
 = 1.035 at 11.70 m.height
 = 1.051 at 12.60 m.height
 = 1.066 at 13.50 m.height
 = 1.081 at 14.40 m.height
- Topographic factor, Kzt = 1.00
- Wind directionally factor, Kd = 0.85
 (for main wind force resisting system, components & cladding, Lattice frameworks, and trussed towers)
- Importance factor, I = 1.15 for category III structure
- Velocity pressure, q = $0.613 \cdot Kz \cdot Kzt \cdot Kd \cdot V^2 \cdot I$
 = $1.50 \cdot Kz$ kN/m²

Height	qz (kN/m ²)
0.00	1.273
1.44	1.273
3.54	1.273
7.00	1.393
9.10	1.472
11.70	1.552
12.60	1.576
13.50	1.599
14.40	1.621



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WIND LOAD ON PIPE RACK

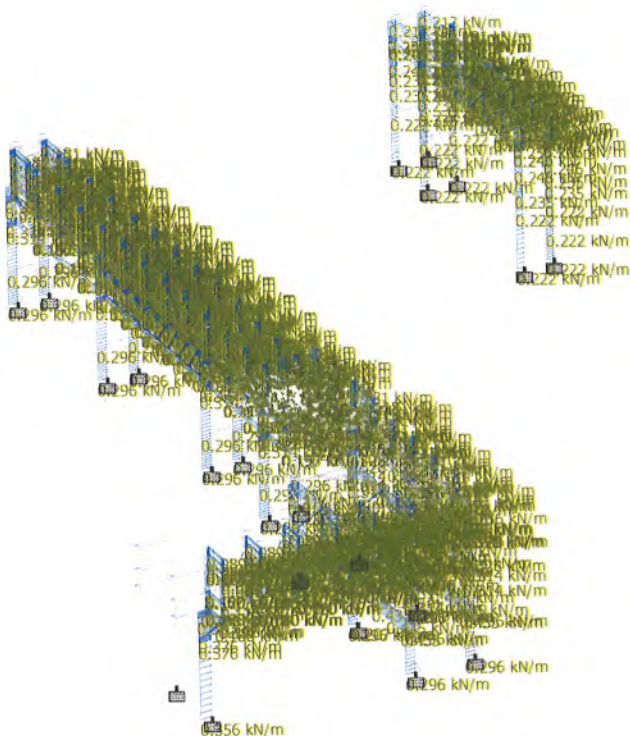
PART-1: TRANSVERSE WIND ON PIPING & CABLE TRAY

- Force for unit in length, F = $qz \cdot G \cdot C_f \cdot A_e$
- Projected area of pipe rack, A_e = Largest pipe diameter (OR)
Cable tray + 10% of pipe (OR)
Cable tray width
(For Rigid structure $T > 1$ Hz)
- Gust effect factore, G = 0.85
- Force coefficient, C_f = 0.70 for pipes & HV cables
= 2.00 for cable trays

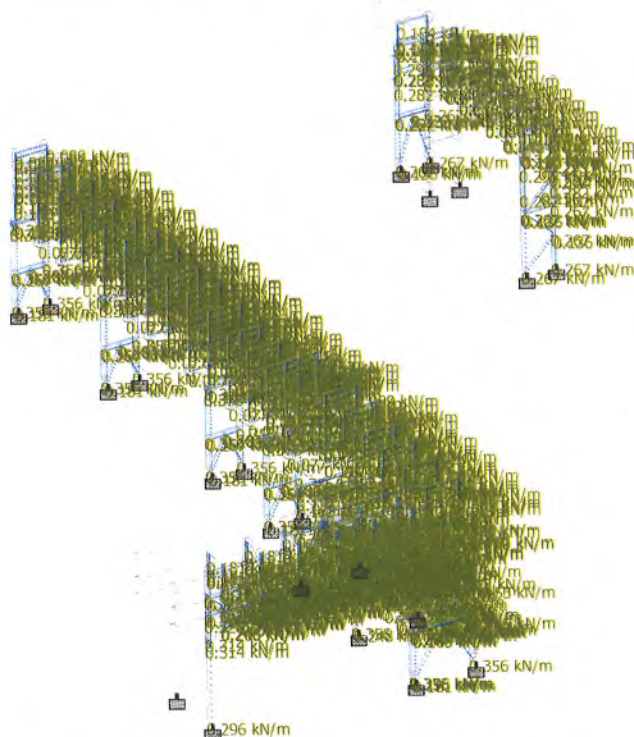
Level of Pipes & Cable Trays

EL(+)	qz (kN/m ²)	Max. Ø pipe (m)	Cable tray height (m)	Width of pipe rack (m)	Support spacing (m)	C_f	Effective area, A_e (m ² /m)	Force per length (kN/m)	Force per support (kN)
7.00	1.393	0.150	-	1.50	2.00	0.70	0.51	0.42	0.84
8.90	1.472	0.150	-	1.50	2.00	0.70	0.51	0.45	0.90

AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE



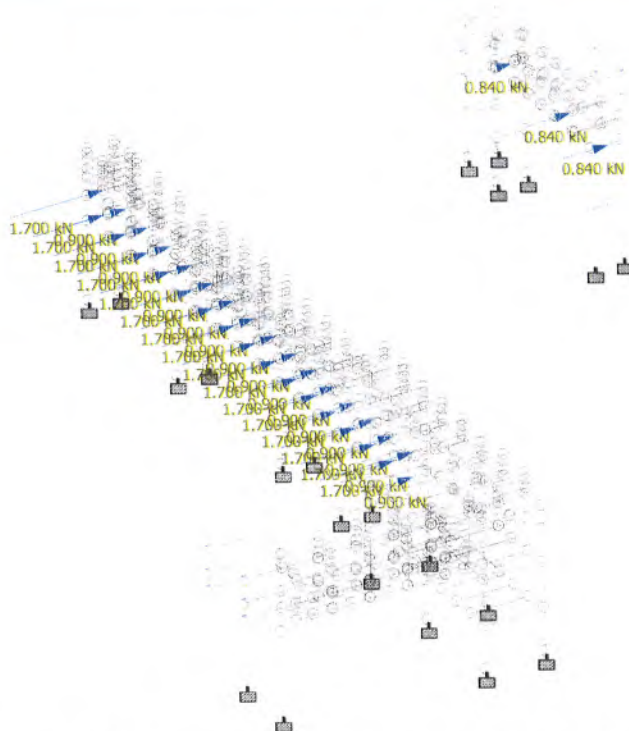
WIND LOAD (FX) ON SUPERSTRUCTURE



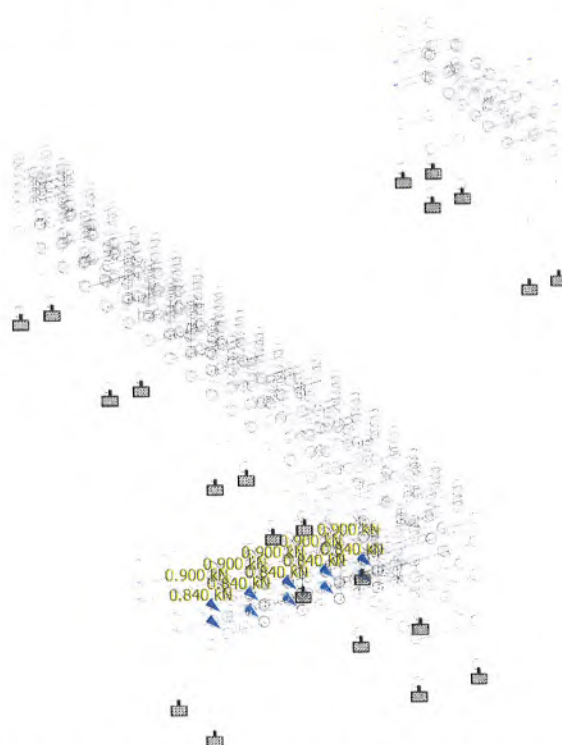
WIND LOAD (FZ) ON SUPERSTRUCTURE



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE



WIND LOAD (FZ) ON PIPING, EQUIPMENT, & CABLE TRAY



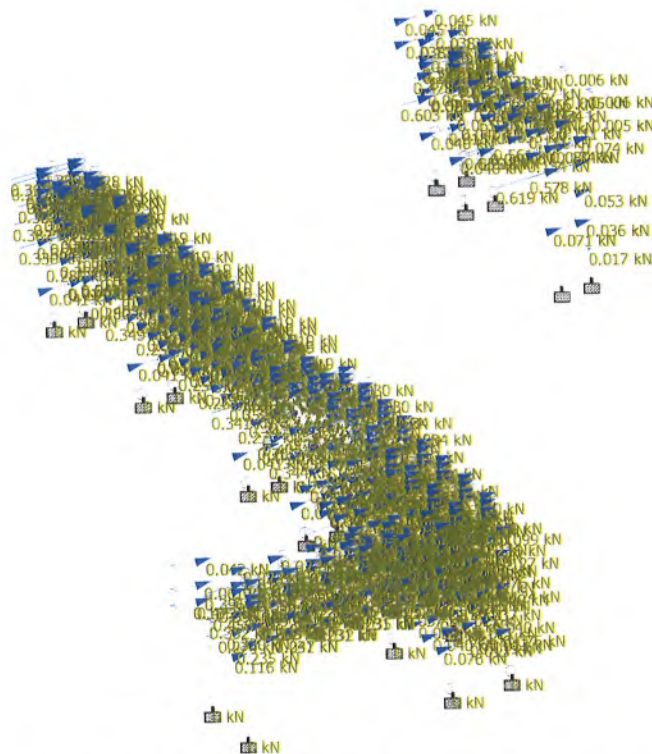
WIND LOAD (FX) ON PIPING, EQUIPMENT, & CABLE TRAY

AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

6.5 SEISMIC LOAD

Pipe Rack is designed for Seismic forces as per UBC 1997

▪ Zone Factor (Zone-1), Z	=	0.075
▪ Occupancy Category	=	3
▪ Seismic Importance Factor, IE	=	1.0
▪ Site Class	=	S _D
▪ Response modification factor, R _{wx}	=	3.0
▪ Response modification factor, R _{wz}	=	3.0



SEISMIC LOAD (FX) ON SUPERSTRUCTURE



SEISMIC LOAD (FZ) ON SUPERSTRUCTURE

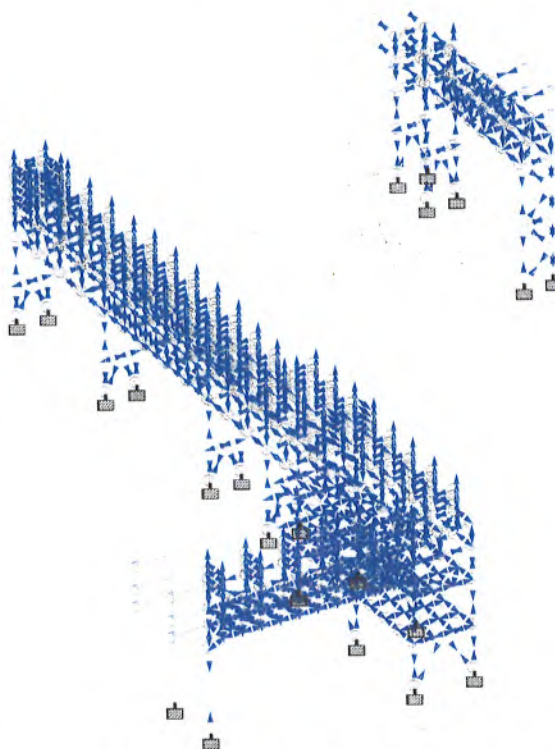


AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

6.6 TEMPERATURE LOAD

Defined in STAAD Pro.

- Coefficient of thermal expansion = 12×10^{-6}
- Applied as temperature change for axial elongation = 20 °C



TEMPERATURE LOAD ON SUPERSTRUCTURE

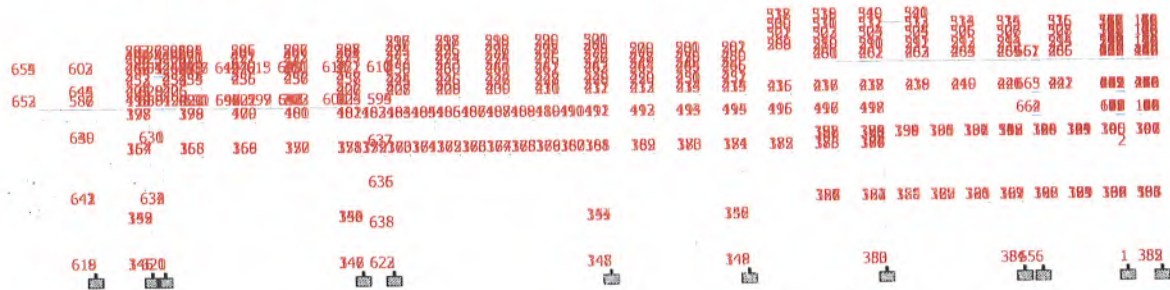


AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

7.0 DESIGN OF SUPERSTRUCTURE FOR PIPE RACK-1, 2, 3

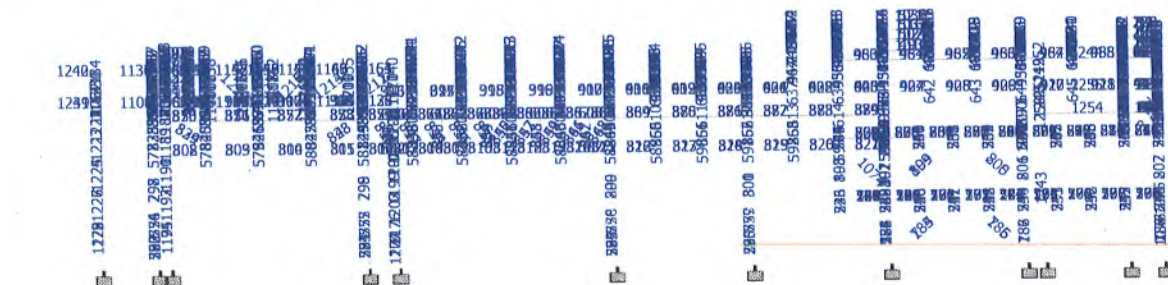
7.1 STAAD MODEL

Note: Node numbers are shown with RED fonts and member numbers/properties are shown with BLUE fonts.

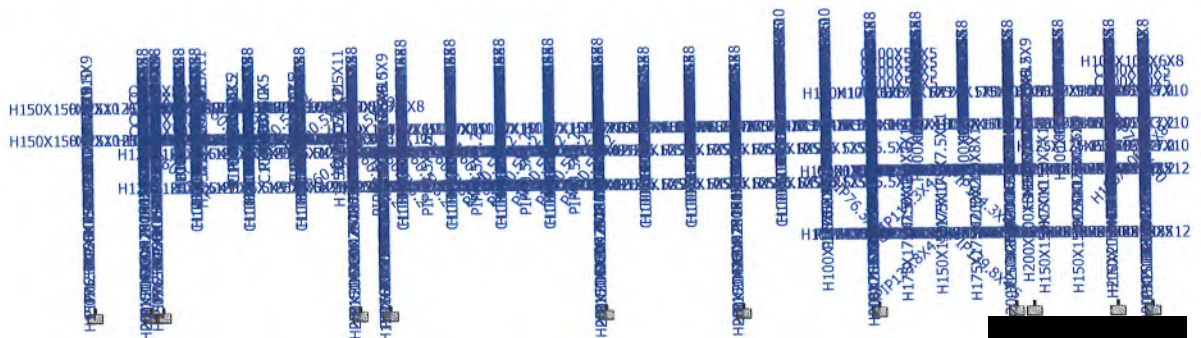


Y
X-Z

Load 12



Y
X-Z

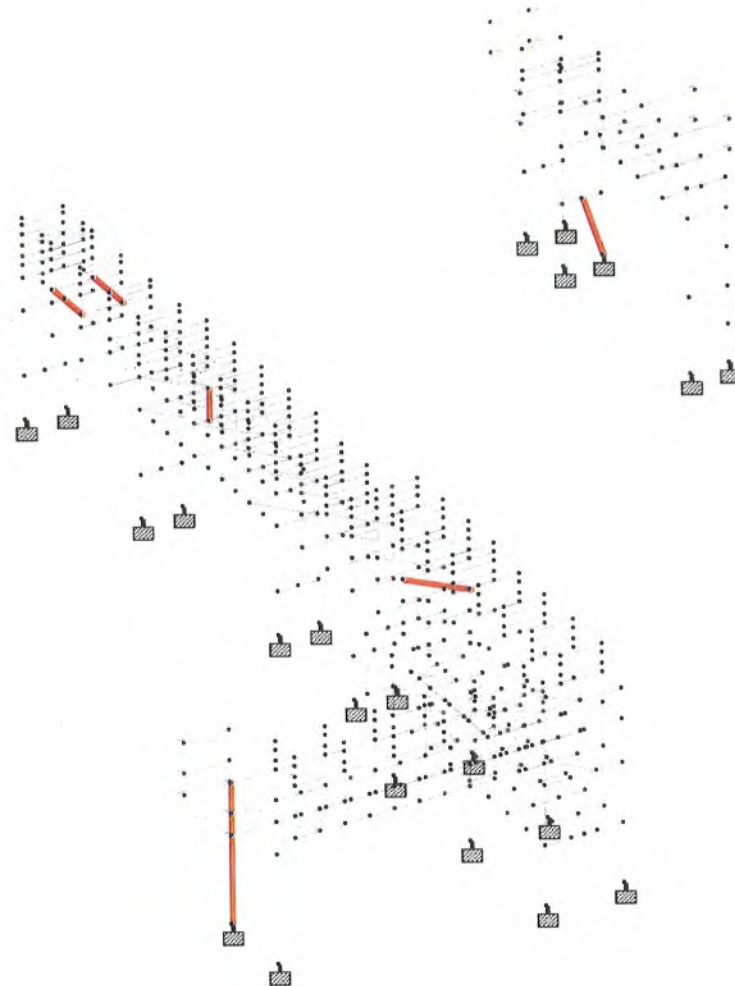


NODE NUMBERS, BEAM NUMBERS AND MEMBER PROPERTY ALONG

AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

7.2 DESIGN RESULTS (STAAD OUTPUT)

Item	Member Section	Critical Member	Load Case	Clause	Design Ratio
Column	H200X200X8X12	1243	377	Eq. H1-1b	0.754
Post	H100X100X6X8	848	393	Sec. E1	0.139
Beam	H100X100X6X8	389	369	Eq. H1-1b	0.974
Beam	H100X100X6X8	906	369	Eq. H1-1b	0.974
Hor. Brace	PIP76.3X4.0	640	349	Eq. H1-1b	0.269
Ver. Brace	PIP76.3X4.0	1195	373	Eq. H1-1a	0.778





AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

7.3 DEFLECTION CHECK

7.3.1 Column Deflection Check

Column Height = 8.9 m

	Node	L/C	Horizontal	Vertical	Horizontal	Resultant	Rotational		
			X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
Max X	657	133	17.926	0.029	30.435	35.321	0.003	-0.010	-0.001
Min X	657	228	-21.066	0.041	-30.238	36.852	0.001	0.011	0.001
Max Y	488	105	-1.854	1.983	1.068	2.917	-0.000	-0.001	0.001
Min Y	7	109	3.073	-2.715	8.260	9.221	0.004	-0.002	-0.001
Max Z	7	137	-5.467	-0.632	31.999	32.469	0.004	-0.004	-0.000
Min Z	657	227	-17.686	0.030	-31.739	36.334	0.001	0.012	0.001
Max rX	7	137	-5.467	-0.632	31.999	32.469	0.004	-0.004	-0.000
Min rX	112	232	-0.773	-0.226	-14.256	14.279	-0.005	-0.001	0.000
Max rY	657	227	-17.686	0.030	-31.739	36.334	0.001	0.012	0.001
Min rY	657	137	14.546	0.040	31.936	35.093	0.003	-0.011	-0.001
Max rZ	657	228	-21.066	0.041	-30.238	36.852	0.001	0.011	0.001
Min rZ	657	133	17.926	0.029	30.435	35.321	0.003	-0.010	-0.001
Max Rst	657	228	-21.066	0.041	-30.238	36.852	0.001	0.011	0.001

Allowable deflection = $8900/200 = 44.50$ mm.

Maximum resultant deflection = Top of column deflection – Column base deflection
= $36.852 \text{ mm} - 0.00 \text{ mm} = 36.852 \text{ mm}$, **SAFE**

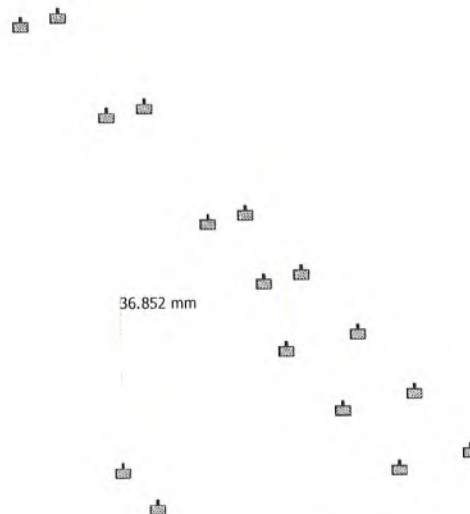


DIAGRAM SHOWS RESULTANT LATERAL DEFLECTION

AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

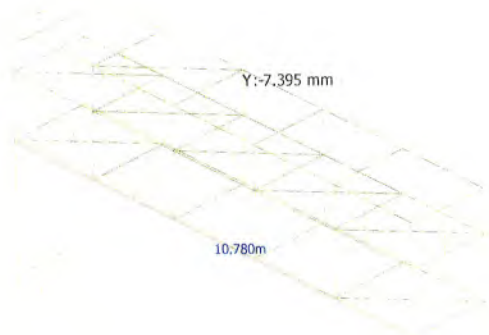
7.3.2 Beam Deflection Check

	Node	L/C	Horizontal	Vertical	Horizontal	Resultant	Rotational		
			X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
Max X	207	222	34.717	-1.595	-3.439	34.923	0.001	0.004	-0.177
Min X	208	141	-34.889	-5.676	1.548	35.381	0.000	0.001	0.265
Max Y	211	105	0.397	1.444	-4.846	5.073	-0.000	-0.000	-0.000
Min Y	429	109	-0.439	-7.395	3.907	8.375	0.000	-0.000	-0.000
Max Z	402	109	0.052	-2.008	5.717	6.060	-0.000	-0.000	0.000
Min Z	206	105	-0.158	1.349	-7.249	7.375	-0.001	-0.000	-0.000
Max rX	432	230	1.213	-0.242	5.637	5.771	0.003	-0.000	-0.000
Min rX	427	232	2.298	-0.291	-6.558	6.955	-0.003	-0.000	-0.000
Max rY	431	231	-22.481	-1.651	-0.041	22.541	-0.001	0.006	0.777
Min rY	431	229	22.645	-1.914	-0.994	22.748	-0.001	-0.006	-0.777
Max rZ	429	231	-34.036	-2.513	0.070	34.129	0.000	0.001	1.165
Min rZ	429	229	33.857	-2.789	-1.040	33.988	0.000	-0.001	-1.165
Max Rst	208	141	-34.889	-5.676	1.548	35.381	0.000	0.001	0.265

Allowable deflection = $10780/360 = 30.00$ mm.

Maximum deflection = 7.395 mm.

= 30.00 mm > 7.395 mm, **SAFE**



Following is reported beam deflection check for steel element of Pipe Rack "1, 2, 3" structure, all members pass the beam deflection design criteria. Hence, the verification is **ACCEPTABLE**.

AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

7.4 CHECK FOR DRIFT

7.4.1 For X-Direction

Maximum story drift is located along Grid P7

Bottom node	Top node	Storey level (h_i) (m)	Storey height ($h=h_{i+1}-h_i$) (m)	Dir.	Load Case	Relative lateral deflection (Δ) (mm)	Drift (Δ/h)	Allowable drift	Check
656	662	5.00	0.90	X	228	2.252	0.002502	0.015	SAFE
659	663	6.50	1.50	X	228	14.567	0.009711	0.015	SAFE
662	663	7.50	1.00	X	228	2.041	0.00204	0.015	SAFE
663	657	8.90	1.40	X	228	2.206	0.00158	0.015	SAFE

X:-21.066 mm

X:-18.860 mm

X:-16.819 mm

X:-2.252 mm

DIAGRAM SHOWS MAXIMUM LATERAL DEFLECTION IN X-DIRECTION (STOREY DRIFT)



AMATA B.GRIMM POWER 1 & 2 (REPLACEMENT) PROJECT
VERIFICATION REPORT FOR PIPE RACK "1, 2, 3" STEEL STRUCTURE

7.4.2 For Z-Direction

Maximum story drift is located along Grid PD

Bottom node	Top node	Storey level (h_i) (m)	Storey height ($h=h_{i+1}-h_i$) (m)	Dir.	Load Case	Relative lateral deflection (Δ) (mm)	Drift (Δ/h)	Allowable drift	Check
1	3	5.00	0.90	Z	137	12.158	0.013509	0.015	SAFE
2	5	6.50	1.50	Z	137	8.267	0.005511	0.015	SAFE
3	5	7.50	1.00	Z	137	4.178	0.00418	0.015	SAFE
5	7	8.90	1.40	Z	137	5.397	0.00386	0.015	SAFE

Z:31.999 mm

Z:26,603 mm

Z:22.425 mm

Z:14.158 mm

DIAGRAM SHOWS MAXIMUM LATERAL DEFLECTION IN Z-DIRECTION (STOREY DRIFT)

ภาคผนวก 2-4

สัญญาซื้อขายน้ำระหว่างโครงการกับ
นิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า



สัญญาซื้อขายน้ำเพื่อโรงไฟฟ้า

ระหว่าง

บริษัท อมตะ วอเตอร์ จำกัด

กับ

บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด

สัญญาซื้อขายน้ำเพื่อโรงไฟฟ้า บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด (ABP1R) นิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี

ใบแนบท้ายสัญญา 5 คุณภาพน้ำเพื่อโรงไฟฟ้าประเภทที่ 1

ตารางคุณภาพน้ำประเภทที่-1

Item	Parameter	Unit	Quality	วิธีวิเคราะห์	ความถี่
1	pH	-	5.5-9.0	Electrometric	เดือนละ 1 ครั้ง
2	Electrical conductivity	us/cm	$\leq 1,250$	Electrometric	เดือนละ 1 ครั้ง
3	Total Dissolved Solids (TDS)	mg/l	≤ 750	Dried at 180 °C)	เดือนละ 1 ครั้ง
4	Temperature	°C	≤ 40	Electrometric	เดือนละ 1 ครั้ง
5	Color	ADMI	≤ 120	ADMI	เดือนละ 1 ครั้ง
6	Turbidity	NTU	≤ 60	Nephelometric	เดือนละ 1 ครั้ง
7	Chloride	mg/l	≤ 350	Argentometric	เดือนละ 1 ครั้ง
8	Total Suspended Solids (SS)	mg/l	≤ 60	Dried at 103-105 °C)	เดือนละ 1 ครั้ง
9	Biochemical Oxygen Demand (BOD ₅)	mg/l	≤ 20	5- Day BOD Test, Membrane Electrode	เดือนละ 1 ครั้ง
10	Chemical Oxygen Demand (COD)	mg/l	≤ 50	Closed Reflux, Titrimetric	เดือนละ 1 ครั้ง
11	Fat Oil & Grease	mg/l	≤ 3	Partition Gravimetric	เดือนละ 1 ครั้ง
12	Total Hardness	mg/l as CaCO ₃	≤ 300	EDTA Titrimetric	เดือนละ 1 ครั้ง
13	Ca Hardness	mg/l	≤ 60	EDTA Titrimetric	เดือนละ 1 ครั้ง
14	Sulfate	mg/l	≤ 200	Nephelometric	เดือนละ 1 ครั้ง
15	Chromium (Hexavalent)	mg/l	≤ 0.05	Colorimetric	เดือนละ 1 ครั้ง
16	Manganese (Mn)	mg/l	≤ 5.0	Atomic Absorption Spectrometry(ASS)	เดือนละ 1 ครั้ง
17	Lead (Pb)	mg/l	≤ 0.2	Atomic Absorption Spectrometry(ASS)	เดือนละ 1 ครั้ง
18	Iron (Fe)	mg/l	≤ 5.0	Atomic Absorption Spectrometry(ASS)	เดือนละ 1 ครั้ง
19	Magnesium (Mg)	mg/l	≤ 60	Atomic Absorption Spectrometry(ASS)	เดือนละ 1 ครั้ง

รายการที่ 12-19 การทดสอบต้องนำน้ำตัวอย่างผ่านการทดสอบ Jar test ด้วย Alum เพื่อลดความขุ่น จนต่ำกว่า 5 NTU แล้วนำมาวัดค่าคุณภาพน้ำ

ใบแนบท้ายสัญญา 6

คุณภาพน้ำเพื่อโรงไฟฟ้าประเภทที่ 2 (1/2)

1/2



Water supply quality standards: Amata City Chonburi and Amata City Rayong

Properties	Parameters	Unit	Standard values
Physical	1 Apperance Colour	Pt-Co Unit	≤ 15
	2 Taste	-	Not Objectionable
	3 Odour	-	Not Objectionable
	4 Turbidity	NTU	≤ 4
	5 pH	-	6.5 - 8.5
Chemical	6 Total Dissolved Solids (TDS)	mg/l	≤ 600
	7 Iron (Fe)	mg/l	≤ 0.3
	8 Manganese (Mn)	mg/l	≤ 0.3
	9 Copper (Cu)	mg/l	≤ 2.0
	10 Zinc (Zn)	mg/l	≤ 3.0
	11 Total Hardness (as CaCO ₃)	mg/l	≤ 300
	12 Sulfate (SO ₄)	mg/l	≤ 250
	13 Chloride (Cl)	mg/l	≤ 250
	14 Fluoride (F)	mg/l	≤ 0.7
	15 Nitrate as NO ₃	mg/l	≤ 50
	16 Nitrite as NO ₂	mg/l	≤ 3
Bacterial	17 Total coliform bacteria	/100 ml	None
	18 <i>E.coli</i>	/100 ml	None
	19 <i>Staphylococcus aureus</i>	/100 ml	None
	20 <i>Salmonella</i> spp	/100 ml	None
	21 <i>Clostridium perfringens</i>	/100 ml	None
Toxic elements	22 Inorganic Mercury (Hg)	mg/l	≤ 0.001
	23 Lead (Pb)	mg/l	≤ 0.01
	24 Arsenic (As)	mg/l	≤ 0.01
	25 Selenium (Se)	mg/l	≤ 0.01
	26 Chromium (Cr ⁶⁺)	mg/l	≤ 0.05
	27 Cadmium (Cd)	mg/l	≤ 0.003
	28 Barium (Ba)	mg/l	≤ 0.7
	29 Cyanide (CN)	mg/l	≤ 0.07

ใบแนบท้ายสัญญา 6

คุณภาพน้ำเพื่อโรงไฟฟ้าประเภทที่ 2 (2/2)

2/2



Water supply quality standards: Amata City Chonburi and Amata City Rayong

Properties	Parameters	Unit	Standard values
Pesticides	30 Aldrin and dieldrin	µg/l	≤ 0.03
	31 Chlordane	µg/l	≤ 0.2
	32 DDT	µg/l	≤ 1
	33 Heptachlor and heptachlor epoxide	µg/l	≤ 0.03
	34 Hexachlorobenzene	µg/l	≤ 1
	35 Lindane	µg/l	≤ 2
	36 Methoxychlor	µg/l	≤ 20
Trihalomethanes	37 Chloroform	µg/l	≤ 300
	38 Bromodichloromethane	µg/l	≤ 60
	39 Dibromochloromethane	µg/l	≤ 100
	40 Bromoform	µg/l	≤ 100
Radioactivity	41 Gross alpha activity	Bq/l	≤ 0.5
	42 Gross beta activity	Bq/l	≤ 1

Remark: Residual chlorine in water supply system not less than 0.2 mg/l

Refer to Provincial Waterworks Authority (PWA) standard, currently is shown as above and any new standard to be enforced in the future.

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Managing Director

ภาคผนวก 2-5

หนังสือยืนยันศักยภาพการจัดการน้ำและ
ความสามารถการรองรับของระบบบำบัดน้ำเสีย
ส่วนกลางของนิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า

ที่ AW 23/117

วันที่ 5 พฤษภาคม 2566

เรื่อง ยืนยันศักยภาพการจัดการน้ำ และความสามารถการรองรับของระบบบำบัดน้ำเสียส่วนกลางของ
นิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี

เรียน กรรมการผู้จัดการ บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด

อ้างถึง หนังสือบริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด ที่ อบพ1. 025/2566 ลงวันที่ 27 เมษายน 2566

ตามหนังสือที่อ้างถึง บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด ขอความอนุเคราะห์จากนิคม
อุตสาหกรรมอมตะซิตี้ ชลบุรี ยืนยันศักยภาพในการจัดการน้ำสำหรับรองรับความต้องการใช้น้ำของ
โครงการทดแทนโรงไฟฟ้าก๊าซธรรมชาติ ABP1 พร้อมทั้งระบุแหล่งน้ำดิบที่นำมาจัดสรร และยืนยัน
ความสามารถของระบบบำบัดน้ำเสียส่วนกลางในการรองรับน้ำทิ้งที่ระบายออกจากโครงการทดแทน
โรงไฟฟ้าฯ ความละเอียดแจ้งแล้ว นั้น

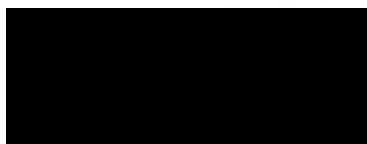
บริษัท อมตะ วอเตอร์ จำกัด ในฐานะผู้บริหารจัดการน้ำใช้และน้ำเสียในนิคมอุตสาหกรรมอมตะ
ซิตี้ ชลบุรี ขอยืนยันศักยภาพการจัดการน้ำ และการรองรับน้ำทิ้งสำหรับโครงการทดแทนโรงไฟฟ้าฯ ของ
บริษัท อมตะ บี.กริม เพาเวอร์ 1 จำกัด โดยมีรายละเอียด ดังนี้

1. บริษัทฯ สามารถจัดการน้ำสำหรับรองรับความต้องการใช้น้ำของโครงการทดแทนโรงไฟฟ้าฯ
ได้เฉลี่ย 8,210 ลูกบาศก์เมตรต่อวัน แบ่งเป็นน้ำที่ผ่านการปรับปรุงคุณภาพแล้ว 3,620
ลูกบาศก์เมตรต่อวัน จากการนำน้ำกลับมาใช้ใหม่(Recycle Water) และน้ำประปา(Treated
Water) 4,590 ลูกบาศก์เมตรต่อวัน จากแหล่งน้ำธรรมชาติ
2. ระบบบำบัดน้ำเสียของนิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี สามารถรองรับน้ำเสียจาก
โครงการทดแทนโรงไฟฟ้าฯ ในปริมาณ 3,500 ลูกบาศก์เมตรต่อวัน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

บริษัท อมตะ วอเตอร์ จำกัด



ผู้จัดการฝ่ายปฏิบัติการ

ที่ AW 22/159

วันที่ 22 สิงหาคม 2565

เรื่อง ยืนยันศักยภาพการจัดการน้ำ และความสามารถการรองรับของระบบบำบัดน้ำเสียส่วนกลางของ
นิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี
เรียน กรรมการผู้จัดการ บริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด
อ้างถึง หนังสือบริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด ที่ อบพ2. 067/2565 ลงวันที่ 19 กรกฎาคม 2565

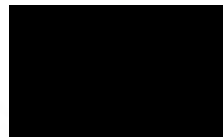
ตามหนังสือที่อ้างถึง บริษัท อมตะ บี.กริม เพาเวอร์ 2 จำกัด ขอความอนุเคราะห์จากนิคมอุตสาหกรรม
อมตะซิตี้ ชลบุรี ยืนยันศักยภาพในการจัดหาน้ำสำหรับรองรับความต้องการใช้น้ำของโครงการทดแทน
โรงไฟฟ้าก๊าซธรรมชาติ ABP2 พร้อมทั้งระบุแหล่งน้ำดิบที่นำมาจัดสรร และยืนยันความสามารถของระบบ
บำบัดน้ำเสียส่วนกลางในการรองรับน้ำทิ้งที่ระบายออกจากโครงการทดแทนโรงไฟฟ้าฯ ความละเอียดแจ้งแล้ว
นี้

บริษัท อมตะ วอเตอร์ จำกัด ในฐานะผู้บริหารจัดการน้ำใช้และน้ำเสียในนิคมอุตสาหกรรมอมตะซิตี้
ชลบุรี ขอยืนยันศักยภาพการจัดการน้ำ และการรองรับน้ำทิ้งสำหรับโครงการทดแทนโรงไฟฟ้าฯ ของบริษัท
อมตะ บี.กริม เพาเวอร์ 2 จำกัด โดยมีรายละเอียด ดังนี้

1. บริษัทฯ สามารถจัดหาน้ำสำหรับรองรับความต้องการใช้น้ำของโครงการทดแทนโรงไฟฟ้าฯ ได้
เฉลี่ย 12,000 ลูกบาศก์เมตรต่อวัน แบ่งเป็นน้ำที่ผ่านการปรับปรุงคุณภาพแล้ว 5,385 ลูกบาศก์
เมตรต่อวัน จากการนำน้ำกลับมาใช้ใหม่ (Recycle Water) และน้ำประปา(Treated Water) 6,615
ลูกบาศก์เมตรต่อวัน จากแหล่งน้ำธรรมชาติ
2. ระบบบำบัดน้ำเสียของนิคมอุตสาหกรรมอมตะซิตี้ ชลบุรี สามารถรองรับน้ำเสียจากโครงการ
ทดแทนโรงไฟฟ้าฯ ในปริมาณ 3,500 ลูกบาศก์เมตรต่อวัน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ
บริษัท อมตะ วอเตอร์ จำกัด



กรรมการผู้จัดการ

ภาคผนวก 2-6

รายการคำนวณระบบผลิตน้ำใช้

<<<กลับหน้าสารบัญ

<<<คลิกเพื่อดูรายละเอียดก่อนหน้า

ABP1R Combined Cycle Cogeneration Plant Project

DATE: 08 Nov 2022

SUPPLEMENTARY COMMUNICATION SHEET for

TITLE OF DOCUMENT	WTP Performance Test Report		
PROJECT CONTROL No	ABP1R-S-T-RE-0072	REV	0
DOCUMENT No	ABP1R-S-T-GC-0004	REV	0

First Issue (REV 0) of this document is prepared based on BPLC1R document.

No.	Rev.	CUSTOMER COMMENTS	REPLIES AND EXPLANATIONS
1	0		
	-		
2			
	-		
3			
	-		

FOR APPROVAL

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TPSC (Thailand) Co., Ltd.

OWNER



**Amata B. Grimm
Power 1 Limited**

PROJECT

**ABP1R Combined Cycle
Cogeneration Plant Project**

CONTRACTOR

TPSC (Thailand) Co., Ltd.

TITLE

WTP Performance Test Report

PROJECT CONTROL NO.

ABP1R-S-T-RE-0072

REV. 0

APPROVED:

JOB NO.

SCALE

DATE

CHECKED:

LA1900560

NONE

08 Nov 2022

DESIGNED:

DRAWING NO.

ABP1R-S-T-GC-0004

REV.

0

TPSC
THAILAND

0 08 Nov 2022 First Issue

REV DATE ISSUE PURPOSE

WTP-PERFORMANCE TEST REPORT

(Total 287 sheets including this page)

FOR

CUSTOMER: TPSC (THAILAND) CO., LTD.

OWNER: B.GRIMM POWER (AMATA) 1 LTD.

PROJECT: ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT

PROJECT NO: PA-2008-TPSC-ABP1R

PREPARED BY:

HYDROZONE COMPANY LIMITED

SEPTEMBER 14, 2022

TPSC (THAILAND) CO., LTD.			HYDROZONE CO., LTD.		
0	September 14, 2022	For Approve			
Rev	Date	Description	Prepared	Checked	Approved



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

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- Acceptance quantity calculation method
- Data log sheet - Service water system
- Data log sheet - Demin water system

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- Auxiliary Power consumption Record
- Calibration certificate for Digital Meter LOVATO DMG800



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

1.0 PURPOSE

The purpose of this document is to conclusion of result for Performance Test

2.0 SCOPE

The intent of this test is to demonstrate that the equipment of water treatment system can be operated and successfully met the requirement of the Performance Test.

The consumable supply for operation such as raw water, chemicals and electrical will be supply by TPSC.

The main equipments necessary to support water treatment package operation and will be parts of the Performance Test are listed below.

Service water treatment system

- MF Unit 1
- MF Unit 2

Demin water treatment system

- RO Unit 1
- RO Unit 2
- CEDI Unit 1
- CEDI Unit 2



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

3.0 PREREQUISITE

- 3.1 Prior to the test commencing, agreement shall be made on what data shall be recorded during the Performance Test.
- 3.2 A separate log book for the unit under test shall be maintained in the control room and shall be submitted as part of the final test protocol acceptance.
- 3.3 During this test, all equipment designed to be in automatic control shall be operated in automatic. Any requirement which is not available prior to the start of the test shall be notified to the TPSC and agreement in writing obtained that the test can or cannot be performed without said equipment operational or available in standby during the test.

4.0 PROCEDURE

- 4.1 The Performance Test shall commence after the Commissioning Test has been completed.
- 4.2 Prior to starting the Performance Test, confirm that a Data Log Sheet has been set up to record the operating conditions through the whole of test period.
- 4.3 At completion of the Performance Test, the operation and running data will be evaluated by TPSC who if satisfied that the Performance Test was successful will sign the Performance Test acceptance on section 6.1 of this document.



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

5.0 TEST CRITERIA

The conditions and pre-conditions for the Performance Test are as follows,

- a. Performance Test shall continue without any interruption during the Performance Test period.
- b. Operation during Performance Test shall be done at acceptance criteria.
- c. Failure or interruption not due to or caused by faulty design, materials or workmanship (but not otherwise), for example human errors, shall not be considered as an interruption.
- d. On-line switching between permanently installed back up equipment will not regarded as an interruption. Use of any other form of redundancy shall be permitted.
- e. Any failure or interruption which is not due to or arising from the HDZ's scope of supply/work will not be considered as an interruption to the Performance Test period.
- f. Minor defects or problems, such as leaks and noise, which do not affect the continuous operation and which do not result in reduced output or efficiency shall not be grounds to interrupt the Performance Test.
- g. Operation during the Performance Test shall be carried out by the HDZ and supervised by TPSC
- h. Minor adjustment which do not result in reduced output of efficiency shall be allowed to be carried out by HDZ.
- i. Cleaning of filter elements and other actions normally required during operation will be allowed to provide, HDZ shall inform TPSC of such actions in advance and the required plant output is not affected.

5.1 NOTED DURING PERFORMANCE TEST

- a. -NA-



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
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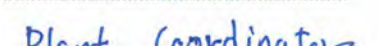
6.0 ACCEPTANCE

6.1 Performance Test is met requirements in conformance to acceptance criteria.

Hydrozone Representative

Signature : 
Name : 
Position : Commissioning Engineer.....
Date : 13 October 2022.....

TPSC Representative

Signature : 
Name : 
Position : Plant Coordinator.....
Date : 3 NOV 2022.....

Owner Representative

Signature : 
Name : 
Position : ADM.....
Date : 8 NOV, 2022.....



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

7. ATTACHMENT



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE CRITERIA

1) SYSTEM CAPACITY

SYSTEM	UNIT	VALUE	UNIT/DAY	
MF Unit net capacity	m ³ /hr/unit	62	m ³ /day/unit	1,488
RO Unit net capacity	m ³ /hr/unit	45	m ³ /day/unit	1,080
CEDI unit net capacity	m ³ /hr/unit	40	m ³ /day/unit	960

2) WATER QUALITY

FILTER WATER AT OUTLET MF UNIT

PARAMETER	UNIT	VALUE
pH		6.0 to 7.9
Turbidity	NTU	< 1
Total Suspended Solids	mg/L	< 1

RO PERMEATE WATER AT OUTLET RO UNIT

PARAMETER	UNIT	VALUE
pH		5.5 to 7.5
Total Suspended Solids		Nil
Total Dissolved Solids	mg/L	< 30

DEMINERALIZED WATER AT OUTLET CEDI UNIT

PARAMETER	UNIT	VALUE
pH		5.5 to 7.5
Conductivity at 25 °C	μS/cm	< 0.2
Silica as SiO ₂	mg/L	< 0.01
Total iron as Fe	mg/L	< 0.01
Total Dissolved Solid	mg/L	< 0.1

RO CONCENTRATE WATER QUALITY (EXPECTED)

PARAMETER	UNIT	VALUE
pH		6.5 to 8.5
Total Suspended Solids	mg/L	< 1
Total Dissolved Solids	mg/L	< 4,500

CEDI CONCENTRATE WATER QUALITY (EXPECTED)

PARAMETER	UNIT	VALUE
pH		5.5 to 7.5
Total Suspended Solids	mg/L	< 1
Total Dissolved Solids	mg/L	< 500

WASTEWATER QUALITY IN NEUTRALIZATION BASIN (EXPECTED)

PARAMETER	UNIT	VALUE
pH		7.5 to 8.5
Total Suspended Solids	mg/L	< 50
Total Dissolved Solids	mg/L	< 10,000
Temperature	°C	< 40

WASTEWATER QUALITY IN COLLECTION TANK (EXPECTED)

PARAMETER	UNIT	VALUE
pH		5.5 to 9.0
Total Suspended Solids	mg/L	< 50
Total Dissolved Solids	mg/L	< 3,500
Temperature	°C	< 40



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
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TIME PERIOD

	Start time																							Stop	
Hours	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
MF unit 1																									
MF unit 2																									
RO unit 1																									
RO unit 2																									
CEDI unit 1																									
CEDI unit 2																									

Remark: All system will be start before record performance test 30 minutes

MF unit 1 & 2 will backwash every 27 minute



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUANTITY CALCULATION METHOD

MF UNIT ACCEPTANCE CRITERIA

MF UNIT 1

$$\begin{aligned}\text{MF UNIT 1 FLOW RATE} &= \frac{[(\text{MF 1 INLET WATER ACCUMULATED FLOW, m}^3) - ((\text{MF BACKWASH WATER ACCUMULATED FLOW, m}^3) \div 2)]}{\text{TIME PERIOD, hr}} \\ (\text{m}^3/\text{hr}) &= \frac{(1685) - (78 \div 2)}{24} \\ &= 68.58 \quad \text{m}^3/\text{hr}\end{aligned}$$

$$\text{SERVICE WATER FLOW RATE} \geq 62 \quad \text{m}^3/\text{hr, ACCEPTANCE}$$

NOTE

- 1) MF 1 INLET WATER ACCUMULATED FLOW (m³) DATA FROM 00GGB11CF001
- 2) MF BACKWASH WATER ACCUMULATED FLOW (m³) DATA FROM 00GBR30CF001
- 3) TIME PERIOD 24 hr.

MF UNIT 2

$$\begin{aligned}\text{MF UNIT 2 FLOW RATE} &= \frac{[(\text{MF 2 INLET WATER ACCUMULATED FLOW, m}^3) - ((\text{MF BACKWASH WATER ACCUMULATED FLOW, m}^3) \div 2)]}{\text{TIME PERIOD, hr}} \\ (\text{m}^3/\text{hr}) &= \frac{(1684) - (78 \div 2)}{24} \\ &= 68.54 \quad \text{m}^3/\text{hr}\end{aligned}$$

$$\text{SERVICE WATER FLOW RATE} \geq 62 \quad \text{m}^3/\text{hr, ACCEPTANCE}$$

NOTE

- 1) MF 2 INLET WATER ACCUMULATED FLOW (m³) DATA FROM 00GGB12CF001
- 2) MF BACKWASH WATER ACCUMULATED FLOW (m³) DATA FROM 00GBR30CF001
- 3) TIME PERIOD 24 hr.



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUANTITY CALCULATION METHOD

RO UNIT ACCEPTANCE CRITERIA

RO UNIT 1

$$\begin{aligned}\text{RO UNIT 1 FLOW RATE (m}^3\text{/hr)} &= \frac{[(2\text{ND PASS RO PERMEATE UNIT 1 WATER ACCUMULATED FLOW, m}^3)]}{\text{TIME PERIOD, hr}} \\ &= \frac{1096}{24} \\ &= 45.67 \text{ m}^3\text{/hr} \\ \text{SERVICE WATER FLOW RATE} &\geq 45 \text{ m}^3\text{/hr, ACCEPTANCE}\end{aligned}$$

NOTE

- 1) 2ND PASS RO PERMEATE UNIT 1 WATER ACCUMULATED FLOW (m³) DATA FROM 00GCF11CF003
- 2) TIME PERIOD 24 hr.

RO UNIT 2

$$\begin{aligned}\text{RO UNIT 2 FLOW RATE (m}^3\text{/hr)} &= \frac{[(2\text{ND PASS RO PERMEATE UNIT 2 WATER ACCUMULATED FLOW, m}^3)]}{\text{TIME PERIOD, hr}} \\ &= \frac{1085}{24} \\ &= 45.2 \text{ m}^3\text{/hr} \\ \text{SERVICE WATER FLOW RATE} &\geq 45 \text{ m}^3\text{/hr, ACCEPTANCE}\end{aligned}$$

NOTE

- 1) 2ND PASS RO PERMEATE UNIT 2 WATER ACCUMULATED FLOW (m³) DATA FROM 00GCF12CF003
- 2) TIME PERIOD 24 hr.



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUANTITY CALCULATION METHOD

CEDI UNIT ACCEPTANCE CRITERIA

CEDI UNIT 1

$$\begin{aligned}\text{CEDI UNIT 1 FLOW RATE} &= \frac{[(\text{CEDI PRODUCT UNIT 1 WATER ACCUMULATED FLOW, m}^3)]}{(\text{m}^3/\text{hr}) \quad \text{TIME PERIOD, hr}} \\ &= \frac{966}{24} \\ &= 40.25 \quad \text{m}^3/\text{hr} \\ \text{SERVICE WATER FLOW RATE} &\geq 40 \quad \text{m}^3/\text{hr, ACCEPTANCE}\end{aligned}$$

NOTE

- 1) CEDI PRODUCT UNIT 1 WATER ACCUMULATED FLOW (m³) DATA FROM 00GCF21CF002
- 2) TIME PERIOD 24 hr.

CEDI UNIT 2

$$\begin{aligned}\text{CEDI UNIT 2 FLOW RATE} &= \frac{[(\text{CEDI PRODUCT UNIT 2 WATER ACCUMULATED FLOW, m}^3)]}{(\text{m}^3/\text{hr}) \quad \text{TIME PERIOD, hr}} \\ &= \frac{962}{24} \\ &= 40.08 \quad \text{m}^3/\text{hr} \\ \text{SERVICE WATER FLOW RATE} &\geq 40 \quad \text{m}^3/\text{hr, ACCEPTANCE}\end{aligned}$$

NOTE

- 1) CEDI PRODUCT UNIT 1 WATER ACCUMULATED FLOW (m³) DATA FROM 00GCF22CF002
- 2) TIME PERIOD 24 hr.



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

MF UNIT 1 QUALITY ACCEPTANCE CRITERIA (S2)

RECORD	CRITERIA	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	6.0 - 7.9		7.5	7.4	7.5	7.5	7.4	7.4	7.5	7.5	7.4	7.4	7.5	7.4	7.5	by Lab	
Turbidity (NTU)	< 1		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.88	< 0.50	< 0.50	< 0.50	< 0.50	by Lab	
Total Suspended Solid (ppm)	< 1		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	By Lab	

NOTE

1) SAMPLING WATER FROM SAMPLING POINT S2

MF UNIT 2 QUALITY ACCEPTANCE CRITERIA (S4)

RECORD	CRITERIA	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	6.0 - 7.9		7.2	7.4	7.4	7.2	7.3	7.2	7.4	7.3	7.2	7.3	7.1	7.3	7.3	by Lab	
Turbidity (NTU)	< 1		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.84	< 0.50	< 0.50	< 0.50	0.74	by Lab	
Total Suspended Solid (mg/L)	< 1		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	By Lab	

NOTE

1) SAMPLING WATER FROM SAMPLING POINT S4



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

RO UNIT 1 QUALITY ACCEPTANCE CRITERIA (S8)

RECORD	CRITERIA	Hour	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 7.5	6.5	6.6	6.7	6.6	6.5	6.6	6.6	6.6	6.7	6.6	6.6	6.6	6.6	6.9	by Lab	
Total Suspended Solid (mg/L)	Nil	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	by Lab	
Total Dissolved Solid (mg/L)	< 30	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	By Lab	

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S8
- 2) pH VALUE ANALYZE BY LAB WILL BE LESS THAN ACTUAL BECAUSE SAMPLE WATER WILL BE CONTAMINATED BY CO₂ IN AIR DURING ANALYSING

RO UNIT 2 QUALITY ACCEPTANCE CRITERIA (S13)

RECORD	CRITERIA	Hour	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 7.5	6.3	6.3	6.4	6.5	6.6	6.3	6.3	6.2	6.2	6.2	6.4	6.4	6.4	by Lab		
Total Suspended Solid (mg/L)	Nil	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	by Lab		
Total Dissolved Solid (mg/L)	< 30	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	By Lab		

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S13
- 2) pH VALUE ANALYZE BY LAB WILL BE LESS THAN ACTUAL BECAUSE SAMPLE WATER WILL BE CONTAMINATED BY CO₂ IN AIR DURING ANALYSING



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

CEDI UNIT 1 QUALITY ACCEPTANCE CRITERIA (S16)

RECORD	CRITERIA	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 7.5	7.14	7.53	7.68	7.31	7.20	7.22	7.41	7.50	7.19	6.93	7.10	6.84	7.26	by portable at field		
Conductivity (µS/cm)	< 0.2	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	by online		
Silica (ppb)	10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	by Lab		
Total Iron (mg/L)	< 0.01	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	by Lab		
Total Dissolved Solid (mg/L)	< 0.1	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	By Lab		

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S16
- 2) THE DETECTION LIMIT OF TOTAL DISSOLVED SOLID BY LABORATORY IS 2 mg/L

CEDI UNIT 2 QUALITY ACCEPTANCE CRITERIA (S19)

RECORD	CRITERIA	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 7.5	7.14	7.34	6.83	6.59	6.91	7.00	6.53	6.58	7.25	7.22	7.28	7.30	7.22	by portable at field		
Conductivity (µS/cm)	< 0.2	0.07	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	by online		
Silica (ppb)	10	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	by Lab		
Total Iron (mg/L)	< 0.01	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	by Lab		
Total Dissolved Solid (mg/L)	< 0.1	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	By Lab		

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S19
- 2) THE DETECTION LIMIT OF TOTAL DISSOLVED SOLID BY LABORATORY IS 2 mg/L



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

RO UNIT 1 CONCENTRATE WATER QUALITY (EXPECTED) (S7)

RECORD	EXPECT	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:210	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	6.5 - 8.5		7.9	7.6	8	7.8	8.1	7.8	7.8	7.8	7.8	7.7	7.7	7.8	7.8	by Lab	
Total Suspended Solid (mg/L)	< 1		< 1	< 1	< 1	< 1	1	6	6	8	9	8	6	9	4	by Lab	
Total Dissolved Solid (mg/L)	< 4,500		1060	1144	1060	1136	1048	1036	1152	1228	1144	1124	1172	1196	1180	By Lab	

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S7
- 2) TOTAL SUSPENDED SOLID > 1 mg/L MAY COME FROM BACTERIA INCREASING IN THE SERVICE WATER STORAGE TANK AND REJECTED TO RO CONCENTRATED WATER

RO UNIT 2 CONCENTRATE WATER QUALITY (EXPECTED) (S12)

RECORD	EXPECT	HOUR	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	6.5 - 8.5		7.6	7.5	7.5	7.5	7.5	7.6	7.6	7.6	7.6	7.7	7.5	7.7	7.7	by Lab	
Total Suspended Solid (mg/L)	< 1		2	9	1	2	2	3	3	2	< 1	2	1	4	4	by Lab	
Total Dissolved Solid (mg/L)	< 4,500		1156	1116	1192	1124	1112	1100	1124	1184	1128	1140	1064	1040	1112	By Lab	

NOTE

- 1) SAMPLING WATER FROM SAMPLING POINT S12
- 2) TOTAL SUSPENDED SOLID > 1 mg/L MAY COME FROM BACTERIA INCREASING IN THE SERVICE WATER STORAGE TANK AND REJECTED TO RO CONCENTRATED WATER



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

CEDI UNIT 1 CONCENTRATE WATER QUALITY (EXPECTED) (S17)

RECORD	EXPECT	HOURL	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 8.5	6.8	6.9	7.2	6.9	7.0	7.1	6.7	6.8	7.1	7.0	6.7	6.6	6.7	by Lab		
Total Suspended Solid (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	by Lab		
Total Dissolved Solid (mg/L)	< 500	7	22	22	22	18	18	17	14	16	20	14	14	14	By Lab		

NOTE

1) SAMPLING WATER FROM SAMPLING POINT S17

CEDI UNIT 2 CONCENTRATE WATER QUALITY (EXPECTED) (S20)

RECORD	EXPECT	HOURL	0	2	4	6	8	10	12	14	16	18	20	22	24	REMARK	
		DATE	14 Sep 2022					15 Sep 2022									
		TIME	15:10	17:10	19:10	21:10	23:10	01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10		
pH	5.5 - 8.5	6	6.4	6.5	6.8	6.9	7.1	6.8	7.1	6.9	7.2	7.1	7.1	7.2	by Lab		
Total Suspended Solid (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	by Lab		
Total Dissolved Solid (mg/L)	< 500	< 2	22	23	21	22	20	17	19	16	18	14	14	15	By Lab		

NOTE

1) SAMPLING WATER FROM SAMPLING POINT S20



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

ACCEPTANCE QUALITY CALCULATION METHOD

NEUTRLIZATION BASIN WASTEWATER QUALITY (EXPECTED)

RECORD	EXPECT	HOUR	0													REMARK	
		DATE	15 Sep 2022														
		TIME	12:00														
pH	7.5 - 8.5	7.4														by Lab	
Total Suspended Solid (mg/L)	< 50	6														by Lab	
Total Dissolved Solid (mg/L)	< 10,000	360														by Lab	
Temperature (°C)	< 40	27.3														By Portable	

NOTE

1) SAMPLING WATER FROM NEUTRALIZATION BASIN (00GCR10BB001)

COLLECTION TANK WASTEWATER QUALITY (EXPECTED)

RECORD	EXPECT	HOUR	0													REMARK	
		DATE	15 Sep 2022														
		TIME	12:00														
pH	5.5 - 9.0	7.3														by Lab	
Total Suspended Solid (mg/L)	< 50	3														by Lab	
Total Dissolved Solid (mg/L)	< 2,000	582														by Lab	
Temperature (°C)	< 40	25.8														By Portable	

NOTE

1) SAMPLING WATER FROM COLLECTION TANK (00GBA30BB001)



ABP1R COMBINED CYCLE COGENERATION PLANT PROJECT
WTP-Performance Test Report
Water Treatment System

DATA RECORD

Appendix-C: Measuring of WTP Product Water Quality

Measuring Point	Measuring Item	Design	Units	14 September 2022										Remark
				01	02	03	04	05	06	07	08	09	10	
				15:10	17:10	19:10	21:10	23:10	:	:	:	:	:	
Micro Filtration 1 (Outlet)														
S2	- Turbidity	≤ 1	NTU	0.33	0.37	0.34	0.25	0.25						At field
S2	- SDI	≤ 3						0.98						At field
S2	- pH	6.0-7.9		7.37	7.29	7.30	7.28	7.26						At field
Micro Filtration 2 (Outlet)														
S4	- Turbidity	≤ 1	NTU	0.33	0.33	0.33	0.32	0.25						At field
S4	- SDI	≤ 3						0.83						At field
S4	- pH	6.0-7.9		7.32	7.22	7.25	7.26	7.25						At field
Service Water Storage Tank (Outlet)														
A1	- Conductivity (AIT 00GCK30CQ001)	< 940	μS/cm	478.87	479.32	482.53	485.96	485.5						Online (For Reference)
S5	- SDI	≤ 3						5.18						At field
A2	- ORP (AIT 00GCF11CQ001)	< 250	mV	257.28	261.78	268.04	273.83	278.53						Online (For Reference)
S10	- SDI	≤ 3						5.25						At field
A7	- ORP (AIT 00GCF12CQ001)	< 250	mV	299.47	290.87	288.45	285.51	279.25						Online (For Reference)
1 st Pass RO Permeate 1 (Outlet)														
S6	- Conductivity	< 290	μS/cm	11.39	11.45	11.54	11.41	11.57						At field
S6	- pH	5.0-7.5	-	7.47	7.37	7.28	7.50	7.38						At field
1 st Pass RO Permeate 2 (Outlet)														
S11	- Conductivity	< 290	μS/cm	10.43	10.55	10.59	11.27	10.47						At field
S11	- pH	5.0-7.5	-	7.36	7.27	7.28	7.05	7.26						At field
2 nd Pass RO Permeate 1 (Outlet)														
A4	- Conductivity (AIT 00GCF11CQ003)	< 20	μS/cm	1.11	1.03	1.06	1.04	1.05						Online
A3	- pH (AIT 00GCF11CQ004)	7.0-8.0	-	5.75	7.85	8.17	8.06	7.96						Online
2 nd Pass RO Permeate 2 (Outlet)														
A9	- Conductivity (AIT 00GCF12CQ003)	< 20	μS/cm	2.6	1.12	1.47	1.39	1.5						Online
A8	- pH (AIT 00GCF12CQ004)	7.0-8.0	-	4.68	8.1	8.34	7.9	7.97						Online

Note: 1. The SDI from service water storage tank is higher design because water storage long time then may have some biological growth and increasing of SDI

2. pH in 1st Pass RO permeate higher than design a little bit because may have some interference by caustic injection point

Measuring Point	Measuring Item	Design	Units	14 September 2022										Remark
				01	02	03	04	05	06	07	08	09	10	
				15:10	17:10	19:10	21:10	23:10	:	:	:	:	:	
1 st Pass RO Concentrate 1 (Outlet)														
A5	- Conductivity (AIT 00GCF11CQ002)	≤ 3520	μS/cm	1703	1712	1724	1733	1747						Online
S7	- pH	6.5-8.5	-	7.78	7.7	7.84	7.78	7.79						At field
1 st Pass RO Concentrate 2 (Outlet)														
A10	- Conductivity (AIT 00GCF12CQ002)	≤ 3520	μS/cm	1649	1689	1700	1713	1711						Online
S12	- pH	6.5-8.5	-	7.69	7.87	7.67	7.7	7.74						At field
2 nd Pass RO Concentrate 1 (Outlet)														
A6	- Conductivity (AIT 00GCF11CQ005)	≤ 1890	μS/cm	72.56	112.61	103.07	109.56	123.67						Online
S9	- pH	6.5-8.5	-	8.09	8.13	8.07	7.94	8.12						At field
2 nd Pass RO Concentrate 2 (Outlet)														
A11	- Conductivity (AIT 00GCF12CQ005)	≤ 1890	μS/cm	66.07	122.15	115.28	110.73	117.21						Online
S14	- pH	6.5-8.5	-	7.89	7.9	7.9	8.0	8.0						At field
RO Water Tank (Outlet)														
A12	- Conductivity (AIT00GCK34CQ001)	< 20	μS/cm	1.89	1.44	1.05	1.03	1.1						Online
CEDI Dilution 1 (Outlet)														
S16	- pH	5.5-7.5	-	7.14	7.53	7.68	7.31	7.2						At field
A13	- Conductivity at 25°C (AIT 00GCF21CQ001)	≤ 0.2	μS/cm	0.06	0.07	0.07	0.07	0.07						Online
A15	- Silica (as SiO ₂) (AIT 00GCF50CQ001)	≤ 10	ppb	4.33	4.52	4.11	4.06	4.25						Online
CEDI Dilution 2 (Outlet)														
S19	- pH	5.5-7.5	-	7.14	7.34	6.83	6.59	6.91						At field
A14	- Conductivity at 25°C (AIT 00GCF22CQ001)	≤ 0.2	μS/cm	0.07	0.08	0.07	0.07	0.07						Online
A15	- Silica (as SiO ₂) (AIT 00GCF50CQ001)	≤ 10	ppb	4.05	4.81	4.57	4.56	4.22						Online

Test Date: 14 September 2022

Measured by (HDZ):



Accepted by (Customer):

Appendix-C: Measuring of WTP Product Water Quality

Measuring Point	Measuring Item	Design	Units	15 September 2022										Remark
				01	02	03	04	05	06	07	08	09	10	
				01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	:	:	
Micro Filtration 1 (Outlet)														
S2	- Turbidity	≤ 1	NTU	0.25	0.25	0.25	0.2	0.25	0.26	0.23	0.31			At field
S2	- SDI	≤ 3					1.9				0.49			At field
S2	- pH	6.0-7.9		7.31	7.44	7.33	7.28	7.28	7.33	7.3	7.35			At field
Micro Filtration 2 (Outlet)														
S4	- Turbidity	≤ 1	NTU	0.17	0.25	0.22	0.25	0.25	0.25	0.21	0.24			At field
S4	- SDI	≤ 3					1.6				0.67			At field
S4	- pH	6.0-7.9		7.29	7.42	7.26	7.26	7.22	7.29	7.27	7.37			At field
Service Water Storage Tank (Outlet)														
A1	- Conductivity (AIT 00GCK30CQ001)	< 940	μS/cm	490.85	494.43	495.35	490.31	488.48	485.96	483.44	484.82			Online (For Reference)
S5	- SDI	≤ 3					6.15				6.24			At field
A2	- ORP (AIT 00GCF11CQ001)	< 250	mV	280.7	284.44	284.97	285.2	284.29	283.98	283.68	283.6			Online (For Reference)
S10	- SDI	≤ 3					6.0				6.03			At field
A7	- ORP (AIT 00GCF12CQ001)	< 250	mV	282.76	283.22	285.74	289.78	284.13	284.67	286.19	281.23			Online (For Reference)
1 st Pass RO Permeate 1 (Outlet)														
S6	- Conductivity	< 290	μS/cm	12.05	12.37	12.77	11.87	11.59	11.47	11.42	11.53			At field
S6	- pH	5.0-7.5	-	7.11	7.5	7.35	7.3	7.41	7.38	7.42	7.47			At field
1 st Pass RO Permeate 2 (Outlet)														
S11	- Conductivity	< 290	μS/cm	10.86	11.14	11.44	11.35	10.93	11.01	11.07	10.92			At field
S11	- pH	5.0-7.5	-	7.27	7.32	7.19	7.26	7.43	7.27	7.39	7.48			At field
2 nd Pass RO Permeate 1 (Outlet)														
A4	- Conductivity (AIT 00GCF11CQ003)	< 20	μS/cm	1.04	1.01	1.08	1.06	1.03	1.08	1.05	1.12			Online
A3	- pH (AIT 00GCF11CQ004)	7.0-8.0	-	8.01	8.17	7.84	7.78	7.84	8.12	8.22	7.75			Online
2 nd Pass RO Permeate 2 (Outlet)														
A9	- Conductivity (AIT 00GCF12CQ003)	< 20	μS/cm	1.57	1.54	1.51	1.54	1.63	1.57	1.53	1.59			Online
A8	- pH (AIT 00GCF12CQ004)	7.0-8.0	-	8.13	8.03	7.99	7.85	8.08	8.3	8.2	8.06			Online

Note: 1. The SDI from service water storage tank is higher design because water storage long time then may have some biological growth and increasing of SDI

2. pH in 1st Pass RO permeate higher than design a little bit because may have some interference by caustic injection point

Measuring Point	Measuring Item	Design	Units	15 September 2022										Remark
				01	02	03	04	05	06	07	08	09	10	
				01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	:	:	
1 st Pass RO Concentrate 1 (Outlet)														
A5	- Conductivity (AIT 00GCF11CQ002)	≤ 3520	μS/cm	1796	1820	1829	1809	1796	1786	1775	1783			Online
S7	- pH	6.5-8.5	-	7.65	7.7	7.66	7.66	7.58	7.62	7.63	7.66			At field
1 st Pass RO Concentrate 2 (Outlet)														
A10	- Conductivity (AIT 00GCF12CQ002)	≤ 3520	μS/cm	1733	1745	1739	1746	1735	1723	1712	1664			Online
S12	- pH	6.5-8.5	-	7.66	7.64	7.67	7.66	7.57	7.61	7.61	7.67			At field
2 nd Pass RO Concentrate 1 (Outlet)														
A6	- Conductivity (AIT 00GCF11CQ005)	≤ 1890	μS/cm	144.01	146.56	147.47	149.61	153.43	155.72	152.28	147.71			Online
S9	- pH	6.5-8.5	-	7.96	8.07	8.06	8.09	8.06	7.89	7.92	8.03			At field
2 nd Pass RO Concentrate 2 (Outlet)														
A11	- Conductivity (AIT 00GCF12CQ005)	≤ 1890	μS/cm	118.71	124.05	125.58	123.29	126.79	130.16	129.54	129.87			Online
S14	- pH	6.5-8.5	-	7.85	7.85	7.85	7.87	7.83	8.08	8.06	7.94			At field
RO Water Tank (Outlet)														
A12	- Conductivity (AIT 00GCK34CQ001)	< 20	μS/cm	1.21	1.18	1.21	1.21	1.24	1.22	1.19	1.47			Online
CEDI Dilution 1 (Outlet)														
S16	- pH	5.5-7.5	-	7.22	7.41	7.5	7.19	6.93	7.1	6.84	7.26			At field
A13	- Conductivity at 25°C (AIT 00GCF21CQ001)	≤ 0.2	μS/cm	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07			Online
A15	- Silica (as SiO ₂) (AIT 00GCF50CQ001)	≤ 10	ppb	4.27	4.85	4.66	4.09	4.12	4.4	4.3	4.05			Online
CEDI Dilution 2 (Outlet)														
S19	- pH	5.5-7.5	-	7.00	6.53	6.58	7.25	7.22	7.28	7.3	7.22			At field
A14	- Conductivity at 25°C (AIT 00GCF22CQ001)	≤ 0.2	μS/cm	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07			Online
A15	- Silica (as SiO ₂) (AIT 00GCF50CQ001)	≤ 10	ppb	3.88	4.21	4.06	5.01	4.61	3.46	4.11	4.40			Online

Test Date: 15 September 2022

Measured by (HDZ):



Accepted by (Customer): _____

Appendix-D: Measurement of WTP Product Water Flow

Measuring Point	Measuring Item	Design	Units	14 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				15:10	17:10	19:10	21:10	23:10		:	:	
F1	Micro Filtration 1 (Inlet) (FIT 00GBB11CF001)											
	- Flow rate	74	m3/hr	74.54	74.53	74.54	74.56	74.55				
	- Accumulate Flow	Per each Hours	m3	7178	7338	7476	7614	7754				
	- Total Flow	1,472	m3/day (24 hrs)	0	160	298	436	576				
F3	Micro Filtration 2 (Inlet) (FIT 00GBB12CF001)											
	- Flow rate	74	m3/hr	74.43	74.45	74.53	74.49	74.43				
	- Accumulate Flow	Per each Hours	m3	12080	12238	12376	12514	12655				
	- Total Flow	1,472	m3/day (24 hrs)	0	158	296	434	575				
F2	Micro Filtration 1 (Outlet) (FIT 00GBB20CF001)											
	- Flow rate	148	m3/hr	148.17	148.78	148.55	148.84	148.54				
	- Accumulate Flow	Per each Hours	m3	14330	14645	14912	15183	15459				
	- Total Flow	2,884	m3/day (24 hrs)	0	315	582	853	1129				
F4	Micro Filtration 1 (Backwash) (FIT 00GBR30CF001)											
	- Flow rate	35	m3/hr	32.4	33.7	33.6	35.1	35.2				
	- Accumulate Flow	Per each Hours	m3	513	517	522	527	533				
	- Total Flow	96.25	m3/day	0	4	9	14	20				
F5	1st RO Permeate 1 (Outlet) (FIT 00GCF11CF001)											
	- Flow rate	53	m3/hr	54.32	54.21	54.10	54.05	54.2				
	- Accumulate Flow	Per each Hours	m3	6334	6457	6562	6670	6779				
	- Total Flow	1,272	m3/day (24 hrs)	0	123	228	336	445				
F9	1st RO Permeate 2 (Outlet) (FIT 00GCF12CF003)											
	- Flow rate	53	m3/hr	53.88	53.9	53.85	53.81	53.7				
	- Accumulate Flow	Per each Hours	m3	7571	7692	7797	7904	8012				
	- Total Flow	1,272	m3/day (24 hrs)	0	121	226	333	441				

Measuring Point	Measuring Item	Design	Units	14 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				15:10	17:10	19:10	21:10	23:10		:	:	
F6	2nd RO Permeate 1 (Outlet) (FIT 00GCF11CF003)											
	- Flow rate	45	m3/hr	45.91	45.83	45.66	45.8	45.56				
	- Accumulate Flow	Per each Hours	m3	6556	6661	6750	6841	6932				
	- Total Flow	1,080	m3/day (24 hrs)	0	105	194	285	376				
F10	2nd RO Permeate 2 (Outlet) (FIT 00GCF12CF003)											
	- Flow rate	45	m3/hr	45.12	45.31	45.28	45.28	45.17				
	- Accumulate Flow	Per each Hours	m3	6474	6576	6665	6754	6845				
	- Total Flow	1,080	m3/day (24 hrs)	0	102	191	280	371				
F7	1st RO Concentrate 1 (Outlet) (FIT 00GCF11CF002)											
	- Flow rate	17	m3/hr	17.28	17.45	17.38	17.43	17.42				
	- Accumulate Flow	Per each Hours	m3	2585	2625	2658	2693	2728				
	- Total Flow	408	m3/day (24 hrs)	0	40	73	108	143				
F11	1st RO Concentrate 2 (Outlet) (FIT 00GCR12CF002)											
	- Flow rate	17	m3/hr	17.54	17.74	17.72	17.72	17.74				
	- Accumulate Flow	Per each Hours	m3	2526	2566	2601	2636	2672				
	- Total Flow	408	m3/day (24 hrs)	0	40	75	110	146				
F8	2nd RO Concentrate 1 (Outlet) (FIT 00GCF11CF004)											
	- Flow rate	8	m3/hr	8.12	8.29	8.22	8.26	8.22				
	- Accumulate Flow	Per each Hours	m3	1172	1191	1207	1224	1240				
	- Total Flow	192	m3/day (24 hrs)	0	19	35	52	68				
F12	2nd RO Concentrate 2 (Outlet) (FIT 00GCF12CF004)											
	- Flow rate	8	m3/hr	8.5	8.14	8.16	8.1	8.26				
	- Accumulate Flow	Per each Hours	m3	1138	1156	1172	1189	1205				
	- Total Flow	192	m3/day (24 hrs)	0	18	34	51	67				

Measuring Point	Measuring Item	Design	Units	14 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				15:10	17:10	19:10	21:10	23:10		:	:	
F13	CEDI Reject 1 (Inlet) (FIT 00GCF21CF001)											
	- Flow rate	5	m3/hr	5.03	5.06	5.04	5.05	5.04				
	- Accumulate Flow	Per each Hours	m3	783	794	804	814	824				
	- Total Flow	120	m3/day (24 hrs)	0	11	21	31	41				
F15	CEDI Reject 2 (Inlet) (FIT 00GCF22CF001)											
	- Flow rate	5	m3/hr	5.01	5.06	5.06	5.06	5.07				
	- Accumulate Flow	Per each Hours	m3	595	606	615	626	636				
	- Total Flow	120	m3/day (24 hrs)	0	11	20	31	41				
F14	CEDI Product 1 (Outlet) (FIT 00GCF21CF002)											
	- Flow rate	40	m3/hr	40.36	40.34	40.18	40.15	40.27				
	- Accumulate Flow	Per each Hours	m3	6244	6339	6418	6497	6578				
	- Total Flow	960	m3/day (24 hrs)	0	95	174	253	334				
F16	CEDI Product 2 (Outlet) (FIT 00GCF22CF002)											
	- Flow rate	40	m3/hr	40.55	40.43	40.43	40.41	40.36				
	- Accumulate Flow	Per each Hours	m3	4865	4956	5035	5115	5195				
	- Total Flow	960	m3/day (24 hrs)	0	91	170	250	330				

Test Date: 14 September 2022

Measured by (HDZ):



Accepted by (Customer):

Appendix-D: Measurement of WTP Product Water Flow

Measuring Point	Measuring Item	Design	Units	15 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	
F1	Micro Filtration 1 (Inlet) (FIT 00GBB11CF001)											
	- Flow rate	74	m3/hr	74.41	74.54	74.38	74.53	74.14	74.56	74.33	74.48	
	- Accumulate Flow	Per each Hours	m3	7895	8032	8180	8328	8455	8599	8732	8863	
	- Total Flow	1,472	m3/day (24 hrs)	717	854	1002	1150	1277	1421	1554	1685	
F3	Micro Filtration 2 (Inlet) (FIT 00GBB12CF001)											
	- Flow rate	74	m3/hr	74.49	74.5	74.33	74.53	74.17	74.54	74.32	74.39	
	- Accumulate Flow	Per each Hours	m3	12795	12932	13081	13229	13356	13499	13633	13764	
	- Total Flow	1,472	m3/day (24 hrs)	715	852	1001	1149	1276	1419	1553	1684	
F2	Micro Filtration 1 (Outlet) (FIT 00GBB20CF001)											
	- Flow rate	148	m3/hr	148.79	148.81	148.64	148.75	148.36	148.78	148.46	148.82	
	- Accumulate Flow	Per each Hours	m3	15732	16001	16292	16582	16830	17112	17396	17630	
	- Total Flow	2,884	m3/day (24 hrs)	1402	1671	1962	2252	2500	2782	3066	3300	
F4	Micro Filtration 1 (Backwash) (FIT 00GBR30CF001)											
	- Flow rate	35	m3/hr	35.2	35.1	35.3	35.2	35.2	35.2	35.1	35.1	
	- Accumulate Flow	Per each Hours	m3	540	547	556	564	571	578	585	591	
	- Total Flow	96.25	m3/day	27	34	43	51	58	65	72	78	
F5	1st RO Permeate 1 (Outlet) (FIT 00GCF11CF001)											
	- Flow rate	53	m3/hr	53.97	53.93	53.99	53.86	53.97	54.09	54.26	54.09	
	- Accumulate Flow	Per each Hours	m3	6887	6994	7111	7224	7323	7434	7546	7632	
	- Total Flow	1,272	m3/day (24 hrs)	553	660	777	890	989	1100	1212	1298	
F9	1st RO Permeate 2 (Outlet) (FIT 00GCF11CF003)											
	- Flow rate	53	m3/hr	53.59	53.52	53.63	53.74	53.62	53.78	54.04	53.87	
	- Accumulate Flow	Per each Hours	m3	8120	8226	8342	8435	8554	8664	8775	8860	
	- Total Flow	1,272	m3/day (24 hrs)	549	655	771	864	983	1093	1204	1289	

Measuring Point	Measuring Item	Design	Units	15 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	
F6	2nd RO Permeate 1 (Outlet) (FIT 00GCF11CF003)											
	- Flow rate	45	m3/hr	45.51	45.59	45.36	45.50	45.46	45.72	45.81	45.65	
	- Accumulate Flow	Per each Hours	m3	7025	7114	7212	7308	7393	7486	7579	7652	
	- Total Flow	1,080	m3/day (24 hrs)	469	558	656	752	837	930	1023	1096	
F10	2nd RO Permeate 2 (Outlet) (FIT 00GCF12CF003)											
	- Flow rate	45	m3/hr	45.32	45.26	45.16	45.22	45.21	45.55	45.46	45.33	
	- Accumulate Flow	Per each Hours	m3	6937	7025	7123	7218	7301	7394	7487	7559	
	- Total Flow	1,080	m3/day (24 hrs)	463	551	649	744	827	920	1013	1085	
F7	1st RO Concentrate 1 (Outlet) (FIT 00GCF11CF002)											
	- Flow rate	17	m3/hr	17.46	17.47	17.48	17.51	17.48	17.45	17.55	17.4	
	- Accumulate Flow	Per each Hours	m3	2763	2797	2835	2872	2904	2940	2976	3003	
	- Total Flow	408	m3/day (24 hrs)	178	212	250	287	319	355	391	418	
F11	1st RO Concentrate 2 (Outlet) (FIT 00GCR12CF002)											
	- Flow rate	17	m3/hr	17.74	17.75	17.76	17.77	17.75	17.73	17.56	17.66	
	- Accumulate Flow	Per each Hours	m3	2708	2742	2780	2818	2851	2887	2923	2951	
	- Total Flow	408	m3/day (24 hrs)	182	216	254	292	325	361	397	425	
F8	2nd RO Concentrate 1 (Outlet) (FIT 00GCF11CF004)											
	- Flow rate	8	m3/hr	8.25	8.26	8.24	8.22	8.21	8.22	8.05	8.14	
	- Accumulate Flow	Per each Hours	m3	1257	1273	1291	1308	1323	1340	1357	1369	
	- Total Flow	192	m3/day (24 hrs)	85	101	119	136	151	168	185	197	
F12	2nd RO Concentrate 2 (Outlet) (FIT 00GCf12CF004)											
	- Flow rate	8	m3/hr	8.2	8.21	8.09	8.07	8.05	8.03	8.05	8.03	
	- Accumulate Flow	Per each Hours	m3	1221	1237	1255	1272	1287	1304	1321	1332	
	- Total Flow	192	m3/day (24 hrs)	83	99	117	134	149	166	183	194	

Measuring Point	Measuring Item	Design	Units	15 September 2022								Remarks
				01	02	03	04	05	06	07	08	
				01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	
F13	CEDI Reject 1 (Inlet) (FIT 00GCF21CF001)											
	- Flow rate	5	m3/hr	5.08	5.07	5.07	5.07	5.07	5.05	5.09	5.05	
	- Accumulate Flow	Per each Hours	m3	835	844	855	866	875	886	896	904	
	- Total Flow	120	m3/day (24 hrs)	52	61	72	83	92	103	113	121	
F15	CEDI Reject 2 (Inlet) (FIT 00GCF21CF001)											
	- Flow rate	5	m3/hr	5.08	5.09	5.07	5.04	5.07	5.07	5.08	5.07	
	- Accumulate Flow	Per each Hours	m3	646	655	666	677	687	697	707	715	
	- Total Flow	120	m3/day (24 hrs)	51	60	71	82	92	102	112	120	
F14	CEDI Product 1 (Outlet) (FIT 00GCF21CF002)											
	- Flow rate	40	m3/hr	40.35	40.35	40.27	40.23	40.11	40.02	40.06	40.25	
	- Accumulate Flow	Per each Hours	m3	6661	6736	6823	6907	6982	7067	7152	7210	
	- Total Flow	960	m3/day (24 hrs)	417	492	579	663	738	823	908	966	
F16	CEDI Product 2 (Outlet) (FIT 00GCF22CF002)											
	- Flow rate	40	m3/hr	40.32	40.33	40.23	40.25	40.18	40.06	40.11	40.33	
	- Accumulate Flow	Per each Hours	m3	5278	5353	5440	5525	5599	5684	5769	5827	
	- Total Flow	960	m3/day (24 hrs)	413	488	575	660	734	819	904	962	

Test Date: 15 September 2022

Measured by (HDZ):



Accepted by (Customer):

Table E1: Log Sheet for Measurement of Tap Water

14 September 2022		PARAMETERS									
TIME	**pH	**Temperature (Degree Celsius)	*Turbidity (NTU): AIT 00GBA10CQ001	**Electric Conductivity (µS/cm)	***TDS (mg/l)	***Total Hardness (mg/l as CaCO ₃)	***Chloride (mg/l as Cl ⁻)	***M-alkalinity (mg/l as CaCO ₃)	***Silica (mg/l as SiO ₂)	***SS (mg/l)	**Free Chlorines (mg/l.)
15.10	7.24	29.0	0.98	557	336	69	<0.1	75	14.79	2	0.05
17.10	7.19	29.2	0.96	560	280	70	<0.1	80	11.12	2	0.04
19.10	7.29	29.1	0.94	550	308	68	<0.1	70	15.24	2	0.01
21.10	7.15	28.9	1.00	548	286	69	<0.1	75	12.99	2	0.06
23.10	7.19	28.4	0.98	560	344	70	<0.1	70	15.07	2	0.06

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 14 September 2022

HYDROZONE CO.,LTD

Table E2 : Log Sheet for Measurement of MF Unit

[illegible]

*Measure by online Meter
**Measure by Portable Meter
***Take Sampling to Lab

Report By : XXXXXXXXXX
Date : 14 September 2022

HYDROZONE CO.,LTD

Table E3 : Log Sheet for Measurement of RO Unit 1

Measuring Point	Measuring Item	14 September 2022								
		Unit	01	02	03	04	05	06	07	08
			15:10	17:10	19:10	21:10	23:10		:	:
F5	*RO pass1 stage2 Product flow rate (FIT 00GCF11CF001)	m³/hr	54.32	54.21	54.10	54.05	54.2			
F7	*RO pass1 stage2 Brine flow rate (FIT 00GCF11CF002)	m³/hr	17.28	17.45	17.38	17.43	17.42			
F6	*RO pass2 stage2 Product flow rate (FIT 00GCF11CF003)	m³/hr	45.91	45.83	45.66	45.8	45.56			
F8	*RO pass2 stage2 Brine flow rate (FIT 00GCF11CF004)	m³/hr	8.12	8.29	8.22	8.26	8.22			
	1 st Pass Recovery Rate	%	75.8	75.64	75.64	75.6	75.64			
	2 nd Pass Recovery Rate	%	85.17	84.8	84.71	84.67	84.67			
A1	*Feed conductivity (AIT 00GCK30CQ001)	µS/cm	478.87	479.32	482.53	485.96	485.5			
A4	*Product conductivity (AIT 00GCF11CQ003)	µS/cm	1.11	1.03	1.06	1.04	1.05			
	Salt Rejection	%	99.77	99.79	99.78	99.79	99.78			
A3	*RO Pass2 inlet pH (AIT 00GCF11CQ004)		5.75	7.85	8.17	8.06	7.96			
P1	*RO Micro Filter inlet pressure (PI 00GCF11CP501)	bar	1.45	1.45	1.45	1.5	1.5			
P2	*RO Micro Filter outlet pressure (PI 00GCF11CP502)	bar	1.4	1.4	1.4	1.45	1.45			
P3	*RO pass1 stage1 inlet pressure (PIT 00GCF11CP002)	bar	15.08	15.31	15.25	15.3	15.32			
P4	*RO pass1 stage2 inlet pressure (PIT 00GCF11CP503)	bar	13.3	13.5	13.4	13.5	13.5			
P5	*RO pass2 stage1 inlet pressure (PI 00GCF11CP504)	bar	9	9.2	9.2	9.2	9.2			
P6	*RO pass2 stage2 inlet pressure (PI 00GCF11CP506)	bar	7.1	7.3	7.3	7.3	7.3			
S8	***Product pH		6.5	6.6	6.7	6.6	6.5			
S8	***Product Suspended Solid (SS)	mg/l	<1	<1	<1	<1	<1			
S8	***Product Total Dissolved Solid (TDS)	mg/l	<2	<2	<2	<2	<2			
S8	***Product Total Hardness	mg/l as CaCO ₃	<1	<1	<1	<1	<1			
S8	***Product Silica (SiO ₂)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10			

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 14 September 2022

HYDROZONE CO.,LTD

Table E3 : Log Sheet for Measurement of RO Unit 2

Measuring Point	Measuring Item	14 September 2022								
		Unit	01	02	03	04	05	06	07	08
			15:10	17:10	19:10	21:10	23:10		:	:
F9	*RO pass1 stage2 Product flow rate (FIT 00GCF12CF001)	m³/hr	53.88	53.9	53.85	53.81	53.7			
F11	*RO pass1 stage2 Brine flow rate (FIT 00GCF12CF002)	m³/hr	17.54	17.74	17.72	17.72	17.74			
F10	*RO pass2 stage2 Product flow rate (FIT 00GCF12CF003)	m³/hr	45.12	45.31	45.28	45.28	45.17			
F12	*RO pass2 stage2 Brine flow rate (FIT 00GCF12CF004)	m³/hr	8.5	8.14	8.16	8.1	8.26			
	1 st Pass Recovery Rate	%	75.35	75.18	75.18	75.24	75.29			
	2 nd Pass Recovery Rate	%	85.02	84.78	84.85	84.91	84.78			
A1	*Feed conductivity (AIT 00GCK30CQ001)	µS/cm	478.87	479.32	482.53	485.96	485.5			
A9	*Product conductivity (AIT 00GCF12CQ003)	µS/cm	2.6	1.12	1.47	1.39	1.5			
	Salt Rejection	%	99.46	99.76	99.7	99.71	99.69			
A8	*RO pass2 inlet pH (AIT 00GCF12CQ004)		5.39	8.1	8.34	7.9	7.97			
P7	*RO Micro Filter inlet pressure (PI 00GCF12CP501)	bar	1.5	1.5	1.5	1.5	1.55			
P8	*RO Micro Filter outlet pressure (PI 00GCF12CP502)	bar	1.38	1.38	1.38	1.4	1.4			
P9	*RO pass1 stage1 inlet pressure (PIT 00GCF12CP002)	bar	14.8	15.03	14.95	14.96	14.97			
P10	*RO pass1 stage2 inlet pressure (PIT 00GCF12CP503)	bar	13.1	13.3	13.3	13.3	13.3			
P11	*RO pass2 stage1 inlet pressure (PI 00GCF12CP504)	bar	8.4	8.6	8.6	8.6	8.6			
P12	*RO pass2 stage2 inlet pressure (PI 00GCF12CP506)	bar	6.7	6.7	6.7	6.7	6.7			
S13	***Product pH		6.3	6.3	6.4	6.5	6.6			
S13	***Product Suspended Solid (SS)	mg/l	<1	<1	<1	<1	<1			
S13	***Product Total Dissolved Solid (TDS)	mg/l	<2	<2	<2	<2	<2			
S13	***Product Total Hardness	mg/l as CaCO ₃	<1	<1	<1	<1	<1			
S13	***Product Silica (SiO ₂)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10			

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 14 September 2022

HYDROZONE CO.,LTD

Table E4 : Log Sheet for Measurement of CEDI Unit 1

IONPURE ® IP-VNX-MAX-1 CEDI Modules

Measuring Point	Measuring Item	14 September 2022								
		Unit	01	02	03	04	05	06	07	08
			15:10	17:10	19:10	21:10	23:10		:	:
S15	**Feed water temperature	°C	29.7	29.7	29.7	29.7	29.6			
S15	***Feed water total hardness	ppm CaCO ₃	< 1	< 1	< 1	< 1	< 1			
S15	**Feed carbon dioxide	ppm as CO ₂	2.5	2.5	2.5	2.5	2.5			
A12	*Feed conductivity (AIT 00GCK34CQ001)	µS/cm	1.89	1.44	1.05	1.03	1.1			
A15	*Product Silica (AIT 00GCF50CQ001)	ppb	4.33	4.52	4.11	4.06	4.25			
A13	*Product conductivity (AIT 00GCF21CQ001)	µS/cm	0.06	0.07	0.07	0.07	0.07			
I1	*DC voltage of Rectifier 1 (00GCF21GU001)	volts	236.49	232.92	222.8	215.39	209.89			
I2	*DC voltage of Rectifier 2 (00GCF21GU002)	volts	268.81	262.22	249.99	241.53	235.62			
I3	*DC voltage of Rectifier 3 (00GCF21GU003)	volts	234.8	231.64	220.74	212.73	207.33			
I1	*DC current of Rectifier 1 (00GCF21GU001)	amps	3.65	3.65	3.65	3.65	3.65			
I2	*DC current of Rectifier 2 (00GCF21GU002)	amps	3.51	3.5	3.5	3.5	3.51			
I3	*DC current of Rectifier 3 (00GCF21GU003)	amps	3.58	3.58	3.58	3.58	3.58			
	Module resistance of Rectifier 1 (volts/amps)	ohms	64.79	63.81	61.04	59.01	57.5			
	Module resistance of Rectifier 2 (volts/amps)	ohms	76.58	74.92	71.43	69.01	67.13			
	Module resistance of Rectifier 3 (volts/amps)	ohms	65.59	64.7	61.66	59.42	57.91			
F14	*Product flow (FIT 00GCF21CF002)	m ³ /hr	40.36	40.34	40.18	40.15	40.27			
F13	*Reject flow (FIT 00GCF21CF001)	m ³ /hr	5.03	5.06	5.04	5.05	5.04			
P13	*Dilute inlet pressure (PI 00GCF21CP503)	bar	5.8	5.8	5.8	5.8	5.8			
P14	*Dilute outlet pressure (PI 00GCF21CP505)	bar	3.4	3.4	3.4	3.4	3.4			
	Product DP (Dilute _{in} -Dilute _{out})	bar	2.4	2.4	2.4	2.4	2.4			
P15	*Concentrate inlet pressure (PI 00GCF21CP504)	bar	3.9	4.0	4.1	4.1	4.1			
P16	*Concentrate outlet pressure (PI 00GCF21CP506)	bar	3.1	3.15	3.15	3.15	3.15			
	Concentrate DP (Conc. _{in} -Conc. _{out})	bar	0.8	0.85	0.95	0.95	0.95			

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 14 September 2022

HYDROZONE CO.,LTD

Table E4 : Log Sheet for Measurement of CEDI Unit 2

IONPURE ® IP-VNX-MAX-1 CEDI Modules

Measuring Point	Measuring Item	14 September 2022								
		Unit	01	02	03	04	05	06	07	08
			15:10	17:10	19:10	21:10	23:10		:	:
S18	**Feed water temperature	°C	29.7	29.7	29.7	29.6	29.7			
S18	***Feed water total hardness	ppm CaCO ₃	< 1	< 1	< 1	< 1	< 1			
S18	**Feed carbon dioxide	ppm as CO ₂	2.5	2.5	2.5	2.5	2.5			
A12	*Feed conductivity (AIT 00GCK34CQ001)	µS/cm	1.89	1.44	1.05	1.03	1.1			
A15	*Product Silica (AIT 00GCF50CQ001)	ppb	4.05	4.81	4.57	4.56	4.22			
A14	*Product conductivity (AIT 00GCF22CQ001)	µS/cm	0.07	0.08	0.07	0.07	0.07			
I4	*DC voltage of Rectifier 1 (00GCF22GU001)	volts	272.33	268.21	257.41	249.03	243.26			
I5	*DC voltage of Rectifier 2 (00GCF22GU002)	volts	236.72	241.2	232.32	224.54	218.59			
I6	*DC voltage of Rectifier 3 (00GCF22GU003)	volts	215.98	223.08	217.17	210.03	204.72			
I4	*DC current of Rectifier 1 (00GCF22GU001)	amps	3.68	3.67	3.68	3.68	3.68			
I5	*DC current of Rectifier 2 (00GCF22GU002)	amps	3.65	3.64	3.64	3.64	3.65			
I6	*DC current of Rectifier 3 (00GCF22GU003)	amps	3.62	3.62	3.61	3.62	3.62			
	Module resistance of Rectifier 1 (volts/amps)	ohms	74	73.08	69.95	67.67	66.1			
	Module resistance of Rectifier 2 (volts/amps)	ohms	64.85	66.26	63.82	61.69	59.89			
	Module resistance of Rectifier 3 (volts/amps)	ohms	59.66	61.62	60.16	58.01	56.55			
F16	*Product flow (FIT 00GCF22CF002)	m ³ /hr	40.55	40.43	40.43	40.41	40.36			
F15	*Reject flow (FIT 00GCF22CF001)	m ³ /hr	5.01	5.06	5.06	5.06	5.07			
P17	*Dilute inlet pressure (PI 00GCF22CP503)	bar	5.8	5.8	5.8	5.8	5.8			
P18	*Dilute outlet pressure (PI 00GCF22CP505)	bar	3.5	3.5	3.5	3.5	3.5			
	Product DP (Dilute _{in} -Dilute _{out})	bar	2.3	2.3	2.3	2.3	2.3			
P19	*Concentrate inlet pressure (PI 00GCF22CP504)	bar	3.9	4.2	4.2	4.2	4.2			
P20	*Concentrate outlet pressure (PI 00GCF22CP506)	bar	3.15	3.2	3.2	3.2	3.2			
	Concentrate DP (Conc. _{in} -Conc. _{out})	bar	0.75	1.0	1.0	1.0	1.0			

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 14 September 2022

HYDROZONE CO.,LTD

Table E5 : Log Sheet for Measurement of Chemical Consumption[illegible]

Report By : _____

Date : 14 September 2022
HYDROZONE CO.,LTD

Table E1: Log Sheet for Measurement of Tap Water

[illegible]

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 15 September 2022

HYDROZONE CO.,LTD

Table E2 : Log Sheet for Measurement of MF Unit

15 September 2022	Inlet Flow (m³/hr)		MF UNIT 1								MF UNIT 2								MF Outlet
			FEED			PERMEATE				Trans-membrane pressure; TMP (bar)	FEED			PERMEATE				Trans-membrane pressure; TMP (bar)	
	*Pressure (bar) (PIT 00GGBB11CP001)	**Turbidity (NTU)	***TDS (mg/l)	*FLOW (m³/hr) (FIT 00GGBB20CF001)	*Pressure (bar) (PIT 00GGBB11CP002)	**Turbidity (NTU)	***TDS (mg/l)	*Pressure (bar) (PIT 00GGBB12CP001)	**Turbidity (NTU)		***TDS (mg/l)	*FLOW (m³/hr) (FIT 00GGBB20CF001)	*Pressure (bar) (PIT 00GGBB12CP002)	**Turbidity (NTU)	***TDS (mg/l)				
TIME	MF Feed Pump 1	MF Feed Pump 2																	
01.10	74.41	74.49	2.55	1.58	336	148.79	2.00	0.25	348	0.55	2.52	1.63	364	148.79	2.00	0.17	344	0.52	0.10
03.10	74.54	74.5	2.57	1.61	336	148.81	2.00	0.25	328	0.57	2.53	1.63	372	148.81	2.00	0.25	384	0.53	0.11
05.10	74.38	74.33	2.58	1.59	312	148.64	2.00	0.25	332	0.58	2.54	1.61	352	148.64	2.00	0.22	352	0.55	0.12
07.10	74.53	74.53	2.59	1.60	264	148.75	2.00	0.2	256	0.59	2.55	1.60	292	148.75	2.00	0.25	328	0.55	0.10
09.10	74.14	74.17	2.60	1.57	284	148.36	2.00	0.25	256	0.60	2.55	1.61	332	148.36	2.00	0.25	328	0.55	0.11
11.10	74.56	74.54	2.60	1.63	344	148.78	2.00	0.26	272	0.60	2.55	1.63	344	148.78	2.00	0.25	348	0.55	0.11
13.10	74.33	74.32	2.61	1.59	292	148.64	2.00	0.23	272	0.61	2.56	1.59	320	148.46	2.00	0.21	352	0.56	0.12
15.10	74.48	74.39	2.61	1.59	312	148.75	2.00	0.31	276	0.61	2.56	1.63	320	148.75	2.00	0.24	322	0.56	0.10
														</					

*Measure by online Meter
 **Measure by Portable Meter
 ***Take Sampling to Lab

Report By : XXXXXXXXXX
 Date : 15 September 2022

HYDROZONE CO.,LTD

Table E3 : Log Sheet for Measurement of RO Unit 1

Measuring Point	Measuring Item	15 September 2022								
		Unit	01	02	03	04	05	06	07	08
			01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10
F5	*RO pass1 stage2 Product flow rate (FIT 00GCF11CF001)	m ³ /hr	53.97	53.93	53.99	53.86	53.97	54.09	54.26	54.09
F7	*RO pass1 stage2 Brine flow rate (FIT 00GCF11CF002)	m ³ /hr	17.46	17.47	17.48	17.51	17.48	17.45	17.55	17.4
F6	*RO pass2 stage2 Product flow rate (FIT 00GCF11CF003)	m ³ /hr	45.51	45.59	45.36	45.50	45.46	45.72	45.81	45.65
F8	*RO pass2 stage2 Brine flow rate (FIT 00GCF11CF004)	m ³ /hr	8.25	8.26	8.24	8.22	8.21	8.22	8.05	8.14
	1 st Pass Recovery Rate	%	75.56	75.56	75.56	75.55	75.55	75.64	75.86	75.65
	2 nd Pass Recovery Rate	%	84.65	84.7	84.65	84.67	84.86	84.93	85.21	85.01
A1	*Feed conductivity (AIT 00GCK30CQ001)	μS/cm	490.85	494.43	495.35	490.31	488.48	485.96	483.44	484.82
A4	*Product conductivity (AIT 00GCF11CQ003)	μS/cm	1.04	1.01	1.08	1.06	1.03	1.08	1.05	1.12
	Salt Rejection	%	99.79	99.8	99.78	99.78	99.79	99.78	99.78	99.77
A3	*RO Pass2 inlet pH (AIT 00GCF11CQ004)		8.01	8.17	7.84	7.78	7.84	8.12	8.22	7.75
P1	*RO Micro Filter inlet pressure (PI 00GCF11CP501)	bar	1.5	1.55	1.55	1.6	1.6	1.6	1.6	1.7
P2	*RO Micro Filter outlet pressure (PI 00GCF11CP502)	bar	1.45	1.5	1.5	1.5	1.5	1.5	1.5	1.6
P3	*RO pass1 stage1 inlet pressure (PIT 00GCF11CP002)	bar	15.31	15.31	15.32	15.33	15.33	15.28	15.2	15.19
P4	*RO pass1 stage2 inlet pressure (PIT 00GCF11CP503)	bar	13.5	13.5	13.5	13.5	13.5	13.3	13.5	13.5
P5	*RO pass2 stage1 inlet pressure (PI 00GCF11CP504)	bar	9.2	9.25	9.25	9.25	9.25	9.25	9.25	9.25
P6	*RO pass2 stage2 inlet pressure (PI 00GCF11CP506)	bar	7.3	7.4	7.4	7.4	7.4	7.3	7.3	7.2
S8	***Product pH		6.6	6.6	6.6	6.7	6.6	6.6	6.6	6.9
S8	***Product Suspended Solid (SS)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1
S8	***Product Total Dissolved Solid (TDS)	mg/l	<2	<2	<2	<2	<2	<2	<2	<2
S8	***Product Total Hardness	mg/l as CaCO ₃	<1	<1	<1	<1	<1	<1	<1	<1
S8	***Product Silica (SiO ₂)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By

Date : 15 September 2022

HYDROZONE CO.,LTD

Table E3 : Log Sheet for Measurement of RO Unit 2

Measuring Point	Measuring Item	15 September 2022								
		Unit	01	02	03	04	05	06	07	08
			01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10
F9	*RO pass1 stage2 Product flow rate (FIT 00GCF12CF001)	m ³ /hr	53.59	53.52	53.63	53.74	53.62	53.78	54.04	53.87
F11	*RO pass1 stage2 Brine flow rate (FIT 00GCF12CF002)	m ³ /hr	17.74	17.75	17.76	17.77	17.75	17.73	17.56	17.66
F10	*RO pass2 stage2 Product flow rate (FIT 00GCF12CF003)	m ³ /hr	45.32	45.26	45.16	45.22	45.21	45.55	45.46	45.33
F12	*RO pass2 stage2 Brine flow rate (FIT 00GCF12CF004)	m ³ /hr	8.2	8.21	8.09	8.07	8.05	8.03	8.05	8.03
	1 st Pass Recovery Rate	%	75.24	75.23	75.16	75.18	75.23	75.21	75.3	75.64
	2 nd Pass Recovery Rate	%	84.62	84.75	84.61	84.75	84.85	84.95	84.98	84.93
A1	*Feed conductivity (AIT 00GCK30CQ001)	μS/cm	490.85	494.43	495.35	490.31	488.48	485.96	483.44	484.82
A9	*Product conductivity (AIT 00GCF12CQ003)	μS/cm	1.57	1.54	1.51	1.54	1.63	1.57	1.53	1.59
	Salt Rejection	%	99.68	99.69	99.7	99.69	99.67	99.68	99.68	99.67
A8	*RO pass2 inlet pH (AIT 00GCF12CQ004)		8.13	8.03	7.99	7.85	8.08	8.3	8.2	8.06
P7	*RO Micro Filter inlet pressure (PI 00GCF12CP501)	bar	1.55	1.6	1.6	1.6	1.6	1.6	1.6	1.6
P8	*RO Micro Filter outlet pressure (PI 00GCF12CP502)	bar	1.4	1.45	1.5	1.5	1.5	1.5	1.5	1.5
P9	*RO pass1 stage1 inlet pressure (PIT 00GCF12CP002)	bar	15.0	15.02	15.04	15.05	15.05	14.99	14.95	14.92
P10	*RO pass1 stage2 inlet pressure (PIT 00GCF12CP503)	bar	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
P11	*RO pass2 stage1 inlet pressure (PI 00GCF12CP504)	bar	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.5
P12	*RO pass2 stage2 inlet pressure (PI 00GCF12CP506)	bar	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6
S13	***Product pH		6.3	6.3	6.2	6.2	6.2	6.4	6.4	6.4
S13	***Product Suspended Solid (SS)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1
S13	***Product Total Dissolved Solid (TDS)	mg/l	<2	<2	<2	<2	<2	<2	<2	<2
S13	***Product Total Hardness	mg/l as CaCO ₃	<1	<1	<1	<1	<1	<1	<1	<1
S13	***Product Silica (SiO ₂)	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 15 September 2022

HYDROZONE CO.,LTD

Table E4 : Log Sheet for Measurement of CEDI Unit 1**IONPURE ® IP-VNX-MAX-1 CEDI Modules**

Measuring Point	Measuring Item	15 September 2022									
		Unit	01	02	03	04	05	06	07	08	
			01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	
S15	**Feed water temperature	°C	29.7	29.7	29.7	29.6	29.7	29.6	29.7	29.7	
S15	***Feed water total hardness	ppm CaCO ₃	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
S15	**Feed carbon dioxide	ppm as CO ₂	1.25	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
A12	*Feed conductivity (AIT 00GCK34CQ001)	μS/cm	1.21	1.18	1.21	1.21	1.24	1.22	1.19	1.35	
A15	*Product Silica (AIT 00GCF50CQ001)	ppb	4.27	4.85	4.66	4.09	4.12	4.4	4.3	4.05	
A13	*Product conductivity (AIT 00GCF21CQ001)	μS/cm	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
I1	*DC voltage of Rectifier 1 (00GCF21GU001)	volts	205.91	203.35	200.83	199.37	197.17	195.52	193.51	194.42	
I2	*DC voltage of Rectifier 2 (00GCF21GU002)	volts	231.77	228.89	226.37	225.0	222.89	221.25	219.19	220.61	
I3	*DC voltage of Rectifier 3 (00GCF21GU003)	volts	203.39	200.56	198.04	196.25	193.55	191.90	189.8	190.76	
I1	*DC current of Rectifier 1 (00GCF21GU001)	amps	3.66	3.65	3.65	3.65	3.63	3.62	3.61	3.62	
I2	*DC current of Rectifier 2 (00GCF21GU002)	amps	3.51	3.51	3.51	3.5	3.49	3.48	3.48	3.48	
I3	*DC current of Rectifier 3 (00GCF21GU003)	amps	3.59	3.58	3.58	3.58	3.56	3.55	3.55	3.55	
	Module resistance of Rectifier 1 (volts/amps)	ohms	56.26	55.71	55.02	54.62	54.32	54.01	53.6	53.7	
	Module resistance of Rectifier 2 (volts/amps)	ohms	66.03	65.21	64.49	64.29	63.86	63.58	62.99	63.39	
	Module resistance of Rectifier 3 (volts/amps)	ohms	56.65	56.02	55.32	54.82	54.37	54.06	53.46	53.73	
F14	*Product flow (FIT 00GCF21CF002)	m3/hr	40.35	40.35	40.27	40.23	40.11	40.02	40.06	40.25	
F13	*Reject flow (FIT 00GCF21CF001)	m3/hr	5.08	5.07	5.07	5.07	5.07	5.05	5.09	5.05	
P13	*Dilute inlet pressure (PI 00GCF21CP503)	bar	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
P14	*Dilute outlet pressure (PI 00GCF21CP505)	bar	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	
	Product DP (Dilute _{in} -Dilute _{out})	bar	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
P15	*Concentrate inlet pressure (PI 00GCF21CP504)	bar	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
P16	*Concentrate outlet pressure (PI 00GCF21CP506)	bar	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	
	Concentrate DP (Conc _{in} -Conc _{out})	bar	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 15 September 2022

HYDROZONE CO.,LTD

Table E4 : Log Sheet for Measurement of CEDI Unit 2

IONPURE ® IP-VNX-MAX-1 CEDI Modules

Measuring Point	Measuring Item	15 September 2022									
		Unit	01	02	03	04	05	06	07	08	
			01:10	03:10	05:10	07:10	09:10	11:10	13:10	15:10	
S18	**Feed water temperature	°C	29.6	29.6	29.7	29.7	29.7	29.7	29.7	29.6	
S18	***Feed water total hardness	ppm CaCO ₃	<1	<1	<1	<1	<1	<1	<1	<1	
S18	**Feed carbon dioxide	ppm as CO ₂	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
A12	*Feed conductivity (AIT 00GCK34CQ001)	μS/cm	1.21	1.18	1.21	1.21	1.24	1.22	1.19	1.35	
A15	*Product Silica (AIT 00GCF50CQ001)	ppb	3.88	4.21	4.06	5.01	4.61	3.46	4.11	4.62	
A14	*Product conductivity (AIT 00GCF22CQ001)	μS/cm	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
I4	*DC voltage of Rectifier 1 (00GCF22GU001)	volts	238.78	236.35	234.25	232.92	230.72	229.21	226.97	228.39	
I5	*DC voltage of Rectifier 2 (00GCF22GU002)	volts	214.56	211.5	208.7	207.06	205.09	203.07	201.24	201.84	
I6	*DC voltage of Rectifier 3 (00GCF22GU003)	volts	200.78	197.63	195.02	193.0	191.03	189.2	187.19	188.38	
I4	*DC current of Rectifier 1 (00GCF22GU001)	amps	3.69	3.68	3.68	3.68	3.65	3.65	3.65	3.65	
I5	*DC current of Rectifier 2 (00GCF22GU002)	amps	3.66	3.65	3.64	3.64	3.61	3.61	3.6	3.6	
I6	*DC current of Rectifier 3 (00GCF22GU003)	amps	3.63	3.63	3.62	3.62	3.59	3.58	3.58	3.58	
	Module resistance of Rectifier 1 (volts/amps)	ohms	64.71	64.22	63.65	63.29	63.21	62.8	62.18	62.57	
	Module resistance of Rectifier 2 (volts/amps)	ohms	58.62	57.95	57.33	56.88	56.81	56.25	55.9	56.07	
	Module resistance of Rectifier 3 (volts/amps)	ohms	55.31	54.44	53.87	53.31	53.21	52.85	52.29	52.62	
F16	*Product flow (FIT 00GCF22CF002)	m3/hr	40.32	40.33	40.23	40.25	40.18	40.06	40.11	40.33	
F15	*Reject flow (FIT 00GCF22CF001)	m3/hr	5.08	5.09	5.07	5.04	5.07	5.07	5.08	5.07	
P17	*Dilute inlet pressure (PI 00GCF22CP503)	bar	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
P18	*Dilute outlet pressure (PI 00GCF22CP505)	bar	3.55	3.55	3.55	3.55	3.55	3.5	3.5	3.5	
	Product DP (Dilute _{in} -Dilute _{out})	bar	2.25	2.25	2.25	2.25	2.25	2.3	2.3	2.3	
P19	*Concentrate inlet pressure (PI 00GCF22CP504)	bar	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
P20	*Concentrate outlet pressure (PI 00GCF22CP506)	bar	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	
	Concentrate DP (Conc _{in} -Conc _{out})	bar	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	

*Measure by online Meter

**Measure by Portable Meter

***Take Sampling to Lab

Report By :

Date : 15 September 2022

HYDROZONE CO.,LTD

Table E5 : Log Sheet for Measurement of Chemical Consumption[illegible]

Report By : _____

Date : 15 September 2022
HYDROZONE CO.,LTD

ATTACHEMENT -5 :- MEASUREMENT OF KWh DURING WTP PERFORMANCE

			01	02	03	04	05	06	07
			14 Sep. 2022			15 Sep. 2022			
Measuring Point	Measuring Item	Unit	15:10	19:10	23:10	03:10	07:10	11:10	15:10
Incomer of WTP MCC	Digital Meter	kWh	83560.39	84384.79	85203.61	86034.55	86881.52	87721.70	88527.67

CALCULATION

Meter reading during starting of test (kWh)	=	kWh [1]
Meter reading at end of test (kWh)	=	kWh [2]
Energy Consumption	=	KWh ([2] -[1])
Test period	=	24 hrs
Total DM water volume CEDI-1 outlet	=	m3 [3]
Total DM water volume CEDI-2 outlet	=	m3 [4]
Total DM water volume	=	m3 ([3] + [4])
Specific energy consumption	=	kWh/ m3 ([2] -[1]) / ([3] + [4]))



Systronics Company Limited.

19/11-12, Sukhumvit Rd., Nernphra, Muang, Rayong, 21150, Thailand,

Tel. +66(38) 694 145-8, Fax. +66(38) 694 149.

COMPARATIVE OF POWER METER REPORT

Page : 1 of 4

Owner Description

Customer : TPSC (Thailand) Co.,Ltd. ABPIR&2R Project
Address : 15-16 Flr., Room No.1514-15, and 1603 Q House (Asoke Building)
66 Sukhumvit 21 Rd., North Klongtoey, Wattana, Bangkok 10110
Location/Service : -

Inspection Method.

The comparative of power meter were conducted using on-site method comparative procedure according to comparison measurement with Portable Power Quality Analyzer.

Traceability Information.

The measurement is traceable to the National Institute of Metrology (Thailand), NIMT.

Objective Information.

- To check and assign the correct value to the power meter that provides true measurement results.
- To check the accuracy of the power meter that has already been installed.

Inspection Procedure.

- Visual check on the first course of power meter.
- Check the meter configuration and the peripherals to have the same value between portable and power meter.
- Use Portable to measure at checkpoint. The same checkpoint is that the current and the voltage must be in the same position or as close as possible to each other.
- When the Portable measurement stable recording Value Voltage, Current and other Value are set parameter.
- Take a photo display Portable and Power meter
- Repeat from beginning for all other power meter.
- Summary of measurement results.



COMPARATIVE OF POWER METER REPORT

Email : info@systronics.co.th

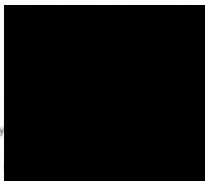
Page : 2 of 4

Results Comparative of Power meter

Item	Power meter No.	Manufacture	Serial No.	Service / Location	Status
1	00JBF10CB001	LOVATO	60201827	-	Pass

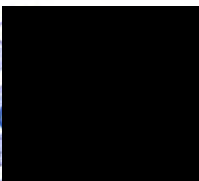
Recommendation : -

Inspection By



Systronics

Approved by



Systronics

Witness By :

()

Customer



Customer Name :	TPSC (Thailand) Co.,Ltd. ABP1R&2R Project	Report No. :	EO220044
Address :	15-16 Flr., Room No.1514-15, and 1603 Q House (Asoke Building)	Job No. :	22080156
	66 Sukhumvit 21 Rd., North Klongtoey, Wattana, Bangkok 10110	Tag No. :	00JBF10CB001
Instrument Type :	Power meter	Service/Location :	-
Manufacture :	LOVATO	Inspection Date :	02 Sep 2022
Model :	DMG 800	Issue Date :	03 Sep 2022
Serial No. :	60201827		

Portable Power Meter Used Information

Instrument Name	Model	Serial No.	Certificate No.	Due Date
Power Quality Analyzer	435	31933104	EIU221414	28 Apr 2022

Power meter and Portable.



(L - L)



(L - N)

Handwritten signature



COMPARATIVE OF POWER METER REPORT

Email : info@systronics.co.th

Page : 4 of 4

Customer Name :	TPSC (Thailand) Co.,Ltd. ABP1R&2R Project	Report No. :	EO220044
Address :	15-16 Flr., Room No.1514-15, and 1603 Q House (Asoke Building) 66 Sukhumvit 21 Rd., North Klongtoey, Wattana, Bangkok 10110	Job No. :	22080156
		Tag No. :	00JBF10CB001
Instrument Type :	Power meter	Service/Location :	-
Manufacture :	LOVATO	Inspection Date :	02 Sep 2022
Model :	DMG 800	Issue Date :	03 Sep 2022
Serial No. :	60201827		

Portable Power Meter Used Information

Instrument Name	Model	Serial No.	Certificate No.	Due Date
Power Quality Analyzer	435	31933104	EIU221414	28 Apr 2022

Description

Voltage system : ☐ 3P 3W ☒ 3P 4W ☐ Other
Current system : ☐ Direct to meter ☒ With Used CT
Voltage : ☒ 400 / 230V ☐ 182 / 105V ☐ Other
CT Value : - VT Value : -

Test Results Comparative of Power meter

Item	Parameter	Unit	Power meter (1)	Portable (2)	Error (3) (1) - (2)	%Error (3) / (2) * 100	Status Pass / Fail
1	Voltage L1-N	V	221.7	221.57	0	0.059	Pass
2	Voltage L2-N	V	221.2	221.04	0	0.072	Pass
3	Voltage L3-N	V	221.3	221.15	0	0.068	Pass
4	Voltage L1-L2	V	383.2	383.25	0	-0.013	Pass
5	Voltage L2-L3	V	382.8	382.93	0	-0.034	Pass
6	Voltage L1-L3	V	383.5	383.48	0	0.005	Pass
7	Current L1	A	30.9	31.0	-0.1	-0.290	Pass
8	Current L2	A	28.4	28.6	-0.2	-0.559	Pass
9	Current L3	A	47.8	47.7	0.1	0.294	Pass
10	Power Factor L1	-	0.712	0.71	0.002	0.282	Pass
11	Power Factor L2	-	0.673	0.67	0.003	0.448	Pass
12	Power Factor L3	-	0.785	0.78	0.005	0.641	Pass
13	Σ Power Factor	-	0.730	0.73	0.000	0.000	Pass
14	Active Power L1	kW	12.40	12.37	0	0.243	Pass
15	Active Power L2	kW	11.30	11.29	0	0.089	Pass
16	Active Power L3	kW	15.43	15.41	0	0.130	Pass
17	Σ Active Power	kW	39.13	39.07	0	0.154	Pass
18	kWh (Begin)	kWh	69374.00	0.000	-	-	-
19	kWh (Final)	kWh	69375.27	1.267	-	-	-
20	kWh (Final - Begin)	kWh	1.27	1.267	0.00	0.237	Pass

Recommendation : -

Signature



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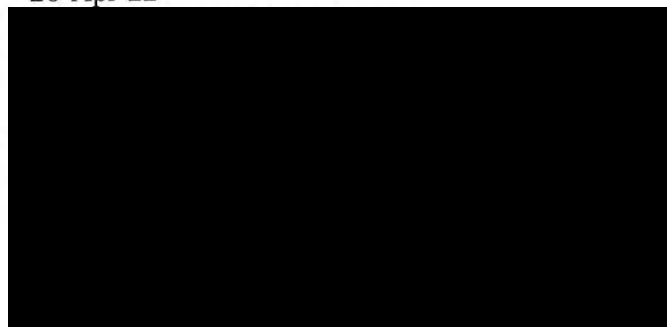
Certificate of Calibration

Customer : Systronic Co., Ltd.
19/11-12, Sukhumwit Road, Nernphra,
Muang, Rayong, 21150

Description of Equipment : Power Quality and Energy Analyzer
Model Number : 435-II
Manufacturer : Fluke
Serial Number : 31933104
Control Number : ---
Receipt Date : 01-Apr-22
Calibration Date : 28-Apr-22
Work Order Number : E1U221414
Certificate No. : E1U221414
Page Number : 1 of 5

We certify that the above mentioned measuring instrument was calibrated in accordance with our quality control system as the ISO/IEC 17025 : 2017 and all the standard equipments used for calibration were traceable to the International of System Units (SI Units) maintained at the National Institute of Metrology (NIMT), Thailand and/or other associated foreign national standards.

Issued Date : 28-Apr-22
Calibrated by :
Checked by :
Approved by :



Approved Signatory

The uncertainties are for a confidence probability of approximately 95%

FEZ-0014-G-Form-06/V4/01/07/21

This certificate is issued in accordance with the conditions of accreditation by the ANSI National Accreditation Board (ANAB), which has assessed the management system of the laboratory and its traceability to recognized national standards and to the units of measurement realised at corresponding national standards laboratory. This certificate may not be reproduced other than in full except with prior written approval from the laboratory manager.



Calibration Report

Certificate No.: E1U221414

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Environment Conditions

Ambient Temperature : $(23 \pm 3) ^\circ\text{C}$
Ambient Relative Humidity : $(55 \pm 15) \% \text{rh}$
Calibration Place : Permanent Calibration Laboratory

Standard Equipment Used

Equip. No.	Equipment Name	Maker & Model	Serial No.	Cert. No.	Due Date
SE-04174	Multi-Product Calibrator	Fluke 5520A+SC600	7395202	E1U214820	05-Dec-22

Traceability

This certificate is traceable to the International System of Unit (SI Unit) maintained at;

- National Institute of Metrology (NIMT), Thailand for ac voltage standards (0.22mV to 1100V, 10Hz to 30MHz).
- National Institute of Metrology (NIMT), Thailand for dc voltage standards (0 to 1100V).

Uncertainty of Measurement

The uncertainty of measurement evaluation has been carried out by using the methodology in the "Expression of Uncertainty and Confidence in Measurement" (M3003). These uncertainties are based on a standard uncertainty multiplied by a coverage factor, $k = 2$ corresponds to a coverage probability of approximately 95%.

Calibration Method

The Unit Under Calibration (UUC) has been calibrated in accordance with the calibration test specification no. E-ACV-M-0002-GE and E-DCV-M-0002-GE by direct measurement against Multi-Product Calibrator.

Calibration Results

The following results were the measurement results applied on the calibrated item and found accurate as show on date and place of calibration only. The results in "**As Found**" column are the measurement recorded before any adjustment or repair. The results in "**As Left**" are the equipment reading taken after the necessary repairs and adjustments. In case the equipment does not be adjusted or repaired, the column of "**As Left**" would be reported wording "**Same**".

Appearance and Function of Use Inspection :

Good



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Current Inputs Measurement Accuracy

UUC Input	Standard Applied	Test Frequency	Equivalent Value	UUC Reading		UUC Error		Tolerance (±)	Uncertainty (±)	Judgment
				As Found	As Left	As Found	As Left			
Range : 1000A, x1 (Ratio 1mV : 1A)										
A / L1	0 V	0 Hz	0 A	1 A	Same	1 A	Same	-0, +5 A	1 A	Pass
	1 V	60 Hz	1000 A	1000 A	Same	0 A	Same	10 A	1 A	Pass
B / L2	0 V	0 Hz	0 A	1 A	Same	1 A	Same	-0, +5 A	1 A	Pass
	1 V	60 Hz	1000 A	1000 A	Same	0 A	Same	10 A	1 A	Pass
C / L3	0 V	0 Hz	0 A	1 A	Same	1 A	Same	-0, +5 A	1 A	Pass
	1 V	60 Hz	1000 A	1000 A	Same	0 A	Same	10 A	1 A	Pass
N	0 V	0 Hz	0 A	1 A	Same	1 A	Same	-0, +5 A	1 A	Pass
	1 V	60 Hz	1000 A	1000 A	Same	0 A	Same	10 A	1 A	Pass

Bandwidth Check of Current Accuracy

UUC Input	Standard Applied	Test Frequency	Equivalent Value	UUC Reading		UUC Error		Tolerance	Uncertainty (±)	Judgment
				As Found	As Left	As Found	As Left			
Range : 100A, x10 AC only (Ratio 1mV : 1A)										
A / L1	100 mV	3 kHz	100.0 A	99.3 A	Same	n/a	Same	≥94.5 A	0.1 A	Pass
B / L2	100 mV	3 kHz	100.0 A	99.3 A	Same	n/a	Same	≥94.5 A	0.1 A	Pass
C / L3	100 mV	3 kHz	100.0 A	99.3 A	Same	n/a	Same	≥94.5 A	0.1 A	Pass
N	100 mV	3 kHz	100.0 A	99.3 A	Same	n/a	Same	≥94.5 A	0.1 A	Pass
Range : 1000A, x1 AC+DC (Ratio 1mV : 1A)										
A / L1	1 V	3 kHz	1000 A	994 A	Same	n/a	Same	≥945 A	1 A	Pass
B / L2	1 V	3 kHz	1000 A	994 A	Same	n/a	Same	≥945 A	1 A	Pass
C / L3	1 V	3 kHz	1000 A	994 A	Same	n/a	Same	≥945 A	1 A	Pass
N	1 V	3 kHz	1000 A	994 A	Same	n/a	Same	≥945 A	1 A	Pass

Voltage Inputs Measurement Accuracy

Checking the A/L1, B/L2, C/L3 Inputs

Pass

Checking the N Input

Pass

UUC Input	Standard Applied	Test Frequency	UUC Reading		UUC Error		Tolerance (±)	Uncertainty (±)	Judgment
			As Found	As Left	As Found	As Left			
Range : 120 V									
A / L1	60 V	60 Hz	59.99 V	Same	-0.01 V	Same	0.12 V	0.02 V	Pass
	120 V	60 Hz	119.98 V	Same	-0.02 V	Same	0.12 V	0.03 V	Pass
	120 V	3 kHz	118.70 V	Same	n/a	Same	≥114 V	0.03 V	Pass
	240 V	60 Hz	239.96 V	Same	-0.04 V	Same	0.12 V	0.05 V	Pass
B / L2	60 V	60 Hz	59.99 V	Same	-0.01 V	Same	0.12 V	0.02 V	Pass
	120 V	60 Hz	119.99 V	Same	-0.01 V	Same	0.12 V	0.03 V	Pass
	120 V	3 kHz	118.55 V	Same	n/a	Same	≥114 V	0.03 V	Pass
	240 V	60 Hz	239.97 V	Same	-0.03 V	Same	0.12 V	0.05 V	Pass
C / L3	60 V	60 Hz	59.99 V	Same	-0.01 V	Same	0.12 V	0.02 V	Pass
	120 V	60 Hz	119.98 V	Same	-0.02 V	Same	0.12 V	0.03 V	Pass
	120 V	3 kHz	118.58 V	Same	n/a	Same	≥114 V	0.03 V	Pass
	240 V	60 Hz	239.96 V	Same	-0.04 V	Same	0.12 V	0.05 V	Pass
N	60 V	60 Hz	60.00 V	Same	0.00 V	Same	0.12 V	0.02 V	Pass
	120 V	60 Hz	119.99 V	Same	-0.01 V	Same	0.12 V	0.03 V	Pass
	120 V	3 kHz	118.65 V	Same	n/a	Same	≥114 V	0.03 V	Pass
	240 V	60 Hz	239.96 V	Same	-0.04 V	Same	0.12 V	0.05 V	Pass



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Calibration Report

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Voltage Inputs Measurement Accuracy

UUC Input	Standard Applied	Test Frequency	UUC Reading		UUC Error		Tolerance (±)	Uncertainty (±)	Judgment
			As Found	As Left	As Found	As Left			
Range : 230 V									
A / L1	115 V	50 Hz	114.94 V	Same	-0.06 V	Same	0.23 V	0.03 V	Pass
	230 V	50 Hz	229.89 V	Same	-0.11 V	Same	0.23 V	0.04 V	Pass
	215 V	3 kHz	212.97 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	460 V	50 Hz	459.90 V	Same	-0.10 V	Same	0.23 V	0.12 V	Pass
B / L2	115 V	50 Hz	114.94 V	Same	-0.06 V	Same	0.23 V	0.03 V	Pass
	230 V	50 Hz	229.89 V	Same	-0.11 V	Same	0.23 V	0.04 V	Pass
	215 V	3 kHz	212.65 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	460 V	50 Hz	459.91 V	Same	-0.09 V	Same	0.23 V	0.12 V	Pass
C / L3	115 V	50 Hz	114.94 V	Same	-0.06 V	Same	0.23 V	0.03 V	Pass
	230 V	50 Hz	229.90 V	Same	-0.10 V	Same	0.23 V	0.04 V	Pass
	215 V	3 kHz	212.70 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	460 V	50 Hz	459.91 V	Same	-0.09 V	Same	0.23 V	0.12 V	Pass
N	115 V	50 Hz	114.97 V	Same	-0.03 V	Same	0.23 V	0.03 V	Pass
	230 V	50 Hz	229.91 V	Same	-0.09 V	Same	0.23 V	0.04 V	Pass
	215 V	3 kHz	212.95 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	460 V	50 Hz	459.91 V	Same	-0.09 V	Same	0.23 V	0.12 V	Pass
Range : 400 V									
A / L1	200 V	50 Hz	199.91 V	Same	-0.09 V	Same	0.40 V	0.04 V	Pass
	400 V	50 Hz	399.79 V	Same	-0.21 V	Same	0.40 V	0.11 V	Pass
	215 V	3 kHz	212.03 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	800 V	50 Hz	799.92 V	Same	-0.08 V	Same	0.80 V	0.21 V	Pass
B / L2	200 V	50 Hz	199.94 V	Same	-0.06 V	Same	0.40 V	0.04 V	Pass
	400 V	50 Hz	399.81 V	Same	-0.19 V	Same	0.40 V	0.11 V	Pass
	215 V	3 kHz	211.84 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	800 V	50 Hz	799.68 V	Same	-0.32 V	Same	0.80 V	0.21 V	Pass
C / L3	200 V	50 Hz	199.92 V	Same	-0.08 V	Same	0.40 V	0.04 V	Pass
	400 V	50 Hz	399.81 V	Same	-0.19 V	Same	0.40 V	0.11 V	Pass
	215 V	3 kHz	211.84 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	800 V	50 Hz	799.66 V	Same	-0.34 V	Same	0.80 V	0.21 V	Pass
N	200 V	50 Hz	199.92 V	Same	-0.08 V	Same	0.40 V	0.04 V	Pass
	400 V	50 Hz	399.81 V	Same	-0.19 V	Same	0.40 V	0.11 V	Pass
	215 V	3 kHz	212.26 V	Same	n/a	Same	≥204.25 V	0.05 V	Pass
	800 V	50 Hz	799.75 V	Same	-0.25 V	Same	0.80 V	0.21 V	Pass
Range : 6 kV (Transients)									
A / L1	400 V	50 Hz	399.7 V	Same	-0.3 V	Same	10.0 V	0.2 V	Pass
	1000 V	50 Hz	999.6 V	Same	-0.4 V	Same	10.0 V	0.3 V	Pass
	215 V	3 kHz	210.5 V	Same	n/a	Same	≥204.2 V	0.1 V	Pass
B / L2	400 V	50 Hz	399.8 V	Same	-0.2 V	Same	10.0 V	0.2 V	Pass
	1000 V	50 Hz	999.6 V	Same	-0.4 V	Same	10.0 V	0.3 V	Pass
	215 V	3 kHz	210.2 V	Same	n/a	Same	≥204.2 V	0.1 V	Pass
C / L3	400 V	50 Hz	399.8 V	Same	-0.2 V	Same	10.0 V	0.2 V	Pass
	1000 V	50 Hz	999.6 V	Same	-0.4 V	Same	10.0 V	0.3 V	Pass
	215 V	3 kHz	210.2 V	Same	n/a	Same	≥204.2 V	0.1 V	Pass
N	400 V	50 Hz	399.8 V	Same	-0.2 V	Same	10.0 V	0.2 V	Pass
	1000 V	50 Hz	999.5 V	Same	-0.5 V	Same	10.0 V	0.3 V	Pass
	215 V	3 kHz	210.9 V	Same	n/a	Same	≥204.2 V	0.1 V	Pass

Notes:

- 1) Tolerances or specifications report in table above are based on the Performance Tests of Fluke 434-II / 435-II / 437-II, Three Phase Energy and Power Quality Analyzer, Service Manual, PN 4822 872 05408, Febr. 2013.
- 2) Statements of conformity (Judgment) are based on the decision rule described in the last page in this certificate.



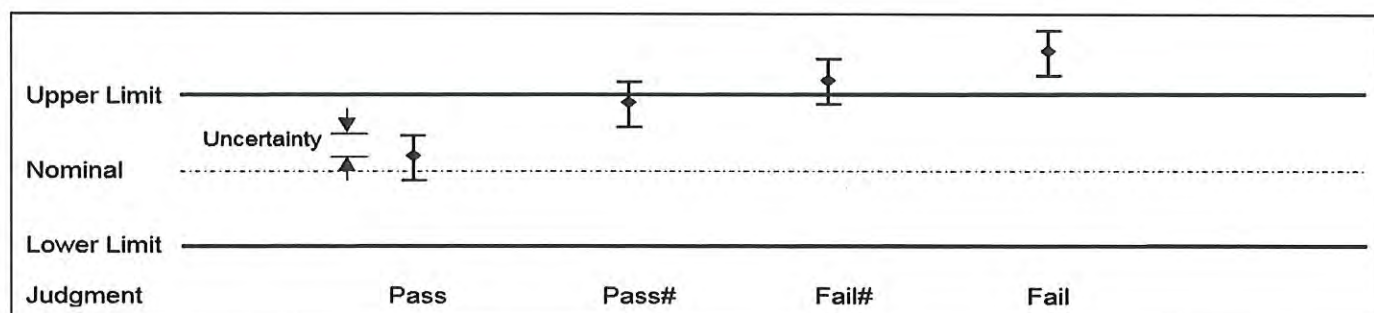
Calibration Report

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Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result in this certificate is applied by using ILAC-G8:03/2009; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements when the measurement uncertainty is taken into account.



- Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the specification limit. Then conformity with the specification is stated.
- Pass# = The measurement result was within the specification limit, but a portion of the expanded uncertainty with a 95% coverage probability was overlapped the specification limit. It is not possible to state conformity using the 95% coverage probability for the expanded uncertainty although the measurement result was below the limit.
- Fail# = The measurement result was out of the specification limit, but a portion of the expanded uncertainty with a 95% coverage probability was in the specification. It is not possible to state non-conformity using the 95% coverage probability for the expanded uncertainty although the measurement result was out of the limit.
- Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the specification limit. Then non-conformity with the specification is stated.

The measurement results and the statements of conformity with specification only relate to the item calibrated.

When functional verification tests and other inspection without measurement uncertainty are performed, the reported results do not affect these statements of conformity.

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