INSTRUMECH COMPANY LIMITED
Head Office : 2/44 Sukhapiban 2 Rd., Pravet, Pravet, Bangkok 10250 Thailand
Tel. : +66(0)2 329 1812-13, Fax. : +66(0)2 328 7690
สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 15-3-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☐ งานเชื่อม/ตัด (Hot Work)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งานเจาะเข็ม

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	Supervisor	[redacted]
2		F/M	
3		T/C	
4		Worker	
5		Diver	
6		Welder	
7.		Fitter	
8.		PE	
9.		CM	
10.		T/C	
11		F/M	
12		Worker	
13		Fitter	

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SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 29-3-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☑ งานเชื่อม/ตัด (Hot Work)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งานถอดถัง Sheet pile

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	F/M	[redacted]
2		Worker	
3		Fitter	
4		PE	
5		CM	
6		T/C	
7.		T/C	
8.		Worker	
9.		Diver	
10.		Welder	
11		Supervisor	
12		F/M	
13		Fitter	

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SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 7-4-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☑ งานเชื่อม/ตัด (Hot Work)
- ☑ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งานติดตั้ง Bracing

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	PE	[redacted]
2		CM	
3		T/C	
4		T/C	
5		Worker	
6		Diver	
7.		Welder	
8.		F/M	
9.		Supervisor	
10.		F/M	
11		Worker	
12		Fitter	
13		Fitter	

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สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 23-04-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☑ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☑ งานเชื่อม/ตัด (Hot Work)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งานประกอบท่อ

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	T/C	[redacted]
2		Worker	
3		Diver	
4		Welder	
5		F/M	
6		Fitter	
7.		F/M	
8.		Worker	
9.		Fitter	
10.		Supervisor	
11		PE	
12		CM	
13		T/C	

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สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 8-3-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☐ งานเชื่อม/ตัด (Hot Work)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งาน Hydro test.

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	Supervisor	[redacted]
2		F/M	
3		PE	
4		CM	
5		T/C	
6		T/C	
7.		Worker	
8.		Diver	
9.		Welder	
10.		F/M	
11		Worker	
12		Fitter	
13		Fitter	

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สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 29-3-2026 เวลา (Time): 08:00 - 17:00

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☑ งานยก (Lifting)
- ☐ งานที่สูง (Working at Height)
- ☐ งานเชื่อม/ตัด (Hot Work)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ PPE
- ☑ อื่นๆ (Other): งานติดตั้ง Valve

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	F/M	[redacted]
2		Worker	
3		Fitter	
4		Supervisor	
5		F/M	
6		T/C	
7.		Worker	
8.		Diver	
9.		Welder	
10.		PE	
11		CM	
12		T/C	
13		Fitter	

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สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 21/6/69 เวลา (Time): 08.00 - 17.00 น.

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานที่สูง (Working at Height)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ อื่นๆ (Other): อ.ก./การคืนพื้นที่
- ☐ งานยก (Lifting)
- ☑ งานเชื่อม/ตัด (Hot Work)
- ☑ PPE

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	ช่าง	[redacted]
2		ช่าง	
3		ช่าง	
4		ช่าง	
5		ช่าง	
6		ช่าง	
7		ช่าง	
8		คนขับ	

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สำนักงานใหญ่ : บริษัท อินสทรูเม็ค จำกัด เลขที่ 2/44 ถนนสุขาภิบาล 2 แขวงประเวศ เขตประเวศ กรุงเทพมหานคร 10250 เลขประจำตัวผู้เสียภาษี 0105556083044

SAFETY TOOLBOX TALK FORM

โครงการ (Project) : WNMR Onshore 4 & 5PL Connection

วันที่ (Date): 17/6/69 เวลา (Time): 08.00 - 17.00 น.

ผู้บรรยาย (Speaker/Supervisor): [redacted]

หัวข้อการพูดคุย (Topic)

- ☐ งานขุด (Excavation)
- ☐ งานที่สูง (Working at Height)
- ☐ งานไฟฟ้า (Electrical Work)
- ☑ อื่นๆ (Other): อ.ก./การคืนพื้นที่
- ☐ งานยก (Lifting)
- ☑ งานเชื่อม/ตัด (Hot Work)
- ☑ PPE

รายชื่อผู้เข้าร่วม (Attendees)

ลำดับ	ชื่อ-นามสกุล	ตำแหน่ง	ลายเซ็น
1	[redacted]	ช่าง	[redacted]
2		ช่าง	
3		ช่าง	
4		ช่าง	
5		คนขับ	
6		ช่าง	
7		ช่าง	
8		ช่าง	
9		คนขับ	

บริษัท ปตท. จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

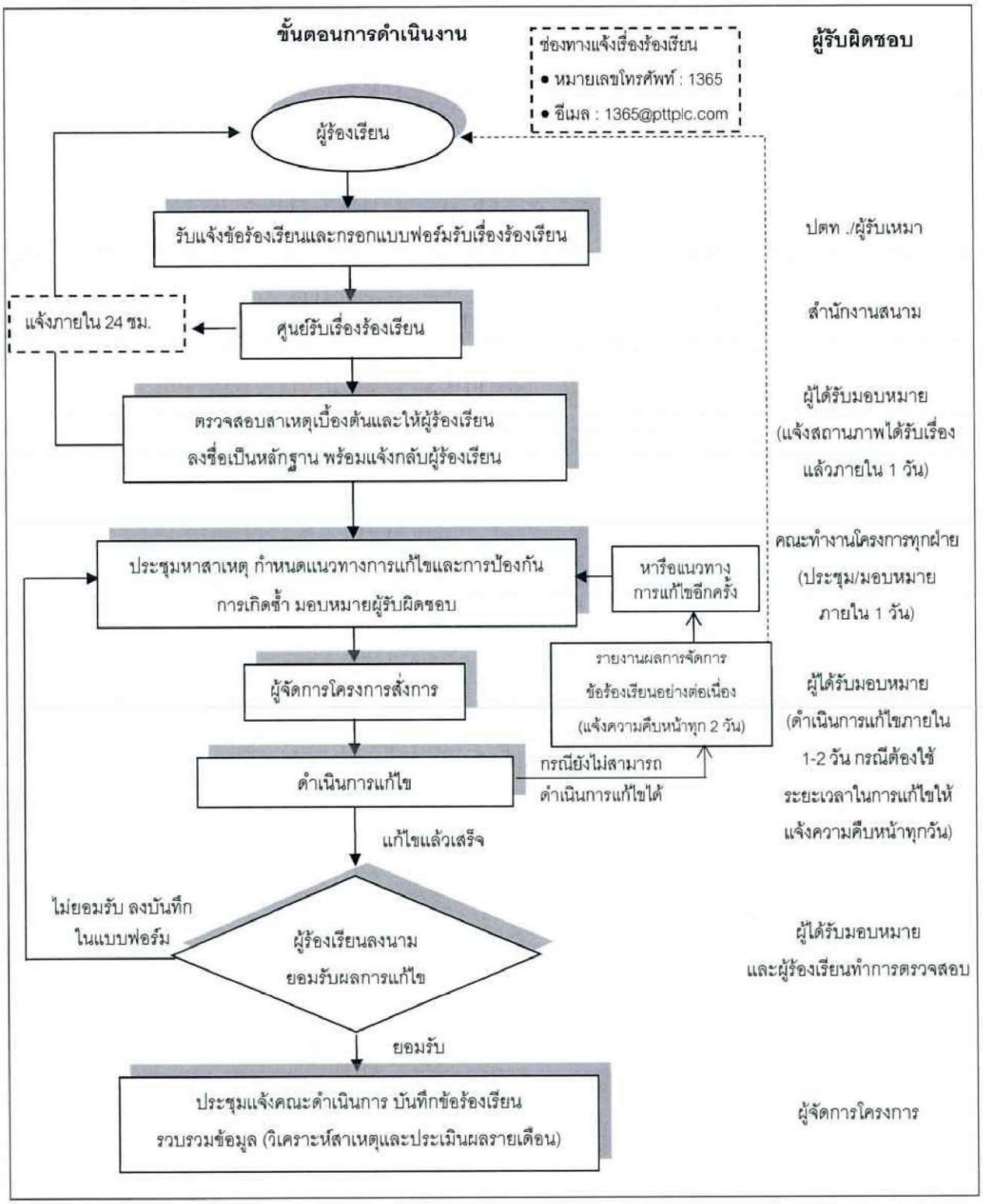
โครงการท่อส่งก๊าซธรรมชาติไปยัง สถานีควบคุมความดันและวัดปริมาณก๊าซวังน้อย

ระหว่างเดือนมกราคมถึงเดือนมิถุนายน พ.ศ. 2569 (ปิดงานระยะก่อสร้าง)

ภาคผนวก 2-6

เอกสารระเบียบขั้นตอนการจัดการข้อร้องเรียน

ผู้จัดทำรายงาน
บริษัท เอ็นทิค จำกัด



แผนผังการจัดการข้อร้องเรียน ในระยะก่อสร้างโครงการ

เลขที่ ❑❑

❑❑–❑❑❑/❑❑

แบบฟอร์มข้อร้องเรียน

พื้นที่โครงการ ช่วง KP.....**ถึง KP**.....**วันที่**.....
อยู่ในพื้นที่หมู่บ้าน.....**ตำบล**.....**อำเภอ**.....**จังหวัด**.....

ข้อมูลผู้ร้องเรียน
ชื่อ-นามสกุล นาย/นาง/นางสาว.....
อาชีพ.....
ที่อยู่.....
โทรศัพท์ บ้าน..... **มือถือ**.....

ข้อร้องเรียน/ข้อเสนอแนะ **ข้อเสนอแนะและแนวทางการแก้ไข**
รายละเอียด..... .....
....
..... **ลงชื่อ**.....
ลงชื่อผู้ร้องเรียนเมื่อไปดูพื้นที่ร่วมกับเจ้าหน้าที่** **ผู้ร้องเรียน

สำหรับเจ้าหน้าที่
สิ่งที่พบหรือเหตุการณ์ที่พบ.....
.....
.....
.....

สาเหตุเบื้องต้น
- ❑ ความบกพร่องในการปฏิบัติงานโครงการฯ ของผู้รับเหมา
- ❑ ความล่าช้าในการดำเนินงาน
- ❑ ความเหมาะสมในการปฏิบัติงาน
- ❑ ความไม่เรียบร้อยของงานที่ปฏิบัติแล้วเสร็จ ❑ อื่น ๆ ระบุ.....

ประเภทของข้อร้องเรียน
- ❑ ด้านก่อสร้าง ❑ ความปลอดภัยและสุขภาพอนามัย
- ❑ ด้านสิ่งแวดล้อม ❑ อื่น ๆ ระบุ.....

ลงชื่อ.....
ผู้รับข้อร้องเรียน
...../...../.....

ตัวอย่างแบบฟอร์มข้อร้องเรียน ในระยะก่อสร้าง และระยะดำเนินการ

ประชุมหาสาเหตุและแนวทางการแก้ไข/ป้องกัน

สาเหตุ.....

.....

.....

แนวทางการป้องกันแก้ไข

.....

.....

.....

หมายเหตุ : แนบเอกสารการประชุม (ถ้ามี)

ความเห็น/คำสั่งการ

.....

.....

.....

ลงชื่อ.....

หน.กส. / ผจ. ส่วน

...../...../.....

ผลการแก้ไข

.....

.....

.....

ลงชื่อ.....

ผู้ดำเนินการแก้ไข

...../...../.....

ข้อร้องเรียน ได้รับการแก้ไขเรียบร้อยแล้ว **ลงชื่อ**..... **ผู้ตรวจสอบ** ..... **รับบันทึกและลงบันทึกข้อร้องเรียน**	**ลงชื่อ**..... **ผู้ร้องเรียน** ..... **ลงชื่อ**..... **หน.กส. / ผจ. ส่วน**

ตัวอย่างแบบฟอร์มข้อร้องเรียนในระยะก่อสร้าง และระยะดำเนินการ (ต่อ)

บริษัท ปตท. จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

โครงการท่อส่งก๊าซธรรมชาติไปยัง สถานีควบคุมความดันและวัดปริมาณก๊าซวังน้อย

ระหว่างเดือนมกราคมถึงเดือนมิถุนายน พ.ศ. 2569 (ปิดงานระยะก่อสร้าง)

ภาคผนวก 2-7

หนังสือแต่งตั้ง จป. ประจำโครงการ/
ประกาศนียบัตรเจ้าหน้าที่ความปลอดภัยในการทำงาน

ผู้จัดทำรายงาน
บริษัท เอ็นทิค จำกัด

บริษัท เอ็นทิค จำกัด 3/4 ถนนประเสริฐมนูกิจ แขวงคลองกุ่ม เขตบึงกุ่ม กรุงเทพมหานคร 10240 โทรศัพท์ : 0 2379 0141-2 www.enticcompany.com

ลำดับ	ชื่อ-สกุล จป. เลขบัตรประจำตัว	ประเภท จป.	คุณสมบัติ การขึ้นทะเบียน	เลขทะเบียน จป.	วันที่แต่งตั้ง	วันที่ยกเลิก	ชื่อสถานประกอบกิจการ	ที่ตั้ง	ประเภทอุตสาหกรรม
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บริษัท ปตท. จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

โครงการท่อส่งก๊าซธรรมชาติไปยัง สถานีควบคุมความดันและวัดปริมาณก๊าซวังน้อย

ระหว่างเดือนมกราคมถึงเดือนมิถุนายน พ.ศ. 2569 (ปิดงานระยะก่อสร้าง)

ภาคผนวก 2-8

ตัวอย่างเอกสารระเบียบขั้นตอนการปฏิบัติงาน (Procedure)

ผู้จัดทำรายงาน
บริษัท เอ็นทิค จำกัด

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	METHOD STATEMENT FOR SOIL COMPACTION FOR STATION	
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1.0 PURPOSE

The purpose of this procedure is to describe the activities and methods used in performing right of way cleaning and re-instatement for the Construction of WNMR Onshore 4 & 5PL Connection Project. The latest revision of the project specifications shall be used as references and is part of this Method Statement in the execution of work.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 DEFINITIONS

PTT	means	PTT Public Company Limited
Project	means	WNMR Onshore 4 & 5PL Connection Project
Contractor	means	Instrumech Company Limited.
AFC	means	Approved for Construction
SH&E	means	Safety, Health and Environment
Subcontractor	means	The party to which Contractor has sub-contracted a portion of the Work under the Contract

4.0 RESPONSIBILITY

4.1 Construction Manager

Construction Manager is responsible for ensuring that activities defined within this procedure shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

4.2 Quality Manager

Quality Manager is responsible to ensure that adequate QC Inspectors are assigned to carry out inspection in accordance with the approved Inspection and Test Plan for the works and ensuring Contractor and are notified of the date, time, and nature of the test

associated with product approval and the installation or application guide from manufacturer.

4.3 QC Engineer

QC Engineer is responsible for the proper documentation or verification of documentation or certificate attesting to the skill and qualification of sand / grit blaster and coating / paint applicator and all required QC documentation which are associated with the inspection and testing activities are completed, accurately done, and "signed-off by the inspecting and approving parties.

4.4 QC Inspector

QC Inspector shall be responsible to carry out visual inspection, surface profile checks. DFT measurements and holiday test of applied coats on pipes and structural steel items, together with the accurate completion of required documentation.

4.5 Subcontractor

The Subcontractor shall be responsible for ensuring:

a. Works carried out on for the project is conducted by experienced personal in accordance with project SH&E requirements.

b. Adequate equipment, supervision, labor, tools, materials, and consumables needed for and to complete the coating works are available.

c. All Inspections and tests required in this procedure are conducted to the relevant project, specification and statutory requirements.

d. Materials and / or products are handled, stored, and issued in accordance with the manufacturer's latest published instructions and the requirements of this or relevant project procedures.

e. Check the elevation top and diameter of pipe with water jet equipment

5.0 EXECUTION

5.1 Selection of Fill Material and Borrow Area:

The local soil sources are surveyed and samples are collected and tested. The relative suitability of different soils is determined and suitable borrow area is selected based on the suitability of soil, availability in required quantity, the cost of compensation for using the borrow area, and the cost of transportation. Once the basic properties such as grain size analysis and index properties are determined, the soil can be classified as per IS – 1498-1970 that also gives the relative suitability for compaction.

Soils with high plasticity index or large shrinkage ratio should be avoided as they tend to expand or compress or become too sticky or shrink. Organic matter that can decay should generally be avoided as fill material unless special precautions are taken.

IS light or heavy compaction tests are conducted on the selected soil to determine the OMC and MDD. The OMC and MDD serve as a guide for developing compaction specifications to be achieved in the field.

5.2 Selection of Field Compaction Equipment:

The following are the different types of equipment used for compaction:

i. Smooth wheel rollers.

ii. Pneumatic tired rollers.

iii. Sheep's foot rollers.

iv. Vibratory rollers.

v. Vibrating plate compaction equipment.

vi. Tamper.

vii. Grid rollers.

These equipment are described in the following subsections**:**

i. Smooth Wheel Rollers:

Smooth wheel rollers are suitable for proof rolling subgrades and for finishing operation of fills. They provide a contact pressure of 30-40 t/m^2 with 100% coverage under the wheels. They are effective in compacting soils in thickness of 20-30 cm and are not efficient for thicker layers. They are suitable only for cohesionless soils.

Smooth wheel rollers are self-propelled or towed steel rollers ranging from 2 to 20 ton capacity. They are suitable for well-graded sands and gravels, silts, and clays of low plasticity. They are unsuitable for uniform sands, silty sands, and clays of high plasticity.

ii. Pneumatic Tired Rollers:

Pneumatic or rubber-tired rollers consist of heavily loaded wagons with several rows of closely spaced tires, four to six in a row. They provide a contact pressure of 60-70 t/m^2 with 70%-85% coverage under the wheels.

Pneumatic tired rollers are suitable for compacting most granular soils. Although they are also used for compacting cohesive soils, they are not as effective as sheep's foot rollers for compacting fine-grained clays. Compaction is achieved by kneading action and also due to static weight of high tire pressure.

iii. Sheep's Foot Rollers:

Sheep's foot rollers consist of hollow drums with a large number of projections called shanks or sheep's foot. These shanks have areas of 25-75 cm^2 for each projector. During rolling, these shanks pierce into the soil giving a high contact pressure of 150-750 t/m^2resulting in most effective compaction of cohesive soils. Compaction is achieved by a combination of kneading action under concentrated high pressure.

The initial passes of the sheep's foot roller compact the lower portion of the lift. Subsequent passes compact the middle and upper portions. Sheep's foot rollers are not suitable for compacting granular soils. The lift thickness should be generally limited to about 20 cm. They do not adequately compact the upper portion of the lift. Hence, compaction of last lift is generally followed by a few passes of a pneumatic or smooth wheel roller.

The sheep's foot rollers are also known as tamping rollers. They are either self-propelled or towed and available in the range of 5-8 t. They are very effective for fine-grained soils and sands and gravels with more than 20% fines. But they are unsuitable for very coarse soils and uniform gravels.

iv. Vibratory Rollers:

Vibratory rollers are very efficient in compacting granular (cohesionless) soils. The vibration is produced by rotating off center or eccentric weights. Vibrators can be attached to smooth wheel rollers, pneumatic tired rollers, or sheep's foot rollers. Vibratory roller compacts the soil from top to bottom. Hence, the lift used should be small, generally limited to 10 cm. Vibratory rollers apply high frequency of about 2000-6000 blows/min of low magnitude. The vibratory action sets the particles in motion and rearranges them to a denser packing.

v. Vibrating Plate Compaction Equipment:

The vibrating plates are similar in principle to vibratory rollers but are small in size. They are used to compact granular soils over small areas, which are inaccessible to the large size compaction equipment. They are also more economical than other compaction equipment.

Vibrating plate rollers are suitable for most soils with low-to-medium fines content. They are unsuitable for large volume work and for wet clayey soils.

vi. Tampers:

Small hand-operated or machine-driven tampers can be used for compacting small areas of cohesive soils. They are similar in principle to the rammers used in laboratory compaction test and can be effectively and economically used compared to other compaction equipment.

Power rammers are also called trench tampers and are pneumatic tampers. They are suitable for trench back fill and work in confined and inaccessible areas. They are unsuitable for large volume work, mainly because of very low day's output.

viii. Grid Rollers:

Grid rollers consist of 30-50 mm bars at a spacing of about 10 cm. Their mass is in the range of 5-12 t. Grid rollers are suitable for well-graded sands, soft rocks, and soils with stones containing fine faction. They are unsuitable for uniform sands, silty sands, and highly plastic clays.

Table 12.6 : summarizes the compaction equipment suitable for different types of soil.

Table 12.6 Recommended field compaction equipment

S. No.	Type of Soil	First Choice	Second Choice
1.	Rock fill	Grid rollers	Pneumatic tired rollers
2.	Highly plastic soils: CH*, MH*	Sheep's foot rollers	Pneumatic tired rollers
3.	Low plastic soils: CL, ML	Sheep's foot rollers or pad foot roller	Pneumatic tired rollers or vibratory rollers
4.	Plastic sands and gravels: SC, GC	Vibratory rollers or pneumatic tired rollers	Pad foot roller
5.	Silty sands and gravels: SM, GM	Vibratory rollers	Pneumatic tired rollers or pad foot roller
6.	Clean sands: SW, SP	Vibratory rollers	Impact roller or pneumatic tired rollers
7.	Clean gravels: GW, GP	Vibratory rollers	Pneumatic tired rollers, impact roller, or grid roller

5.3 Compaction of Soil in the Field:

Compaction equipment can efficiently compact the soil up to a limited depth. Hence, the fills or embankments are compacted in several layers, called lifts. If lift thickness is too large, soil at the top of the lift will be well compacted whereas that at the bottom will not be compacted completely. For certain compaction equipment, the reverse also happens. For most compaction equipment, lift thickness should be of the order of 15 cm.

The soil from the borrow area is transported and spread in several layers. The compacted thickness is about two- third of the loose thickness. Each layer is compacted by passing the roller over the soil required number of times. About 10-15 passes of the roller are the most efficient and economical ways to achieve MDD during compaction. After this, the next layer of loose soil is spread and compacted. The procedure is repeated until the required height of the fill, embankment, or earth dam is reached.

Water content should be closely monitored during compaction. If the soil gets too wet, it will be impossible to compact. If the soil is too dry, compaction will not be effective. Since it is easier to add than remove water, water is added in increments during the rolling operation.

5.4 Field Compaction Control:

Improper compaction of soil in the field will lead to the dry density of compacted soil less than the required maximum achievable dry density, resulting in the following problems:

i. Low shear strength of compacted soil leading to shear failure of the soil and foundation supported on the compacted soil.
ii. Excess total and differential settlements leading to the failure of foundation and structures supported on the compacted soil.
iii. Slope failure of slopes of compacted fills, embankments, and earth dams.
iv. Excessive volume changes in the compacted fill in terms of excessive swelling and shrinkage.
v. Increase of permeability of the compacted fill leading to the loss of water, failure of hydraulic structures due to piping, etc.

It is, therefore, necessary to adopt proper field compaction control to ensure that the dry density and the water content of the compacted soil is within specified limits of MDD and OMC, respectively.

6.0 SAFETY

Contractor shall comply with all applicable safety laws, regulations (including permit to work systems) and safe operating standards of Owner/Consultant. Contractor shall take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of Owner and all Third parties.

7.0 QUALITY CONTROL

The works shall be carried out in accordance with PL-A-2201.15-0637-001 "Project Master Schedule". This procedure will be monitored in accordance with requirements of PL-Y-2201.15-0637-001 "Inspection and Test Plan" together with the requirements the Environmental Impact Assessment (EIA) Report and all relevant PTT specifications.

8.0 JOB SAFETY AND ENVIRONMENT ANALYSIS (JSEA)

Refer to document no.MN-X-2201.15-0637-001 "Job Safety and Environment Analysis"

9.0 REFERENCE DOCUMENT

PL-A-2201.15-0637-001	Project Master Schedule
ACI – 117	Standard Tolerances for Concrete Construction
ACI – 3.1	Specification for Structural Concrete for Buildings
ACI – 304	Recommend Practice for Measuring, Mixing, Transporting and Placing Concrete
ACI – 315	Details and Detailing of Reinforcement
ASTM – A196	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM – C33	Specification for Concrete Aggregates

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	METHOD STATEMENT FOR SHEET PILE PIT	
DOCUMENT NO.:	PR-C-2201.15-0637-003	REVISION: 0

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1.0 PURPOSE

The sheet pile are temporary structures constructed to keep water and soil out of excavations in which trench and bore pit are to be built. After the substructures have been completed, the sheet piles are removed.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 REFERANCE DOCUMENTS

PL-A-2201.15-0637-001	PROJECT MASTER SCHEDULE
PL-A-2201.15-0637-002	PROJECT EXECUTION PLAN
MN-X-2201.15-0637-001	JOB SAFETY ENVIRONMENT ANALYSIS (JSEA)
PR-D-2201.15-0637-001	VERIFY EXISTING PIPELINE PROCEDURE
ST-C-2201.15-0637-003	DESIGN CALCULATION FOR SHEET PILE PIT REPORT
PR-C-2201.15-0637-005	METHOD STATEMENT FOR BACKFILL
D3-2201.15-0637-005	DETAILS SHEET PILE PIT

4.0 RESPONSIBILITIES

4.1 Construction Manager

Construction Manager is responsible for ensuring that activities defined within this procedure shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

4.2 Project Engineer

The Project Engineer is responsible for the detailed planning of activities and resources required for the execution of this procedure, perform the construction work according to the approved drawing.

4.3 QC Inspector

QC Inspectors shall be to carry out inspection in accordance with the approved Inspection and Test Plan for the works and ensuring Contractor and are notified of the date, time,

and nature of the test associated with product approval and the installation or application guide from manufacturer

4.4 SH&E Officer

SH&E Manager is responsible for ensuring compliance of all parties with the SH&E requirements. He will provide trained and competent personnel to monitor and assist with compliance by construction.

4.5 Subcontractor

The Subcontractor shall be responsible for ensuring:

a. Works carried out on for the project is conducted by experienced personal in accordance with project SH&E requirements.

b. Adequate equipment, supervision, labor, tools, materials, and consumables needed for and to complete the coating works are available.

c. All Inspections and tests required in this procedure are conducted to the relevant project, specification and statutory requirements. Materials and / or products are handled, stored, and issued in accordance with the manufacturer's latest published instructions and the requirements of this or relevant project procedures.

5.0 EXECUTION

5.1 Location Setting & Driven

5.1.1 The contractor shall be surveyed the location of pit and underground pipeline refer to document PR-D-2201.15-0637-001 Verify Existing Pipeline Procedure. Be sure the location of driving sheet pile don't have obstacle.

5.1.2 The backhoe to install vibrating machine (vibro hammer) shall be used for driving sheet piles.

5.1.3 Setting of sheet pile should begin at one corner and continue around the pit. Be sure the corners are vertical and placed in the right locations. This will ensure the proper positioning of the remaining sheet piling.

5.1.4 A panel of sheet piling should be threaded and set prior to driving any sheets to grade.

5.2 Excavating The Pit and Install Bracing

5.2.1 The pit shall be excavated by excavator through the - 0.5 m. below 1st bracing level. For the pit's corner, The soil shall be removed with manual if necessary.

5.2.2 Perform installation H-beam (sheet pile bracing) in accordance with AFC drawing.

5.2.3 After bracing has been set. The excavation for next level bracing shall be done with item 5.2.1

5.2.4 The excavator not allowable for excavating near the gas pipeline (at least 0.3 m. around the pipe diameter) The contractor shall be performed manual excavation on this boundary. The excavator shall be done for excavate the side of the pipe, away from pipe edge at least 0.3 m.

5.2.5 Excavate the bottom of pipe with manual till the final depth.

5.2.6 For the gap, that can't driven sheet piles. Steel plate or eucalyptus poles shall be installed for protect the pit from landslide.

5.3 Flood Protection and De-watering

Temporary settlement sump shall be dug for dewatering.

5.4 Disposal of Excavated Material

Excavated material shall be temporary stored to the stockpiles.

5.5 Extracting of sheet pile pit

5.5.1 Prior to remove of the bracing system and sheet piles, The pit shall be backfill and compaction with soil. The elevation of backfilling are below the lowest bracing 0.3 to 0.5 m. Method of backfill as per PR-C-2201.15-0637-005 METHOD STATEMENT FOR BACKFILL.

5.5.2 Extracting the bracing by using gas cutting, And then remove the beam out of sheet pile pit.

5.5.3 For the next bracing, The method as per item 5.5.1 and 5.5.2

5.5.4 After remove all beam, Use vibration hammer to pull the pile.

6.0 EQUIPMENTS

- Excavator
- The backhoe to install vibrating machine (vibro hammer)
- Hiab
- Excavation Hand Tools
- Survey Equipment
- Water jet set
- Welded set
- Scaffold or ladder
- Gas cutting
- Submersible pump (Generator, if necessary)

7.0 MATERIALS

- Sheet piles (Type of beam as per calculation)
- Steel beam (Size of beam as per calculation)
- Hard Barricade
- Warning sign
- Steel plate
- Eucalyptus poles

8.0 SAFETY

8.1 All SH&E of all operations will be carried out in strict accordance with the requirements of MN-X-2201.15-0637-001 "Job Safety Environment Analysis". The Contractor will take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of PTT and all Third parties.

8.2 Barricading the sheet pile pit by marking flag strips and warning sign on downtime.

8.3 During the driven and pulling sheet pile, all personnel shall be removed from the working area.

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

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1.0 PURPOSE

The purpose of this procedure are describe sequence and method of excavation for installation, settlement and alignment the 30" pipeline of WNMR Onshore 4 & 5PL Connection Project.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 REFERANCE DOCUMENT

PTT-PR-P-001	PIPELINE OPEN CUT CONSTRUCTION PROCEDURE
PL-A-2201.15-0637-001	PROJECT MASTER SCHEDULE
PL-A-2201.15-0637-002	PROJECT EXECUTION PLAN
MN-X-2201.15-0637-001	JOB SAFETY ENVIRONMENT ANALYSIS (JSEA)
PR-D-2201.15-0637-001	VERIFY EXISTING PIPELINE PROCEDURE
D3-2201.15-0637-003	PIPELINE ALIGNMENT SHEET
D3-2201.15-0637-004	CROSS SECTION DRAWING
D3-2201.15-0637-005	DETAILS SHEET PILE PIT
D3-2201.15-0637-008	TYPICAL TRENCH AND EXCAVATION DETAILS
D3-2201.15-0637-009	SALES TAP DETAILS DRAWING

4.0 RESPONSIBILITIES

4.1 Construction Manager

Construction Manager is responsible for ensuring that activities defined within this procedure shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

4.2 Project Engineer

The Project Engineer is responsible for the detailed planning of activities and resources required for the execution of this procedure, perform the construction work according to the approved drawing.

4.3 QC Inspector

QC Inspector is responsible for ensuring that the owner agreed quality requirements are satisfied and that they are included in this method statement. He shall ensure that the inspectors inspect and control in accordance with this method statement and inspection test plan.

4.4 SH&E Officer

SH&E Manager is responsible for ensuring compliance of all parties with the SH&E requirements. He will provide trained and competent personnel to monitor and assist with compliance by construction.

4.5 Subcontractor

The Subcontractor shall be responsible for ensuring:

a. Works carried out on for the project is conducted by experienced personal in accordance with project SH&E requirements.

b. Adequate equipment, supervision, labor, tools, materials, and consumables needed for and to complete the coating works are available.

c. All Inspections and tests required in this procedure are conducted to the relevant project, specification and statutory requirements. Materials and / or products are handled, stored, and issued in accordance with the manufacturer's latest published instructions and the requirements of this or relevant project procedures.

5.0 EXECUTION

5.1 Setting Out of the Works

5.1.1 Setting out of the work shall be in accordance with the approved drawing and procedure.

5.1.2 Prior to start excavation, permit shall be completely applied and permitted by PTT. The suitable procedure of excavation shall be applied for each phase.

5.1.3 All workers will be oriented to work properly and safely before commencing the work. Safety precaution measure, such as safety warning sign, safety officer etc., will be deployed to protect the worker and public during operation in accordance with the requirement. The stability of the trench and sheet pile protection has to be proofed prior to construction to ensure the safety of above ground existed structure and adjacent embankment.

5.2 Method of Excavation (Trenching)

5.2.1 The excavation work shall be begun after the completion of verifying underground pipeline and tie-in point. The alignment survey of the centerline of the pipeline shall be carried out and triangle transit markers fixed in poles shall be installed on the both sides of the trench area. The ground levels shall be taken in records before excavation along the centerline.

5.2.2 The trench line will be located in according to the alignment sheet. The width of the trench will be not less than 1.10 meters width. The depth of the trench will be specified to provide the pipe covering not less than 1.50 meters for general

area, 3.50 meters for DOH road, 2.00 meters for Klong, 1.50 meters for minor open drain and 2.00 meters for major drain.

5.2.3 Where the pipeline laid across or close to other existing underground utilities/structures. Contractor will firstly get permission from related authorities and/or Owner to verify them. Contractor will take appropriate measures to ensure the protection of existing utilities in accordance with the requirement and/or instruction of the related authorities and/or owner. Contractor will excavate the trench manually where use of backhoe may result in damage to the property and subsurface structures during excavation. In case of damage to any of existing structures/utilities, Contractor will be responsible for repairing, which will be carried out to the satisfaction of concerned authorities and/or owner. The data, size and depth and location, of the utilities will be recorded. Then the utilities will be backfilled and compacted as require by the related authorities.

5.2.4 Prior to trenching operations, all foreign and buried utilities in vicinity of the trench shall be located and exposed by hand excavation, pegs, flags and a warning sign shall be installed indicating type, size and depth of the utility. No mechanical excavation shall be undertaken within 0.5 meter of the utility. A minimum separation distance of 30 cm shall be maintained when crossing foreign utilities and other buried facilities or a greater distance as instructed by the authority having jurisdiction.

5.2.5 When all existing has been verified. Excavator will be used for digging pipeline trench. Care will be taken to ensure that top soil is not in mixed with sub soil. It is required that excavated soil intended to backfill the pipe trench is not mixed with foreign material. The excavated material will never be deposited over against the strung pipe. Excavated material will be stock nearby the trench.

5.2.6 Trenching will be made with sufficient slopes protection. Contractor will keep the trench in good condition until the pipe is laid.

5.2.7 Trenching width and depth shall include allowances for bends, tie in requirements, valve installations and any additional extra width requirements such as Field joint, NDE and hydrostatic test.

5.3 Method of Excavation Tie-in pit

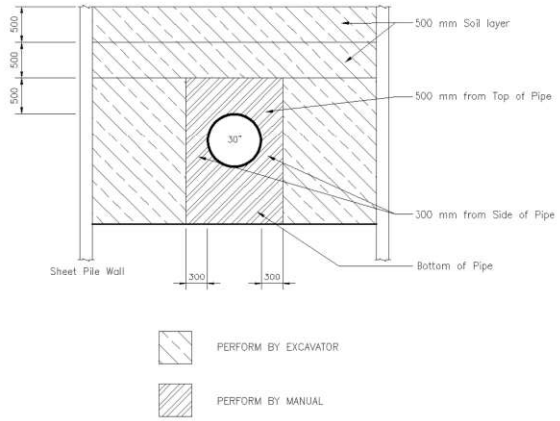
5.3.1 Prior to excavation work, Contractor shall perform verify existing pipe line and utilities by waterjet method (following PR-D-2201.15-0637-001 Verify Existing Pipeline Procedure). Depth of underground pipe line and sales tap valve shall be recorded.

5.3.2 Excavation shall be separated to several layers, Layer thickness should not over 500 mm. Prior to mechanical excavation each layer contractor shall verified underground by using steel rod. Ensuring the layer do not have any utilities and obstacle.

5.3.3 For 500 mm above of top of pipe, shall perform manual excavation till the underground pipe and valve appear.

5.3.4 Excavator shall be used for dig and remove soil between pipe edge and sheet piles wall, away from pipe edge at least 300 mm.

5.3.5 Excavate the bottom of pipe with manual trough the final depth, And then Dressing of excavated pits as specified in the drawings.



(Section views for tie-in pit)

5.4 Flood Protection and De-watering

Excavated materials shall be filled along the trench to blocked surface water flow down to the open-cut area. Temporary settlement sump shall be dug intervene (as necessary) along the route for dewatering.

6.0 EQUIPMENTS

- Excavator
- Tippers, Dump trucks
- Excavation Hand Tools
- Survey Equipment
- Water jet set
- Submersible water pump (Generator, if necessary)

7.0 MATERIALS

- Marking Flag Strips
- Warning sign

8.0 SAFETY

8.1 All SH&E of all operations will be carried out in strict accordance with the requirements of MN-X-2201.11-0637-001 "Job Safety Environment Analysis". The Contractor will take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of PTT and all Third parties.

8.2 Where public access to the ROW, Safety officer shall barricade the trench by marking flag strips and warning sign on downtime.

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

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1.0 PURPOSE

The purpose of this procedure are describe sequence and method of backfill and compaction for 30" underground pipeline of WNMR Onshore 4 & 5PL Connection Project.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 REFERANCE DOCUMENT

PTT-PR-P-001	PIPELINE OPEN CUT CONSTRUCTION PROCEDURE
PL-A-2201.15-0637-001	PROJECT MASTER SCHEDULE
PL-A-2201.15-0637-002	PROJECT EXECUTION PLAN
MN-X-2201.15-0637-001	JOB SAFETY ENVIRONMENT ANALYSIS (JSEA)
PR-D-2201.15-0637-001	VERIFY EXISTING PIPELINE PROCEDURE
D3-2201.15-0637-003	PIPELINE ALIGNMENT SHEET
D3-2201.15-0637-004	CROSS SECTION DRAWING
D3-2201.15-0637-008	PIPELINE AND F.O.C. WARNING TAPE DETAILS
D3-2201.15-0637-009	TYPICAL PROTECTIVE CONCRETE SLAB DETAILS
D3-2201.15-0637-010	TYPICAL TRENCH AND EXCAVATION DETAILS

4.0 RESPONSIBILITIES

4.1 Construction Manager

Construction Manager is responsible for ensuring that activities defined within this procedure shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

4.2 Project Engineer

The Project Engineer is responsible for the detailed planning of activities and resources required for the execution of this procedure, perform the construction work according to the approved drawing.

4.3 QC Inspector

QC Inspector is responsible for ensuring that the owner agreed quality requirements are satisfied and that they are included in this method statement. He shall ensure that the inspectors inspect and control in accordance with this method statement and inspection test plan.

4.4 SH&E Officer

SH&E Manager is responsible for ensuring compliance of all parties with the SH&E requirements. He will provide trained and competent personnel to monitor and assist with compliance by construction.

4.5 Subcontractor

The Subcontractor shall be responsible for ensuring:

a. Works carried out on for the project is conducted by experienced personal in accordance with project SH&E requirements.

b. Adequate equipment, supervision, labor, tools, materials, and consumables needed for and to complete the coating works are available.

c. All Inspections and tests required in this procedure are conducted to the relevant project, specification and statutory requirements. Materials and / or products are handled, stored, and issued in accordance with the manufacturer's latest published instructions and the requirements of this or relevant project procedures.

5.0 EXECUTION

5.1 Setting Out of the Works

5.1.1 Setting out of the work shall be in accordance with the approved drawing and procedure.

5.1.2 Prior to start excavation, permit shall be completely applied and permitted by PTT. The suitable procedure of excavation shall be applied for each phase.

5.1.3 All workers will be oriented to work properly and safely before commencing the work. Safety precaution measure, such as safety warning sign, safety officer etc. , will be deployed to protect the worker and public during operation in accordance with the requirement.

5.2 Backfill

5.2.1 Backfill material

- Sand
- Soil

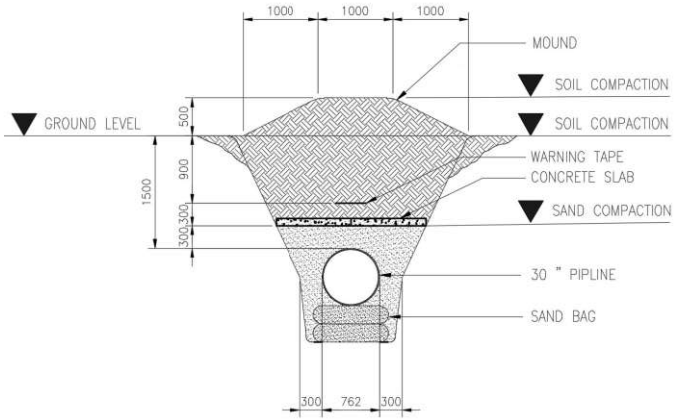
5.2.2 Excavator shall be use for carried the sand or soil into the trench.

5.2.3 Backfill and Compaction shall be separated to several layers, Layer thickness should be of the order to 200 mm.

5.2.4 Backfill and compaction sequence

- Backfill the trench with sand. The pipeline shall be covered by sand with minimum 300 mm thickness. Compact the sand layer by vibrating compactor.
- Installation protective concrete slab on the compacted sand layer cover the underground pipeline route.
- For next compaction layers, Using soil for backfill. The 1st soil layers may contain of soil 300 mm. thickness, then install warning tape.
- Continue backfill and compact soil till existing ground level. The compact soil should over the existing ground (mound) at least 3000 mm wide and 500 mm high. For this soil layers, shall be used roller compactor for compaction.

The compaction layer (sample) for 1.5 m. buries pipe as following fig.



(Typical trench backfill section)

Note : Typical detail of trench, warning tap and concrete slab will show in the reference document (article 3 of this procedure).

6.0 EQUIPMENTS

- Excavator
- Tippers, Dump trucks
- Excavation Hand Tools
- Compactor
- Submersible water pump (Generator, if necessary)

7.0 MATERIALS

- Sand
- Concrete slab
- Warning tab
- Marking flag strips and warning sign

8.0 SAFETY

8.1 All SH&E of all operations will be carried out in strict accordance with the requirements of MN-X-2201.11-0637-001 "Job Safety Environment Analysis". The Contractor will take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of PTT and all Third parties.

8.2 Where public access to the ROW, Safety officer shall barricade the trench by marking flag strips and warning sign on downtime.

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	METHOD STATEMENT FOR THE CONSTRUCTION OF BORED PILING	
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1.0 PURPOSE

The purpose of this procedure is to describe the activities and methods used in performing construction of bored piling for the Construction of WNMR Onshore 4 & 5PL Connection Project. The latest revision of the project specifications shall be used as references and is part of this Method Statement in the execution of work

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 DEFINITIONS

PTT	means	PTT Public Company Limited
Project	means	WNMR Onshore 4 & 5PL Connection Project
Contractor	means	Instrumech Company Limited.
AFC	means	Approved for Construction
SH&E	means	Safety, Health and Environment
Subcontractor	means	The party to which Contractor has sub-contracted a portion of the Work under the Contract

4.0 RESPONSIBILITY

4.1 Construction Manager

Construction Manager is responsible for ensuring that activities defined within this procedure shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

4.2 Quality Manager

Quality Manager is responsible to ensure that adequate QC Inspectors are assigned to carry out inspection in accordance with the approved Inspection and Test Plan for the works and ensuring Contractor and are notified of the date, time, and nature of the test

associated with product approval and the installation or application guide from manufacturer.

4.3 QC Engineer

QC Engineer is responsible for the proper documentation or verification of documentation or certificate attesting to the skill and qualification of sand / grit blaster and coating / paint applicator and all required QC documentation which are associated with the inspection and testing activities are completed, accurately done, and "signed-off by the inspecting and approving parties.

4.4 QC Inspector

QC Inspector shall be responsible to carry out visual inspection, surface profile checks. DFT measurements and holiday test of applied coats on pipes and structural steel items, together with the accurate completion of required documentation.

4.5 Subcontractor

The Subcontractor shall be responsible for ensuring:

a. Works carried out on for the project is conducted by experienced personal in accordance with project SH&E requirements.

b. Adequate equipment, supervision, labor, tools, materials, and consumables needed for and to complete the coating works are available.

c. All Inspections and tests required in this procedure are conducted to the relevant project, specification and statutory requirements.

d. Materials and / or products are handled, stored, and issued in accordance with the manufacturer's latest published instructions and the requirements of this or relevant project procedures.

5.0 EXECUTION

The pile boring operations shall be performed using the suitable bucket drill rigs depends on the diameter, depth, soil condition and construction method.

If necessary, the bore-holes shall be stabilized with a temporary casing in the upper layer (depends on soil and site condition) .The length of the casing will be determined from the actual soil condition encountered on site.

5.1 Setting Out

5.1.1 The location of permanent bored piles shall be set out and pegged by the subcontractor's surveyor based on AFC drawings and control points at site. The surveying details of each location to be recorded incorporating reduced level and coordinates. Each individually surveyed pile position shall be protected from disturbance prior to commencement of boring works. Two reference points to be installed equidistant at not less than 2.0 m from the pile centre location.

5.1.2 Prior to drilling, Location of pile setting shall be verified by waterjet method to ensure the existing pipeline and facilities. For the station, contractor shall verify pile location by method below.

- Setting verify location and border (2 x 2 m. from pile center)
- Remove gravel by adequate excavator (PC30)
- Perform manual excavation for verify grounding and lightning protection cable rout with minimum 50 cm depth.
- Confirm verify by waterjet method to ensure the underground facilities at deeper layers.

B

5.2 Drilling

Prior to commencing any operations, the client representative will be required to verify all associated technical information such as presence of services, pile coordinates, platform and cut-off levels, validity of drawings etc. Then, if necessary, after accurately setting out of the pile location by a land surveyor, a temporary casing will be set in position with length of casing to be determined from ground condition. The vertical accuracy of the casing will be checked during the installation process using 2 numbers of plumb bob. Excavation of the soil inside the casing/bored holes will be carried out using the drill bucket method.

The drilling process will be continued to the designed founding depth or to the commencement of rock head level by using augers and drilling buckets. Pile lengths shall be as per the current construction drawings or as otherwise instructed by the client/Engineer. At the point of encountering the rock (as define in the contract specification) head level, for examples, where the soil drilling tools are unable to penetrate the strata any further, boring shall cease in order that the client's representative may verify the occurrence and confirm the rock socketing criteria. For drilling through rock, rock drilling tools shall be applied. This shall include rock auger, core barrels, (round shank, roller bit) cross cutters and where necessary, chisels. The final toe level of the pile shall be verified by the client's representative. A detailed record of all encountered ground conditions together with the associate dimes and type of equipment and materials used will be recorded in the 'Pile Bore Log'. Upon reaching the final depth, loose and re-moulded material and debris will be removed using 'cleaning bucket'. The cleaning bucket is a specially design flat bottom bucket which will pick up all the loose material at the bottom of the hole. The base of the hole shall be checked by the measuring the depth of the base.

5.3 Installation of Steel Cage

The reinforcement cage will be fabricated in lay-down sections. The length, type and size of the steel cage will be according to contract drawings and specifications. The cages will be provided with stiffening rings and others accessories to enable handling, lifting and installation without permanent deformations. Cages will be installed into the bored hole using a service crane of the required lifting capacity

Concrete spacers wired to the cage shall provide lateral support and ensure adequate concrete cover. Spacers shall be placed at 3 equal levels of each 12 m. cage with 3 nos. at each level. If the diameter of bored pile more than 2000 mm the spacers shall be placed more than 3 nos. to be advised by consultant representative.

5.4 Concreting

All pile shall then be concreted by using the 'tremie' method. Concrete of higher slump (= 10 cm ± 2.5 cm) shall be used for 'tremie' method. The self-compacting mixed concrete will be discharged through a tremie pipe, which is lowered centrally to the bottom of the bored hole prior to filling it with concrete. Concrete level of the borehole was recorded after each concrete truck discharged and graph will be plotting against theoretical. One length shall be continuously embedded in the concrete during this process to ensure that

the discharge of concrete is below the level of the impurities, which might be present in the top part of the rising head of concrete. All testing and sampling of the concrete shall be carried out as instructed by the Engineer or Engineer's representative. A complete record of all cubes taken shall be maintained in a proper form and slump test results shall be recorded on the 'Delivery Order' and the 'Pile Bore Log'. All compressive concrete tests will be carried out at the supplier's laboratory and independent lab. The client will be notified of the dates of the test by regular issuance in order the tests maybe witnessed. For a continuous assurance of concrete quality and integrity, concrete will be poured to minimum 0.6m above the theoretical cut-off level. All completed piles shall be temporarily barricaded and to be backfilled to ground level with a suitable material the next day.

5.5 Spoil Removal

Spoil from piles will be cleared from the boring locations by means of an excavator as boring proceeds. Depending on the volume of spoil excavated, it will be removed to stockpile area or spoil pit, for drying before loading and removed off-site.

5.6 Report Document

The report document shall be follow PTT specification such as refer BM, date of drilling, refer level of top pile and pile tip, pile deviation, reinforcing detail of bore pile etc. The form of document according shall be submit before start work.

6.0 SAFETY

6.1 All SH&E of piling operations will be carried out in strict accordance with the requirements of MN-X-2201.15-0637-001 "Job Safety Environment Analysis". The Contractor will take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of PTT and all Third parties.

6.2 Correct safety PPE-equipment, headwear and footwear will be worn at all times during construction.

7.0 JOB SAFETY AND ENVIRONMENT ANALYSIS (JSEA)

Refer to document no.MN-X-2201.15-0637-001 "Job Safety and Environment Analysis"

8.0 REFERENCE DOCUMENT

PL-A-2201.15-0637-001	Project Master Schedule
PTT SP-C-000-51	Specification for Concrete Foundation and Reinforcing Steel
PTT SP-C-000-74	Specification for Design criteria for Civil Structural and Building work
PTT SP-C-000-75	Specification for Civil structural design for Structures & Foundations
PTT SP-C-000-82	Specification for Concrete piles and Piling
PTT SP-C-000-83	Specification for Pile Testing
C3-2201.15-0637-001	Piling Plan
C3-2201.15-0637-002	Pipe support location plan

B

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

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RADIOGRAPHIC EXAMINATION TEST PROCEDURE

1.0 SCOPE

This Radiographic examination procedure is applied for welds of the WNMR Onshore 4 & 5PL Connection Project.

2.0 DEFINITION

PTT	means	PTT Public Company Limited.
Project	means	WNMR Onshore 4 & 5PL Connection Project
Contractor	means	Instrumech Company Limited.
CSWIP	means	Certification Scheme for Weldment Inspection Personnel
ASNT	means	American Society for Non-Destructive Testing.
IQI	means	Image Quality Indicator.
DWSI	means	Double Wall Single Image
SWSI	means	Single Wall Single Image
OFD	means	Object to Film Distance
FFD	means	Film to Focal Spot Distance
SFD	means	Source to Film Distance
UG	means	Geometric Unsharpness
SS	means	Source Side
FS	means	Film Side.
RPI	means	Radiation Protection Inspector
OAP	means	Office of Atoms for Peace

3.0 RESPONSIBILITY

3.1 For the examination of qualification test welds, radiographers shall be qualified to ASNT Level II.

3.2 Assistant Radiographer shall be fully trained in the use of Radiographic equipment and Radiation Safety

3.3 Radiographic Interpretation of qualification welds and production welds shall only be carried out by ASNT Level III qualified interpreter with relevant experience and shall be certified in accordance with SNT-TC-1A or the Owner's approved equivalent.

3.4 It will, at all times, be the objective of the technician to report all significant flaws. When doubt exists about the type of imperfections being disclosed by indication verification may be obtained by using other non-destructive testing methods.

3.5 Radiography will only be carried out following visual inspection by Contractor.

4.0 EXECUTION

Each film produced shall be in accordance with the Contractor, Owner/Consultants requirements. and bear the following identification given in 4.1 and 4.2 below.

4.1 Radiographs

- Contract Number:
- Weld no. (prefixed) - See procedure Welding and Inspection Control Procedure
- Centimeter marker
- Image Quality
- Indicator Chain age (100 mm interval)

4.2 Exposed Film Packaging

- Subcontractor Name,
- Box Number
- Name of Contractor
- Name of project
- Project Number
- Pipe Size
- Wall Thickness
- Weld Procedure Identification
- Date of Test
- Radiographer's Identification Number
- Original, Repair or Tie-in Weld
- Copy of all Radiographic Reports.

4.3 All films shall be processed in accordance with the film manufacturer's recommendations and under controlled conditions to ensure consistency of quality.

4.4 The utmost care shall be taken at all times to ensure films are free from processing and handling marks. Unacceptable films will be re-shot.

4.5 Production welds and qualification welds shall be examined using one of the following Single Wall Single Image, Double Wall Single Image and Elliptical. Factors to be taken into consideration when choosing the radiographic techniques are:

- Type of radiation
- Geometry of the object, i.e. thickness, diameter, access around joint exposure times involved
- Expected quality and defect sensitivity of the chosen technique
- Physical geometry of the radiographic equipment and effective focal spot/source size

4.6 A radiographic procedure shall be qualified for each pipe size to be examined. A set of radiographs shall be produced in accordance with the proposed radiographic procedures to demonstrate density, sensitivity and coverage of the weld.

4.7 radiographic report form shall be completed and endorsed by the radiographer before being submitted for verification by the client.

4.8 The NDE subcontractors/surface radiographic technician shall be supplied with the following information in order to proceed with the radiographic examination of the qualification/production welds.

4.9 The ID of the production/qualification weld will be clearly marked adjacent to the weld with the following.

- Client Name and Project Title
- Pipe Dimensions and Grade
- Weld Procedure Details identification
- Joint Weld Number
- Welder Identification
- Date of Welding
- Original or Repair, Cut out Weld or Tie-in

5.0 EQUIPMENT

5.1 Balteau or ICM x-ray tube set will be panoramic tube activated by an external control panel and with the maximum capacity up to 300 kV for internal using Single Wall Single Image technique. Amertest 660 Gamma-ray equipment shall only be considered on a case by case basis where x-ray becomes impossible due to geometrical reasons. Internal 6"-10" & 22-72" diameter x-ray crawler with Balteau or ICM 160/300 kV x-ray tube.

5.2 All DWSI shots will be made using a directional head. Collimated panoramic heads will not be used.

5.3 FILM Each radiographic technique shall specify the specific type of fine grain film to use.

6.0 MATERIAL

6.1 Chemicals

Only chemicals recommended by the film manufacturer shall be used, e.g. AGFA G 135, AGFA G 335 etc.

6.2 Film

AGFA D7 70mm Roll Pack or equivalent for X-ray and D4 for gamma ray.

6.3 Screens

Lead screens shall be used with D4 or D7 type film.

7.0 TECHNIQUE FOR RADIOGRAPHIC EXAMINATION

7.1 Weld surface preparation

Prepare weld surfaces by removing weld profile irregularities on both sides (where accessible) by any suitable process to such a degree that the resulting radiographic image due to any irregularities cannot mask or be confused with the image of any discontinuity. The finished surface of all butt welded joints may have reasonably uniform crowns, with reinforcement on each side of all butt welded joints not to exceed the following thickness.

Nominal Wall Thickness (t) (mm.)	Reinforcement high (mm.)
Less than and equal to 6.4	1.6
>6.4 up to and incl.12.7	3.2
>12.7 mm. up to and incl.25.4	4.0
over 25.4	4.8

7.2 Selection of Penetrometers

7.2.1 For welds without reinforcement

The thickness on which the penetrometer will be based is the nominal single wall thickness. Backing rings or strips are not to be considered as part of the weld thickness.

7.2.2 For welds with reinforcement

The thickness on which the penetrometer will be based is the nominal single wall thickness plus the estimated weld reinforcement. Backing rings or strips are not to be considered as part of the weld or reinforcement thickness.

7.3 Placement of Penetrometers

7.3.1 Place a standard source side penetrometer on the side nearest the radiation source. Where inaccessibility prevents this, place a film side penetrometer in contact with the object being examined. Place a lead letter "F" at least as high as the film interval numbers or penetrometer identification number(s) adjacent to or on the penetrometer(s) but it shall not of penetrometers.

7.3.2 Place wire type penetrometers over the weld joint at the edge of the diagnostic area with the thinnest wire outermost and at the location marker.

7.3.3 The penetrometer identification numbers and lead letter "F" when used, not appear in the area of interest, except it impractical to place because of the geometric configuration.

7.4 Number of Penetrometers

7.4.1 Use at least one penetrometer for each exposure.

7.4.2 An additional penetrometer may be used to meet the required density variation limits.

7.4.3 When more than one film holder or cassette is used for a single exposure, a penetrometer image shall appear on each radiograph, except for the following conditions:

- For cylindrical or spherical vessels or piping where the source is respectively placed on the axis or located at the center, a circumference which exceeds240 degree is radiographed called Panoramic Technique, at least three (3)penetrometers shall be spaced approximately 120 degree apart.
- For the same source locations in 5.4.3.1 when a section of a circumference which is equal to or less than 240 degree is radiographed, one (1) penetrometer shall be in the approximate center of the section exposed, and one at each end. totally 3 per exposure.

7.5 Blocking and Masking Technique

7.5.1 Use filters, if necessary, to improve the quality of the radiograph.

7.5.2 A lead symbol "B", with minimum dimensions of 1/2 in.(12.7 mm.) height and 1/16 in. (1.6 mm.) in thickness, shall be attached to the approximate middle of the back of each film holder. If a light image of the "B" appears on a darker background of the film, that radiograph shall be considered unacceptable. A dark image of the "B" on a lighter background is not cause for rejection.

7.6 Number of Exposure

The number of spot radiographs and their location shall be in accordance with the drawing and specifications.

8.0 PLACEMENT OF LOCATION MARKERS (FILM INTERVAL NUMBERS OR IDENTIFICATION NUMBERS) AND FILM IDENTIFICATION

8.1 Place location markers, which are to appear as images on the film, on the surface near the weld at the film intervals for multiple exposures or the approximate center point of the film location for single exposures. The location of the markers shall be marked on the surface of the part (usually with a low stress center punch or paint stick) or on a record drawing. In this manner, the area of interest on a radiographic film may be accurately traceable to its location on the surface of the part. It also provides evidence on the radiograph that the area being examined has been obtained.

8.2 Lead number location markers (film interval numbers or identification numbers), which are to appear as images on the film, shall be placed on the material adjacent to the weld at the marks located in 6.1 and as follows:

8.2.1 Location markers shall be placed on the source side when radiographing joints in:

- Flat components or longitudinal joints in cylindrical or conical components.
- Curved or spherical components whose concave side is toward the source and when the source to material distance is less than the inside radius of the component.
- Curved or spherical components whose convex side is toward the source.

8.2.2 Location markers shall be placed on the film side when radiographing joints in curved or spherical components whose concave side is toward the source and when the source to material distance is greater than the inside radius.

8.2.3 Location markers may be placed on either the source side or film side when radiographing joints in curved or spherical whose concave side is toward the source and the source to material distance equals to the inside radius of the component.

8.2.4 As an alternative to source side placement in 8.2.1(1), location markers may be placed on the film side when the radiograph shows coverage beyond the location markers.

8.3 Markers for pipe welds shall be located lead numbers as API 1104 requirement.

8.4 Permanently mark each film with the following information:

- Contract Number
- Pipe Line Identification, Isometric drawing number, Spool number
- Joint identification number, or weld number
- Film interval numbers or identification number

- Reshoot (RS), repair shot (R1, R2.), reconfirm shot (RC) etc.
- Manufacture's name or symbol
- Welder or welding operators identification
- Date of the radiograph
- Pipe diameter and wall thickness

9.0 GEOMETRICAL UNSHARPNESS LIMITATION GUIDELINE

The following geometrical unharness values shall be used as a guide for determining the minimum source to weld or object distance (D).

Material Penetrated Thickness, inch (mm)	Ug Maximum, inch (mm.)
Under 2" (51)	0.020" (0.5)
2" (51) through 3" (76)	0.030" (0.76)
Over 3" (76) through 4" (102)	0.040" (1.0

Geometrical unharness (Ug), equals source size (F), times the distance (t) from source side of weld or object being radiographed to the film (tested object thickness), over distance (D) from source of radiation to weld or object being radiographed.

$$Ug = Ft/D$$

10.0 EVALUATION OF RADIOGRAPHIC QUALITY

10.1 Evaluate the radiographic quality by the image of a properly located penetrometer and the following film quality requirements:

10.1.1 The images of the identifying numbers, the wires of the penetrometer which determine IQI Sensitivity conform to Image Quality, shall be appeared on the radiograph.

10.1.2 The film density through the image of the penetrometer and the area of interest for single film viewing shall be 2.0 minimum. The maximum density shall be 3.5 for viewing. A density variation through the interest area shall not be more than minus 15% or plus 30% from the density through the body of the penetrometer.

10.1.3 Each penetrometer shall represent an area of essentially uniform radiographic density as judged by a density comparison strip or densitometer. If the film density through the area of interest, varies by more than specified in 9.1.2 an additional penetrometer is required for the exceptional area or areas.

10.1.4 All radiographs shall be free from mechanical, chemical or other processing defects that could interfere with proper interpretation of the radiograph.

11.0 DOCUMENTATION

11.1 Record the radiographs with their grading, on a "Radiographic Interpretation Report". (See typical sample in attachment no 1)

11.1.1 Record the spot radiography and 100% radiography on separate report forms.

11.1.2 Acceptable radiographs may be combined on one line of the report, provided the interval numbers are consecutive.

11.1.3 List reconfirm separately in sequence and mark them RC1, RC2, etc.

11.1.4 List repairs separately in sequence and mark them R1, R2, etc.

11.1.5 List reshoots, taken for reasons other than either of the above, separately from the original film and mark then RS.

11.1.6 When inaccessibility or other limitations prevent the location of markers as stipulated in Paragraph 8.2.1 or 8.2.2, a dimensioned sketch of the geometric arrangement including marker locations shall be documented on sketch of "Radiography Examination" form.

11.2 The following radiographs need not be retained or recorded.

11.2.1 In-Process Radiographs taken for information only on an area of a joint not fully welded regardless of whether or not they are used for making repairs.

11.2.2 Technique radiographs showing no reject able indications taken to establish parameters that produce radiographs that meet the film quality requirements of this procedure.

11.2.3 Radiographs showing no reject able indications, but unacceptable from standpoint of film quality requirements due to defective film, improper processing, physical damage, or improper technique.

11.2.4 Radiographs that cannot be identified as to location (i.e. vessel number, pipe number, joint number, film number).

12.0 NUMBER AND LENGTH OF FILM

Pipe Dia.	No. of Film	Film size	Technique
3.5" & less	2	3.5" x 8.5"	DWDI
4"	3	3.5" x 8.5"	DWSI
6"	4	3.5" x 8.5"	DWSI
8"	5	3.5" x 8.5"	DWSI
10"	3	3.5" x 17"	DWSI
12"	3	3.5" x 17"	DWSI or SWSI
14"	3	3.5" x 17"	DWSI or SWSI
18"	4	3.5" x 17"	DWSI or SWSI
20"	5	3.5" x 17"	DWSI or SWSI
24"	5	3.5" x 17"	DWSI or SWSI
28"	6	3.5" x 17"	DWSI or SWSI
30"	6	3.5" x 17"	DWSI or SWSI

13.0 RADIOGRAPHIC SAFETY PROCEDURE

13.1 General:

The purpose of this procedure is to make employees fully aware of their responsibilities regarding personal safety and the safe usage of radioactive sources and/or irradiating apparatus no set of rules can guarantee safety at work co-operation and common sense are required as well, from all parties concerned, if incidents and accidents. This safety procedure is based on the requirement of Thai laws, and has been approved.

13.2 Operator's responsibility:

No person shall operate any irradiating apparatus or radioactive substance without the use and knowledge of application of

- A functional radiation survey meter.
- A functional personal radiation monitor, a dosimeter and or film badge.

13.3 Working rules:

13.3.1 Handling and usage of radiographic equipment

Before proceeding to the job site, the radiography worker has to ensure that he has a functional radiation (monitor) survey meter and that the equipment he is intending to use is fully operational. Any abnormalities or irregularities in the operation of the equipment should immediately be reported to management for corrective action and maintenance.

During the transport of gamma radiography equipment, the source container is to be secured to the vehicle to prevent any accidental shift under conditions normally expected during transport, and located in or on the vehicle so that the radiation dose received by any person traveling in the vehicle is minimized and within safe limits. Only radiation workers are permitted in the vehicle and the dose rate to any persons shall be verified to be less than 20 uSv (micro seivert) per hour by measurement before commencing the journey, at appropriate times during the journey and on arrival at destination.

13.3.2 Working rule for an open site (Field)

1. On first arriving at the site, the operator shall:
   - advise the person responsible for the area in which the radiography site will be set up of the intended operations and the estimated amount of time required to complete the work, and
   - as certain the nature, duration and location of all other work to be performed in the vicinity of the site and the possible points of entry to the site.
2. Before commencing exposures, a well-defined and clearly visible boundary shall be erected around the site, including above and below as necessary, such that the does rate at the boundary shall not exceed 25 uGy/hr during exposures. This shall be checked periodically by the operator by means of a survey meter. The boundary shall be marked with radiation warning signs. Warning lights shall be used to indicate that an exposure is under way. The area within the boundary shall be kept under surveillance at all times during exposures to ensure that no person enters it or remains within it. Unnecessary occupation of areas near the boundary should be avoided.
3. The boundaries of adjacent exposure sites should not overlap. If an overlap is unavoidable, close liaison shall be maintained between operators responsible for the overlapping sites to avoid accidental exposure.
4. The operator shall, according to appropriate advice prepared by the Engineer, ensure that dose rates in occupied areas are such that no member of the public will receive a dose exceeding 1 mSv per year from radiography performed within the site
5. A second person, who is capable of promptly taking charge in an emergency, shall be immediately available to assist during industrial radiographic

exposures. The second person, the assistant industrial radiographer, must be a radiation worker. This person must be thoroughly familiar with the equipment and it use, the approved working rules and emergency procedures appropriate to work and the relevant requirements.

6. Wherever possible, collimators shall be used to restrict the area of primary radiation beam to the minimum necessary for radiography. Radiography equipment and the item to be radiographed shall be set up so that each of components, particularly the X-ray tube or the source, are stable and therefore will not move during the exposure.
7. Before commencing an exposure the operator shall ensure by inspection the all-unauthorized persons are outside the boundary and that the assistant operators are in an area where the dose rate is as low as, or lower than, where he or she is.
8. Just prior to commencing an exposure, a signal shall be given to warn persons within a reasonable distance that an exposure is about to take place.
9. A personal radiation monitoring device and a personal dosimeter shall be worn by the operator and assistant operators at all times during industrial radiography operations.
10. The operator shall continually check the radiation level at his or her location during exposure using a survey meter.
11. The operator alone shall exercise control over:
    - the radiation source during exposure; and
    - the occupancy of the site during the period of exposure of the source by continuous and competent supervision of the site.
12. Care shall be taken at all times to ensure that unauthorized persons cannot operate the equipment.
13. Before a site is vacated. The operator shall ensure, by monitoring, that all radiation source is locked in the fully shielded condition or switched off, as appropriate, and returned to the source container store or to the transport vehicle and that all boundary-defining equipment has been removed. The operator shall inform the person responsible for the area when this has been carried out.

14.0 REFERENCE

ASME B31.8	Gas Transmission and Distribution Piping System
API 1104	Welding of Pipelines and Related Facilities

15.0 ATTACHMENT

Attachment : Radiographic Examination Report Form (Sample)

PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED
NDT, TESTING, INSPECTION & ENGINEERING CONSULTANT
TEL : 02-721-2742 , FAX : 02) 721-2577 , RAYONG : 038) 682208-9 , SRIRACHA : 038) 116-947-8

Page : 1 of 1

REPORT No. / Project No. / Shooting Date:	RADIOGRAPHIC EXAMINATION REPORT	INSPECTION & TEST RECORDS

CLIENT : | PROJECT NAME :

PROCEDURE No. :	PAE-RT-001 (Rev.0)	EXPOSURE TIME	- min. - sec.	SOURCE TO FILM DISTANCE	Inch.
RADIATION SOURCE	γ - ray (Ir-192)	FILM DENSITY RANGE	2.0 - 4.0	TYPE OF	☐ ASTM 1A
SOURCE STRENGTH	Ci.	SENSITIVITY	Essential Wire No. T-276	PENETRAMETER	☐ ASTM 1B
SOURCE SIZE	3 x 2.5 mm.	Wire required No.	Visible No.	KOI PLACEMENT	☐ Source Side ☐ Film Side
INDUSTREX FILM	MX125 "Carestream"	Wire Achieved No.	Visible No.	FILM PROCESSING	MANUAL
SIZE		INTENSIFYING FRONT	0.005 Inch.	MATERIAL	
FILM LOADING	1	SCREEN BACK	0.005 Inch.	THICKNESS	mm

RADIOGRAPHIC TECHNIQUE : ☐ SWSI ☐ DWSI ☐ DWDI ☐ Superimposed

APPLICABLE STANDARD : ASME Section V Article 2 | ACCEPTANCE CRITERIA : ASME B31.3 Table 341.3.2 Normal Fluid Service

Dwg / Line / Sheet No.	Joint No.	Pipe/Plate Size Dia.	Pipe/Plate Size Thk.	Welder No.	Film No.	Type of Defects / Size	Results	Density Achieved	Remarks
						Total	3.5"x8.5"	-	Films
							3.5"x17"	-	Films

ABBREVIATIONS :

ACC : Accepted	P : Porosity	RUC : Root Undercut	CRP : Concave Root Penetration
REJ : Rejected	CP : Cluster Porosity	SI : Slag Inclusion	ERP : Excessive Root Penetration
RS : Reshoot	WH : Worm Hole	LP : Lack of Penetration	BT : Burn Through
NAD : No Apparent Defects	IUC : Intermittent Undercut	LOF : Lack of Fusion	TI : Tungsten Inclusion
C : Crack	EUC : External Undercut	IP : Incomplete Penetration	SF : Surface Flaw

Completed by :	Interpreted by	Reviewed/Witnessed by	Approved by
Company :	PAE Technical Service Public Co.,Ltd.		
Signature :			
Name :			
Date :			

MAGNETIC PARTICLE EXAMINATION TEST PROCEDURE

1.0 SCOPE

This magnetic particle examination procedure is to be applied in additional to visual inspection for inspecting of imperfection of welds. Magnetic particle examination shall be performed in accordance with a procedure. Such a procedure shall consider at least the following information.

2.0 REFERENCE

The current edition of the following documents has been referenced in the preparation of this procedure and shall be considered a part of this procedure as applicable to:

API 1104	Welding of Pipelines and Related Facilities
ASTM-E 709	Standard recommended practice for magnetic particle examination. American Society for Non-destructive Testing (ASNT) Recommended practice, Personnel Qualification and Certification in Non-destructive Testing
ASME Section IX	Qualification Standard for Welding, Brazing, and Fusing Procedure; Welders; Brazers; and Welding, Brazing, and Fusing Operators

3.0 QUALIFICATION of PERSONEL

3.1 Personnel performing magnetic particle examination shall be qualified and certified in accordance with 3rd party quality control procedure shall be developed in accordance with ASNT SNT.TC-1A or of equivalent competence.

3.2 Personnel performing magnetic particle examination and recording the test results shall have, as a minimum Level II certification Level I individuals may perform the examination only under the supervision of Level II or Level III individual.

3.3 The examiner shall have an annual vision test with correction if necessary equivalent to 20/30 for distance and is able to read a Jaeger Type # 2 standard chart at a distance of not less than twelve (12) inches. He shall be capable of distinguishing and differentiating contrast between colours used.

4.0 EQUIPMENT and MATERIALS

4.1 Type of Magnetic Particle

This project shall apply both of wet and dry of magnetic particle. The selection between two types is up to type of welding, position of welding and time require for cool down of weld joint.

4.2 Equipment

Name	Manufacturer	Model No.	Remark
Yoke	Magnaflux	Y-6	230 VAC
Black light	Spectronics Corporation	BIB-150B/F	110VAC

5.0 SURFACE PREPARATION

5.1 The surface of the part to be examined should be essentially clean, dry and free of contamination such as oil, grease, loose rust, loose sand, loose scale, thick paint and weld spatter.

5.2 Nonconductive coatings, such as paint in the order of 1 or 2 mils (0.02 to 0.05 mm), will not normally interfere with the formation of indications, but they must be removed at all point where electrical contact is to be made.

5.3 Cleaning of the test surface may be accomplished by detergents, organic solvents or mechanical means. As-welded, as-rolled, as-cost, or as-forged surfaces are generally satisfactory, but if the surface is unusually non-uniform, as with burned-in sand or a very rough weld deposit, interpretation may be difficult because of mechanical entrapment of the magnetic particles.

6.0 DESCRIPTION of METHOD

6.1 This procedure involves magnetizing the area to be examined, followed by applying ferromagnetic particles (the examination medium) to the surface. The particles will form patterns on the surface where cracks and other discontinuities cause distortion in the normal magnetic field.

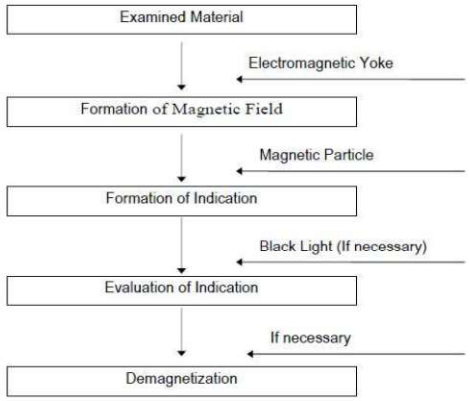
6.2 Which ever technique is used, maximum sensitivity will be to linear discontinuities oriented perpendicular to the lines of flux.

6.3 For optimum effectiveness, each area should be examined at least twice, with lines of flux during one examination, approximately perpendicular to the lines of flux during the other.

7.0 SEQUENCE of OPERATION

7.1 Examination shall be done by the continuous method; that is the magnetizing current remains on while excess of the examination medium is being removed.

7.2 Process sequence is as follow:



8.0 MAGNETIZATION CURRENT

8.1 Alternating Current (AC) shall be used if inspection is limited strictly to discontinuities extending to the surface.

8.2 Direct current (DC) shall be used to indicate discontinuities which may be slightly under the surface.

9.0 MAGNETIC FIELD INDICATOR

9.1 A magnetic field indicator may be used as a convenient rough check of the adequacy and direction of part magnetization.

9.2 Sufficient magnetic field must be generated in the part under examination to clearly develop the test pattern in the indicator.

9.3 Using the field indicator, a suitable flux or field strength is indicated when a clearly defined line of magnetic particles from across the copper face of the indicator when the magnetic particles are applied simultaneously with the magnetic force.

10.0 TECHNIQUE

10.1 The magnetizing force of yokes shall be checked at interval stated in paragraph 10, or whenever a yoke has been damage. If a yoke has not been in use for a year or more a check shall be done prior to first use.

10.2 Alternating current yoke shall have a lifting power of at least 10 pounds (4.5 Kg) at the maximum pole spacing that will be used.

10.3 Each weight shall be weighed with a scale from a reputable manufacturer and stenciled with the application nominal weight prior to first use.

11.0 CALIBRATION of EQUIPMENT

Frequency of calibration as detail below:

11.1 The magnetizing force of all yokes shall be checked on 6 months interval basis, or whenever the yoke has been damage.

11.2 AC yokes shall meet the minimum requirement as specified in ASTM-E 709 Standard recommended practice for magnetic particle examination.

12.0 DIRECTION of MAGNETIZATION

At least two separate examinations shall be carried out on each area. In the second examination the lines of magnetic flux shall be approximately perpendicular to those used for the first examination. The examination shall be conducted with sufficient overlap to assure 100% coverage.

13.0 WET MAGNETIC PARTICLE

13.1 Wet magnetic particles to be used shall be Magnaflux 7HF (prepared bath) black (or equivalent). Wet particles are designed to suspend in a vehicle such as water or oil at a given concentration for application to be test surface by flowing, spraying or pouring.

13.2 The wet particles are available in both fluorescent and non-fluorescent concentrates.

13.3 Wet methods inspection are generally used to locate smaller discontinuities than the dry method.

13.4 The 7HF is composed of 7C Black Magnaflux powder suspended in a low volatility mineral oil.

13.5 When using the continuous magnetizing method, fix the part in the magnetizing unit, cover the surface quickly with 7HF spray and immediately magnetize the part.

13.6 Magnaflux 7HF shall be vigorously agitated by shaking can a minimum of 15 seconds immediately prior to application and occasionally during use. It shall be applied in an even spray pattern with the applicator nozzle held from seven to twelve inches from the magnetized surface to be examined. Spray application shall continue until the film of suspension is continuous and even all over the area to be examined. Additional spray application may be used as needed.

13.7 Each new batch number of magnetic particles shall be checked for performance/sensitivity upon receipt. A minimum of one container of each "In stock" batch number of wet magnetic particle shall be checked for performance/sensitivity a minimum of one every six-months, or at any time an examiner has any reason to question the performance/sensitivity of a particular wet magnetic particle batch number or when requested by client.

14.0 DRY MAGNETIC PARTICLE

14.1 Prepare the part surface – the surface should be relatively clean but this is not as critical as it is with liquid penetrant inspection. The surface must be free of grease, oil or other moisture that could keep particles from moving freely. A thin layer of paint, rust or scale will reduce test sensitivity but can sometimes be left in place with adequate results. Specifications often allow up to 0.003 inch (0.076 mm) of a nonconductive coating (such

as paint) and 0.001 inch max (0.025 mm) of a ferromagnetic coating (such as nickel) to be left on the surface. Any loose dirt, paint, rust or scale must be removed.

14.2 Magnetic Flux - A measure of quantity of magnetism, taking account of the strength and the extent of a magnetic field. The total number or lines of force existing in a magnetic circuit

14.3 Dust on the dry magnetic particles - Dust on a light layer of magnetic particles.

14.4 Gently blow off the excess powder - With the magnetizing force still applied, remove the excess powder from the surface with a few gentle puffs of dry air. The force of the air needs to be strong enough to remove the excess particles but not strong enough to dislodge particles held by a magnetic flux leakage field.

14.5 Terminate the magnetizing force – If the magnetic flux is being generated with an electromagnet of an electromagnetic field, the magnetizing force should be terminated. If permanent magnets are being used, they can be left in place.

14.6 Inspect for indications – Look for areas where the magnetic particles are clustered.

15.0 WHITE LIGHT INTENSITY CONTROL TEST

White light intensity for examination with non-fluorescent method should be routinely checked to assure adequate white light at the surface of the part being examined as determined by inspector.

16.0 BLACK LIGHT INTENSITY CONTROL TEST

16.1 The black light shall warm up at least 5 minutes prior to use or measurement of the intensity of the ultraviolet light emitted. The black light shall generate its intensity of at least 1000 $\mu W/cm^2$ at part surface to be inspected.

16.2 Post-test cleaning is necessary where magnetic particle material(s) could interfere with subsequent processing or with service requirements.

16.3 Removal of wet particles by flushing with solvent. Other suitable post test cleaning techniques may be used if they will not interfere with subsequent requirements.

17.0 INTERPRETATION of INDICATION

17.1 All valid indication formed by magnetic particle examination are the result of magnetic flux leakage fields. Indication may be relevant or non-relevant.

17.2 Indication caused by particles being held by nonmagnetic forces are false, include particles lying in the depression at the side of a weld or particles wedges in to rust or scale.

17.3 Relevant indications are produced by flux leakage field which are the result of discontinuities that may or may not be acceptable.

17.4 Relevant indication should be evaluated in terms of API 1104 Welding of Pipelines and Related Facilities

17.5 No relevant indication can occur singly or in patterns as a result of flux leakage field created by condition such as changes in section.

18.0 EXAMINATION of REPAIRS

Repairs shall be re-examined by the same procedure used for the original examination.

19.0 ACCEPTANCE STANDARD

Magnetic Particle acceptance standards shall be in accordance with the requirement of API 1104 Welding of Pipelines and Related Facilities and contact specification.

20.0 REPORT

A "Magnetic Particle Examination Record" shall be filled out for all acceptable and unacceptable results by 3rd party and shall be submitted to client.

21.0 ATTACHMENT

Attachment : Magnetic Particle Test Report Form (Sample)

PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED
NDT, TESTING, INSPECTION & ENGINEERING CONSULTANT
TEL : 02) 322-0222 , FAX : 02) 721-2577 , RAYONG : 038) 682 208-9 , Fax. 038) 682 206

MAGNETIC PARTICLE TEST REPORT | Report No. : | Page No. 1 of 1 | Test Date :

Client :		Job No. :	
Project :		Weld Process :	
Description :		Material :	
Acceptance Standard :		Procedure No :	PAE-MT-005
Stage of Examination	☐ Prepared Edge ☐ As weld and HAZ	☐ Before / After PWHT ☐ Before / After Hydro Test	☐ Back Chipping ☐ _____
Surface Preparation	☐ Grinding	☐ Brushing	☐ _____
Lighting Type	☐ Sun Light ☐ Min.1000 Lux at 10 mm. from surface	☐ Aretificial Light (Sport light)	☐ Black Light
Calibration	☐ 10 lb (4.5 kg)	☐ 40 lb (18 kg)	
Equipment	☐ Magnaflux	Type : ☐ AC 220 V. ☐ DC 12 V.	☐ Permanent Magnet
Technique	☐ Yoke	☐ Prod ☐ Continuous	☐ Residual
Background	☐ Magnaflux WCP-2	☐ Aerosol Spray Paint	☐ As Base Material
Magnetic Particle	☐ Magnaflux 7HF	Type : ☐ Dry ☐ Wet	☐ Fluorescent / Visible

Line No./ Drawing No.	Joint No.	Size (mm) Length	Thk.	Weld Type	Welder No.	Results	Remarks
	Total		Metre				

Remark/Test Restriction : ACC - Accepted , REJ - Rejected
C - Complies , DNC - Does Not Comply , NSDD - No Surface Discontinuity Detected

Completed by	Inspected by	Witnessed / Reviewed	Owner Approved by
Company	PAE Technical Service PCL.		
Signature			
Name			
Date			

PENETRANT TEST PROCEDURE

1.0 SCOPE

1.1 This examination method shall be used to inspect the surface of ferromagnetic or nonferromagnetic. Level II personnel shall endorsed signature on the reports.

1.2 This procedure is to be used only when surfaces being examined are in temperature range of 50ºF (10ºC) to 125ºF (52ºC).

1.3 This procedure is certified to meet the requirements of paragraph T-150 of the ASME Section V Code.

2.0 PERSONNEL

Personnel certified to at least a Level I, who meet the requirements of SNT-TC-1A or equivalent, shall perform and evaluate the examinations.

3.0 REFERENCE

- API 1104
- ASME Section V, Article 6
- ASME B31.3
- ASME Section IX

4.0 PENETRANT MATERIALS

4.1 Typical penetrant materials to be used with this procedure are: (Do not intermix PT types).

Manufacture : SHERWIN INCORPORATED.

Trade Name : Dubl – Chek

Dye Penetrant : DP – 51

Liq. Developer : D – 106

Cleaner/Remover : DR – 62

Method : Solvent-removability color penetration testing method.

4.2 Typical Cleaning Agents: In addition to the penetrant cleaners, detergents, organic solvents, descaling solutions, solution may be used for cleaning.

NOTE:

When examining nickel base alloys or austenitic stainless steels, all materials, including penetrants, solvents or cleaning agents, developers, etc., shall be analyzed individually for residual total sulfur, chlorine and fluorine content in accordance with Section V, Article 6, Para. T-625. For nickel base alloys, the residual total sulfur content shall not exceed one (1) percent by weight. For austenitic stainless steels, the residual total chlorine and fluorine content shall not exceed one (1) percent by weight. Cleaning solvents and agents purchased with known chemical composition do not require analysis.

5.0 PROCEDURE

5.1 Prepare, clean and dry the surface to be examined and all adjacent areas within one (1) inch (25 mm.).

5.1.1 Remove surface materials such as dirt, rust, scale, weld flux, spatter, paint, grease, oily films, water, or other matter that could obstruct the entrance of the penetrant into a discontinuity. As-welded, as-rolled, or as-forged condition are generally satisfactory, but surface preparation by grinding or brushing may be necessary where surface irregularities could interfere with the final examination results.

5.1.2 When brushing austenitic or nickel base alloys use stainless wire brushed.

5.2 Dry wet surfaces to be examined by normal evaporation to ensure that no trace of cleaning agent remains on the surface.

5.3 Provide adequate lighting for this examination.

5.4 The temperature of the surface to be examined, the penetrant, the remover and the developer must be between 50°F (10°C) and 125°F (52°C) throughout the examination. Local heating or cooling is permitted provided temperatures remain in the range of 50°F-125°F(10°C-52°C).

5.5 Apply penetrant by spraying. The penetration time shall be at least ten (10) minutes. This minimum time may have to be extended and qualified under certain conditions such as when it is not possible to maintain the temperature above 50°F (10°C) or when a longer penetration time is recommended by the manufacturer.

5.6 After the penetration time has elapsed, remove the excess penetrant from the surface being examined by wiping with clean material or cloth and then spray the cleaning agent on the cloth and wiping again until most traces of penetrant have been removed.

5.7 Within thirty (30) minutes after removing the excess penetrant, apply the developer in a thin, even coating (agitate to ensure that particles in suspension are dispersed) by spraying. Avoid lapping and running developer to prevent masking indications. Let developer dry.

5.8 Observe the surface during the application of the developer to detect the nature of indications which bleed excessively. Final interpretation shall be made from seven (7) to thirty (30) minutes after application of the developer.

6.0 EVALUATION OF INDICATIONS

6.1 All indications shall be evaluated in terms of the acceptance standards.

6.2 Non-relevant Indications - Any indication which is believed to be non-relevant shall be regarded as a defect and shall be re-examined to verify whether or not actual defects are present. Surface conditioning may precede the re-examination. Non-relevant indications which would mask indications of defects are unacceptable.

6.3 Relevant indications are those which result from mechanical discontinuities.

6.4 Linear indications are those indications in which the length is more than three (3) times the width.

6.5 Rounded indications are those indications which are circular or elliptical with the length equal to or less than three (3) times the width.

7.0 ACCEPTANCE STANDARDS

7.1 The following relevant indications are unacceptable :

7.1.1 Any linear indications.

7.1.2 Rounded indications with dimensions greater than 3/16 inch (4.8 mm.).

7.1.3 Four (4) or more rounded indications in a line separated by 1/16 inch (1.6 mm.) or less edge-to-edge.

7.2 All surfaces of alloy cladding or lining welds required to be examined shall be free of cracks

NOTES:

- Only indications with major dimensions greater than 1/16 inch (1.6 mm.) are considered relevant.
- An indications of an imperfection may be larger than the imperfection that causes it; however, the size of the indication is the basis for acceptance evaluation.

8.0 REPAIRS

8.1 When an imperfection is repaired by chipping or grinding and subsequent repair by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices or corners.

8.2 When an imperfection is to be repaired by welding, after the imperfection is thought to have been removed and prior to making weld repairs, the area shall be examined by the applicable steps in 6.0 to ensure it has been removed or reduced to an acceptably sized imperfection.

9.0 ATTACHMENT

Attachment 1 -Liquid Penetrant Test Report Form (sample)

PAE TECHNICAL SERVICE PUBLIC COMPANY LIMITED
NDT, TESTING, INSPECTION & ENGINEERING CONSULTANT
TEL : 02) 322-0222 , FAX : 02) 721-2577 , RAYONG : 038) 682 208-9 , Fax. 038) 682 206

LIQUID PENETRANT TEST REPORT			Report No. :	Page No.
			Date :	
Client :			Test Procedure : PAE # 006	
Project Name :			Test Product : ☐ Plate ☐ Pipe	
Name of Parts :	Material :		☐ Weld ☐ Other Specify	
Stage of Test	☐ Prepared Edge ☐ Before / After PWHT ☐ Back Chipping			
	☐ As Welded ☐ Before / After Hydro Test ☐ Other Specify			
Surface Preparation	☐ Grinding ☐ Brushing ☐ Solvent Cleaning			
Lighting	Type	☐ Sun Light ☐ Aretificial Light (Sport light) ☐ Black Light		
	Level	☐ Min.1000 Lux at 10 mm. from surface		
Technique :	Inspection Method :	Chemical Product :Manufacturer	Inspection Technique :	
☐ Water Washable Penetrants	☐ Visible	- Penetrant : Magnaflux SKL-SP1	- Cleaner Remove	
☐ Post - Emulsifying Penetrants	☐ Fluorescent	- Cleaner : Magnaflux SKC-S	- Penetrant Dwell Time 5 Min.	
☐ Solvent - Removable Penetrants		- Developer : Magnaflux SKD-S2	- Developer Dwell Time 10 Min.	
Application Standard : ASME-V Article 6		Acceptance Standard :		

DWG No. / Line No. / Iso No.	Sheet No.	Joint No.	Joint Type	Size		Welder No.	Results	Remarks
				Dia.	Thk.			
			Total		DI			

Note : ☐ Bevel ☐ Root Pass ☐ Cover Pass

Completed by	Inspected by	Witnessed / Reviewed	Owner Approved by
Company	PAE Technical Service PCL		
SIGNATURE :			
NAME :			
DATE :			

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	ABOVEGROUND PIPING CLEANING, HYDROSTATIC TESTING AND DRYING PROCEDURE	
DOCUMENT NO.:	PR-P-2201.15-0637-002	REVISION: 0

REVIEW STAMP		COMMENTS
☐ E. Work may proceed.		
☐ F. Work may proceed. Submit Final Document / Drawing.		
☐ G. Revise and Resubmit. Work may proceed Subject to incorporation of changes indicated.		
☐ H. Revise and Resubmit. Work may not proceed.		
☐ I. Review not required. Work may proceed.		
Acceptance in any of these categories shall be in no way relieve the Contractor/Supplier of its responsibility for the due and proper performance of the Work in accordance with the Contract/Purchase Order.		
Name:		
Sign:		
Date:		

Rev.	Date	Description	Prepared By	Checked By	Approved By
0	03 Oct. 2022	Issued for Construction	SKW	KPS	PJK
B	09 Sep. 2022	Re Issued for Approval	SKW	KPS	PJK
A	22 Aug. 2022	Issued for Approval	SKW	KPS	PJK

CONTRACTOR:

INSTRUMECH COMPANY LIMITED

DOCUMENT CHANGE RECORD

Rev	Date	Prepared/ Revised By	Reviewed By	Approved By	Description
A	22 Aug. 2022	SKW	KPS	PJK	Issue for Approval
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1.0 PURPOSE

The purpose of this procedure is to provide specific instructions to the construction personnel to enable them to carry out cleaning, hydrostatic testing and drying aboveground piping of WNMR Onshore 4 & 5PL Connection Project. in accordance with project requirements.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 SCOPE OF PROCEDURE

The scope of this procedure is applicable to all cleaning, hydrostatic and drying to be carried out for aboveground piping work in WNMR Onshore 4 & 5PL Connection Project

The aim of this procedure is to provide the criteria for the works of all process, service and utility piping, including the controlling, reporting and inspecting. The requirements of this procedure does not cover pressure testing of shop fabricated equipment such as vessels, tanks, heat exchangers and skid mounted piping.

All piping systems shall be tested in accordance with approved line lists, procedures, quality and safety plans, specifications and applicable codes and standards listed.

A complete hydrostatic testing shall be performed on all nominated systems and any specified equipment upon completion of construction work but before final Painting and insulation shall be applied.

4.0 DEFINITIONS

PTT	means	PTT Public Company Limited.
Project	means	WNMR Onshore 4 & 5PL Connection Project
Contractor	means	Instrumech Company Limited.
SMYS	means	Specified Minimum Yield Stress.
Dewatering	means	Removal of water from the pipe which can be carried out by various means such as draining and pigging.
Drying	means	Removal of internal surface water, remaining after dewatering, by methods such as dry air, swabbing and vacuum evaporation.
P&IDs	means	Piping and Instrument Diagrams
EIA	means	Environment Impact Assessment
JSEA	means	Job Safety and Environmental Analysis

5.0 RESPONSIBILITY

5.1 Operation Manager has the overall authority and responsibility for the execution of this project regarding anticipated job quality, effective cost control and schedule control, and for the entire project management toward the successful completion of the project

5.2 The Operation Manager shall be responsible for ensuring that personnel are adequately trained, and that equipment is fit for use to complete activities defined within this procedure and project requirement. He reports to the Lead Project and has the overall responsibility for HSS&E implementation and results.

5.3 QA/QC Manager / Engineer are responsible for ensuring that all Quality Assurance and Control activities are carried- out in accordance with Project Requirements.

5.4 HSS&E Manager is responsible for Health, safety, security and environment compliance.

5.5 The Contractor is responsible for carrying out all activities associated with this procedure.

5.6 The Quality Control Representative is responsible for ensuring that all works are carried out in accordance with this procedure and project requirements.

5.7 Specific Responsibilities

The works shall be scheduled and controlled by Contractor Engineers, in liaison with Construction. The Piping Superintendent will ensure that the line/systems are fabricated and installed in accordance with the P&ID's, piping plan drawings, specifications and piping isometrics. Construction will request Contractor & Owner QA/QC Inspectors to "punch" the line/ system.

Contractor & PTT QA/QC Inspectors shall verify the line is constructed according to the construction drawings and specifications and confirm relevant certifications associated with the line/system are correctly filled out and in order. Contractor QA/QC will inform Contractor when the line is ready for testing.

Contractor shall package and monitor the status of the test pack. The test pack with all the original certificates will be held in the Engineering Department. Field packs (consisting of photocopied P&ID's, isometrics with testing limits) will be developed and issued to construction to expedite and facilitate hydrostatic testing.

Contractor shall submit the hydrostatic test packs for PTT review prior to the execution of pressure tests.

PTT is to witness and acknowledge testing and submit test results to PTT

Contractor QA/QC is to inspect all flushing and drying of the tested system as per Environment Impact Assessment requirement.

6.0 CLEANING, HYDROTESTING AND DRYING

6.1 General

For In shop pipe shall be tested before buried. A detailed Hydrostatic Test Pack will be prepared for test detailing the following;

- Extent of pipe to be tested.
- Line list of piping to be tested and indication of whether the whole or part of a line is to be tested.
- Items to be removed (control valves, filters, pressure regulators, orifice plates, instruments and instrument lines).
- Location of blinds, spades, end caps, plugs or other means of terminating pipe for testing.
- Test pressures and test pressure limits.

Notice shall be given to Owner/Consultant prior to cleaning, hydrostatic testing and drying operations. The following shall be received by Owner/Consultant prior to proceeding with the respective work:

- Approval of the piping system test package (prior to test)
- Construction complete on piping system to be tested (prior to cleaning)
- Preparation complete, system ready for test (prior to test)
- Pressure test completed and accepted (prior to drying)
- Restoration of piping system complete (after drying)

6.2 Test Headers

Any fabricated test headers used to terminate the shop piping will be complete of NDT and hydro-tested prior to use at a pressure of at least 1.5 times the maximum test pressure and certified.

6.3 Cleaning during Fabrication and Installation

Care shall be taken in fabrication and installation to ensure that foreign material is excluded from the inside of the piping. Where appropriate, air blowing or flushing may be used

where foreign material is suspected. Any air blowing or flushing should be carried out prior to installation of valves.

6.4 Preparation for Testing

Prior to filling and testing, the section to be tested shall be prepared by installing suitable blinding to isolate the section. Any fitting not suitable for the test pressure (such as relief valves, safety valves) or items not to be included in the test (such as control valves, filters, orifice plates, instruments and instrument lines) are to be removed or isolated and appropriate blinding installed.

Check valves are either to be removed or pressure equalization provided. Ball valves are either to be in the half open position or to have equalization provided between the body cavity and the bore. Plug valves may be left fully open.

6.5 Final Check Prior to Filling.

The proposed pipe to be tested shall be checked before filling to ensure completeness, correct pressure rating for the test, status of removal or isolation of items to be excluded from the test, correct location and installation of spades, blinds, plugs and other forms of termination. The final check shall include a check on the fabrication to ensure completeness of NDT and required traceability.

6.6 Water Sources and Filling

The water to be used will either be supplied directly from the domestic water supply or via water tankers from the domestic water supply. The water to be used shall passed chlorides test with reliable laboratory, That must contain less than 50 ppm chlorides. Chemical treatment is otherwise not required.

Filling will take place from the low points if possible with venting at the high points. This may be assisted by using the pressurizing pump or a pump to assist with care being taken to stop the pump prior to closing the last vent.Water to be tested prior usage and after before discharging as per EIA requirement. Water Certification shall be submitted.

6.7 Instrumentation and Calibration

Test gauge will be used to record the pressures. Test gauges are used will be calibrated by third party prior to test. Either a pressure chart recorder or a pressure transducer connected to a data logger will be used in addition to the test gauge. The pressure recorder or transducer/data logger combination used for pressure tests will be externally calibrated by third party. In addition, the temperature shall be taken and recorded with temperature recorder – calibrated.

Certificate of testing instruments are required prior to perform test. The Calibration date shall not exceed 6 month till testing date.

6.8 Testing

The assembly will be tested above the minimum test pressure specified in the line list for a period Min. of 2 hours or until complete inspection of all joints is carried out, whichever is the longer.

The maximum pressure shall not exceed the yield strength of the pipe or the lowest rating of any included fittings. The minimum test pressure and permitted pressure range shall be detailed in the relevant test pack.

On completion of the pressure test, the pressure shall be reduced to static pressure and the vents at the high points left open.

6.9 Test Acceptance

Piping test acceptance is based on the pipe and fittings withstanding the pressure for the required duration without any leaks detected visually. In addition, the pressure shall be check form pressure gauge, pressure recorder, dead weight tester and record. Any leakage which occurs in permanent fittings or pipe is to be rectified and then the test repeated. record. Any leakage which occurs in permanent fittings or pipe is to be rectified and then the test repeated.

6.10 Draining

On successful completion of the test, the piping is to be drained from low points assisted by venting at the high points to the drainage system in. The test water shall be checked

prior to discharge to the drainage system. The acceptance criteria for the water are as the following:

pH	Between 5.5-9.0
Temperature	< 40°C
SS	< 50 mg/l
Oil & grease	< 5 mg/l

If the quality of the water is not meet the acceptance criteria, Contractor shall treat the water by using the filter until the water is meet the acceptance criteria prior to discharge to the existing drainage system. (adhere to EIA requirement.)

6.11 Restoration following Testing

Following the pressure test and draining of the relevant spools and subsections of the station, any temporary isolating spades, blinds and caps not required for drying will be removed to permit drying of the complete assembly. Generally, sections tested at different pressures will be reassembled for drying.

6.12 Drying

When all sections of the station are tested and the restoration sufficiently complete to permit drying, the station will be dried.

Drying of the assembly will be carried out using dry compressed air (compressor shall be install water trap and filter system) directed through the piping. It may be necessary to build up pressure and then discharge at high velocity through the pipe work to remove water lying at low points. Drains on valve cavities are to be opened and the cavities blown out.

Blowdown lines will not be dried and will be blown through to remove the bulk of water remaining following testing. This will be carried out during the drying of the station by discharging out through the blowdown lines.

Valve bodies and instrument lines shall be dried using dry compressed air.

6.13 Restoration of the System

On completion of drying, the station is to be reinstated in readiness for commissioning. All items removed or blinded for testing are to be reinstated. Connection to pipeline section, all are to be put into operating condition.

7.0 REPORTING

Contractor will maintain complete and comprehensive records of all hydrostatic tests. Records will be accurately dated and shall be clearly identified with respect to the specific pipe section to which they apply. The final test pack for tested sections shall include:

- Test Instrument calibration certificates.
- A written record of events that transpired during the test period including comments on all leaks and failures and their dispositions.
- Logs showing pressure, pipe wall temperature and ambient temperature readings with the data and time for each reading graph charts. Each log sheet shall be signed by Contractor / PTT.
- Pressure recorder charts or data logger readings/manual readings and the plotted data.
- Corrected isometric plans or piping plans with all material related to the test identified.
- List of Items excluded from the test
- Piping Pressure Test Approval Form signed by Owner.
- Location of blinds, spades, end caps, plugs and test heads.

.

8.0 SAFETY

Contractor shall implement measures to keep persons not working on the testing operation away from the test area. Contractor shall erect barricades to restrict the test area. Approval from Owner/Consultant shall be obtained on the measures to be implemented and on the structures to be erected before starting the hydrostatic testing program.

9.0 REFERENCE DOCUMENTS

ASME B31.3	Process Piping
ASME B31.8	Gas Transmission and Distribution Piping Systems
PR-Z-2201.15-0637-001	Piping Non-Destructive Test Procedure
MN-X-2201.15-0637-001	Job Safety Environment Analysis
EIA	Environmental Impact Assessment

10.0 ATTACHMENTS

ATTACHMENT 1 : INLET STATION PRESSURE

ATTACHMENT 2 : SCHEMATIC DIAGRAM FOR HYDROSTATIC TEST

ATTACHMENT 3 : TYPICAL HYDROTEST ARRANGEMENT LAYOUT DRAWING

ATTACHMENT 4 : HYDROSTATIC TEST RECORD FORM

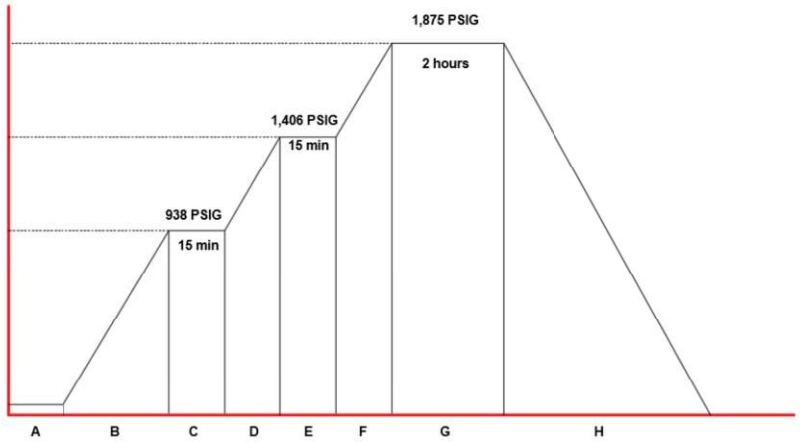
ATTACHMENT 1 : TEST PRESSURE

Test Medium	=	Clean Water
Design Pressure (DP) Class 600	=	1250 PSIG
Test Pressure (**TP**)	=	Strength Test : 1.5 x DP
Test Pressure (**TP**) Class 600	=	1875 PSIG

Note : The Design pressure reference form document : PTT SP-P-000-01 Specification for Piping Material Classes Revision 0 "PIPING MATERIAL CLASSE D60" page 20.

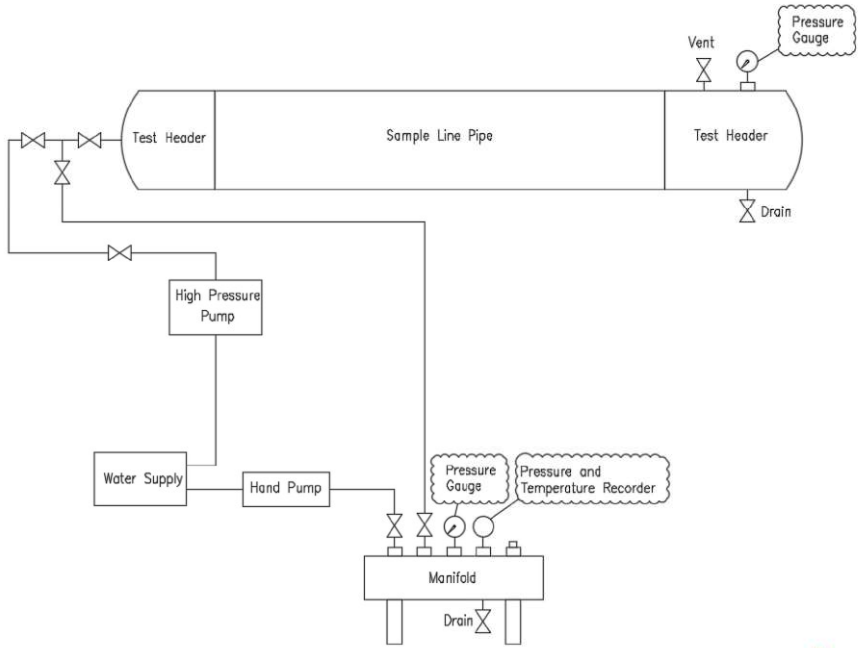
ATTACHMENT 2 : SCHEMATIC DIAGRAM FOR HYDROSTATIC TEST

Pressurizing Chart



A = Water Filling
B, D and F = Levelling
C = 50% of Test Pressure
E = 75% of Test Pressure
G = 1.5 of Design Pressure
H = Depressurize

ATTACHMENT 3 : TYPICAL HYDROTEST ARRANGEMENT LAYOUT DRAWING



B

ATTACHMENT 4 : HYDROSTATIC TEST RECORD FORM (Sample)

HYDROSTATIC TEST RECORD

INSTRUMECH COMPANY LIMITED

PROJECT NAME	: WNMR Onshore 4 & 5PL Connection Project		
OWNER	: PTT PUBLIC COMPANY LIMITED	REPORT NO.	:
CONTRACTOR	: INSTRUMECH COMPANY LIMITED	ISSUE DATE	:
SUB-CONTRACTOR	:	TEST PACKAGE NO.	:
		PAGE :	of

TEST INSTRUMENT DETAIL	PRESSURE INDICCATIOR	CHART RECORDER
BRAND NAME		
TYPE		
SERIAL NO.		
OPERATING RANGE		

DURATION TIME	PRESSURE			AMBIENT TEMPERATURE (°C)	PRESSURIZING STEP	REMARK
	PRESSURE INDICATOR		CHART			
	P 1 (PSIG)	P 2 (PSIG)	RECORDER (PSIG)			

COMMENT/NOTE : .....

Recorded by	:	Company		Date	
Inspected by	:	Company		Date	
Witnessed by	:	Company		Date	
Approved by	:	Company		Date	

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	UNDERGROUND PIPELINE CLEANING, HYDROSTATIC TESTING AND DRYING PROCEDURE	
DOCUMENT NO.:	PR-P-2201.15-0637-003	REVISION: 0

REVIEW STAMP	COMMENTS
☐ E. Work may proceed.	
☐ F. Work may proceed. Submit Final Document / Drawing.	
☐ G. Revise and Resubmit. Work may proceed Subject to incorporation of changes indicated.	
☐ H. Revise and Resubmit. Work may not proceed.	
☐ I. Review not required. Work may proceed.	
Acceptance in any of these categories shall be in no way relieve the Contractor/Supplier of its responsibility for the due and proper performance of the Work in accordance with the Contract/Purchase Order.	
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B	01 Oct. 2022	Re Issue for Approval	SKW	KPS	PJK
A	21 Sep. 2022	Issued for Approval	SKW	KPS	PJK

INSTRUMECH COMPANY LIMITED

CONTRACTOR:

INSTRUMECH COMPANY LIMITED

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1.0 PURPOSE

The purpose of this procedure is to provide specific instructions to the construction personnel to enable them to carry out cleaning, gauging, hydrostatic testing and drying for pipeline of WNMR Onshore 4 & 5PL Connection Project. in accordance with project requirements.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through the Wang Noi Pipeline - Kaeng Khoi and 5th natural gas pipeline connect at WNMRS. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

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- Supply main equipment, pipe fitting and accessories.
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3.0 SCOPE OF PROCEDURE

The scope of this procedure is applicable to all cleaning, gauging, hydrostatic testing and drying to be carried out for buried piping work in WNMR Onshore 4 & 5PL Connection Project

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All pipe systems shall be tested in accordance with approved line lists, procedures, quality and safety plans, specifications and applicable codes and standards listed.

A complete hydrostatic testing shall be performed on all nominated systems and any specified equipment upon completion of construction work but before final Painting and insulation shall be applied.

4.0 DEFINITIONS

PTT	means	PTT Public Company Limited.
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Contractor	means	Instrumech Company Limited.
SMYS	means	Specified Minimum Yield Stress.
Dewatering	means	Removal of water from the pipe which can be carried out by various means such as draining and pigging.
Drying	means	Removal of internal surface water, remaining after dewatering, by methods such as dry air, swabbing and vacuum evaporation.
P&IDs	means	Piping and Instrument Diagrams
EIA	means	Environment Impact Assessment
JSEA	means	Job Safety and Environmental Analysis

5.0 RESPONSIBILITY

5.1 Construction Manager

Construction Manager is responsible for ensuring that Pipeline pressure testing activities for the pipelines shall always be performed by trained, experienced employees in a manner acceptable to Project Specification and Procedure requirements.

5.2 Engineer

Engineer shall be responsible for ensuring activities shall always be performed by competent persons and ensuring activities defined within this procedure are carried out in accordance with procedure, specification and statutory requirements. The Engineer, in conjunction with the Safety Supervisor, is responsible for the safe planning and operation of the works.

5.3 QC Manager

QC Manager is responsible to ensure that all construction inspection and testing requirements have been completed and that the relevant Release certificate has been issued prior to commencement of Pipeline pressure testing activities. All Quality Assurance and Control activities are carried- out in accordance with Project Requirements.

5.4 SH&E Manager

SH&E Manager is responsible for ensuring compliance of all parties with the SH&E requirements of the Project as summarized in article 8.0 of this document. He will provide trained and competent personnel to monitor and assist with compliance by construction personnel with the SH&E requirements, and will assist with the development of JSEA's.

5.5 Specific Responsibilities

The works shall be scheduled and controlled by Contractor Engineers, in liaison with Construction. The Piping Superintendent will ensure that the line/systems are fabricated and installed in accordance with the P&ID's, piping plan drawings, specifications and piping isometrics. Construction will request Contractor & Owner QA/QC Inspectors to "punch" the line/ system.

Contractor & PTT QA/QC Inspectors shall verify the line is constructed according to the construction drawings and specifications and confirm relevant certifications associated with the line/system are correctly filled out and in order. Contractor QA/QC will inform Contractor when the line is ready for testing.

Contractor shall package and monitor the status of the test pack. The test pack with all the original certificates will be held in the Engineering Department. Field packs (consisting of photocopied P&ID's, isometrics with testing limits) will be developed and issued to construction to expedite and facilitate hydrostatic testing.

Contractor shall submit the hydrostatic test packs for PTT review prior to the execution of pressure tests.

PTT is to witness and acknowledge testing and submit test results to PTT

Contractor QA/QC is to inspect all flushing and drying of the tested system as per Environment Impact Assessment requirement.

6.0 CLEANING AND GAUGING

6.1 Cleaning

The test section shall be cleaned to remove all dirt, construction debris, metallic dust and foreign matter. Pigs shall be propelled through the pipeline with compressed air and controlled to an average speed of two (2) meters per second.

The pipeline section shall be accepted as clean when the last pig has no more debris, magnetic matter and/or foreign matter ahead of the pig.

The number of cleaning runs made, quantity and make-up of any foreign matter removed from the test section shall be recorded for each cleaning run performed. All records from each cleaning run, will be included in the final cleaning report.

6.2 Gauging

After successful cleaning operation. A gauging pig shall be run through each test section to ensure that the line is free from unacceptable dents, buckles or obstructions.

The gauging plate shall be installed within the front section of the gauging pig between the leading and trailing seals. The pig will be loaded into the launcher and run down the line. The pig speed will be combined and run as part of the cleaning while the back pressure is controlled at approximately 196-294 kpa.

The gauging plate shall be 10 mm in thickness. The gauging plate diameter shall be determined from the formula:

d = 0.95 ID whichever is smaller,

where:

d = gauging plate diameter in mm

ID = minimum internal diameter mm

The gauging plate shall be inspected by Owner and acceptance sheet shall be signed off by Owner.

6.3 Buckles

If a buckle, dent or other deformity is located, the contractor shall repair the pipe. After the repair the gauging pig shall be run again through the pipeline following the same procedure as the first run.

7.0 HYDROSTATIC TESTING

7.1 General

The hydrostatic test shall not commence before the pipeline construction work is complete and all weld joints have passed radiographic examination.

The release certificate will include a copy of the approved test certification, a copy of the audited pipe Book for the appropriate test section which has been verified by third party inspection company, Owner/Consultant ensuring that all Welding, NDT, Coating,

Backfilling operations have been completed and are acceptable to the Owner/Consultant. This procedure will be implemented following the cleaning, filling of pipelines.

Pipe shall be pre-tested in accordance with the approved procedure and method.

Since pipeline cleaning and gauging will be completed prior to hydro test, all block valves shall be installed immediately after completion of cleaning. Temporary pig traps shall be utilized for hydro test.

7.2 Test Preparation

- Calibrated pressure gauge, dead weight, pressure recorder and temperature measurement shall be within six (6) month prior to commencing testing and shall be fitted to the test section at the pig launcher trap adjacent to the pressuring pump and one at the pig receiving trap.
- A dead weight tester shall also be installed on the test section.
- Temporary Pig Traps (launcher and Receiver) will be used.
- All necessary valves, fittings and piping shall be installed between the water source and fill test header
- The pressure pump shall be connected to the test header with a separate connection of filling line.

7.3 Final Check Prior to Filling.

The proposed pipe to be tested shall be checked before filling to ensure completeness, correct pressure rating for the test, status of removal or isolation of items to be excluded from the test, correct location and installation of spades, blinds, plugs and other forms of termination. The final check shall include a check on the fabrication to ensure completeness of NDT and required traceability.

7.4 Water Sources and Filling

The water to be used will either be supplied directly from the domestic water supply or via water tankers from the domestic water supply. The water to be used shall passed chlorides test with reliable laboratory, that must contain less than 50 ppm chlorides. Chemical treatment is otherwise not required.

Filling will take place from the low points if possible with venting at the high points. This may be assisted by using the pressurizing pump or a pump to assist with care being taken to stop the pump prior to closing the last vent. Water to be tested prior usage and after before discharging as per EIA requirement. Water Certification shall be submitted.

7.5 Testing

7.5.1 Stabilization

- Prior to commencing pressurization, each pressure pump shall be calibrated with the stroke counter to confirm output per stroke.
- Thermal stabilization check shall be made after completion of the filling operation and pressurizing the line nearly to leak test pressure. (Assessment for thermal stability should be complete prior to strength and leak tests).
- After thermal stabilisation the increase in, pressure shall be achieved gradually and smoothly and shall be recorded and monitored by the dead-weight tester. The rate of increase in pressure is approximately one (1) bar per minute. Pressurisation shall be continuous from commencement to the test pressure.
- The pressure shall be raised to 70% of the minimum hydro test pressure or 70% of the strength test pressure (for class 600 = 1,312 Psig (92 barg)) and hold for 15 mins minimum.
- All valves, flange connections and appurtenances shall be checked for leakage at this time.

7.5.2 Strength Test

- Raise the pressure to specified value of 1.50 time of design pressure (for class 600 = 1,875 Psig (131 barg)) and hold for two (2) hours minimum.
- The readjustment operation shall not be repeated more than 3 times. If the third readjustment operation is not satisfactory, the section shall be considered as not being water tight and Contractor shall proceed to locate any leak, make the necessary repairs, and restore the places affected by the leaks.
- If a leakage is detected in one such section, then the pipeline trench shall be excavated to physically locate that leakage. The particular "weld joint" shall be repaired and radiography. In case leakage source is due to the rupture of pipe, the particular pipe segment shall be replaced. The trench shall be backfilled and the complete pipeline shall be hydro tested again.

7.5.3 Leak Test

- When the requirements for the strength test have been satisfied the leak test will commence after reducing the test pressure. Some of water to be bled off to reach leak test pressure.
- During the leak test hold period, the pressure on the test section shall be constantly monitored and shall be maintained within the specified test limits. The hydro test pump shall be isolated and no water shall be added in the

pipeline. If required, water may be added to the test section to raise the pressure. Over pressuring shall be prevented by bleeding.

- The duration of Leak test will be minimum 22 hours. Pressure measurements will be taken with the dead weight tester every half hour. The pipe skin and ambient temperatures will be continuously recorded.

7.6 Test Acceptance

Test acceptance is based on the pipe and fittings withstanding the pressure for the required duration without any leaks detected. In addition, the pressure shall be check form pressure gauge, pressure recorder, dead weight tester and record. Any leakage which occurs in permanent fittings or pipe is to be rectified and then the test repeated. record. Any leakage which occurs in permanent fittings or pipe is to be rectified and then the test repeated.

7.7 Dewatering

Locations for dewatering of the mainline test sections shall have the permission of the relevant authorities having jurisdiction and the respective landowners affected by the disposal.

The location of these will be based on suitable locations where discharge will have minimal effect and will preferably be into drains or other suitable locations capable of taking the water volumes required. Care shall be taken to ensure that excessive amounts of solids, sludge and neutralising chemicals are not discharged to the environment.

The testing water shall be released at a velocity that does not lead to erosion and scour. Where the discharge water is expected to enter a river or waterway, the discharge location should be arranged with splash plates and a hay bale structure for filtering, with the hay bale structure placed in an area to allow additional filtration through natural vegetation prior to entering the river or waterway.

Dewatering will be carried out using compressed air to drive a bi directional pig remaining in the test header for the appropriate dewatering direction. Dewatering may be carried out with dry air. Dewatering directions are determined by the dewatering location and not by the fill direction.

7.8 Drying

Upon completion of De-watering, Pre-drying will be carried out with dry air. Low pressure headers will be installed as required and pre-drying commenced with pigs launched as required.

Pre drying may be terminated when the bulk of the water has been removed. Foam pig shall swab the line until swab shows no color change. The final foam pig shall be accepted when penetration of dust is less than 25 mm and no measurable debris shall be discharged with the foam pig and dew points below 0 °C are achieved at the end remote from the Air Drying Plant.

Steel bodied pigs may be run as required to remove any residual water left in the line following dewatering operations. These pigs will be run with dry compressed air.

8.0 REPORTING

Contractor will maintain complete and comprehensive records of all hydrostatic tests. Records will be accurately dated and shall be clearly identified with respect to the specific pipe section to which they apply. The final test pack for tested sections shall include:

- Test Instrument calibration certificates.
- A written record of events that transpired during the test period including comments on all leaks and failures and their dispositions.
- Logs showing pressure, pipe wall temperature and ambient temperature readings with the data and time for each reading graph charts. Each log sheet shall be signed by Contractor / PTT.
- Pressure recorder charts or data logger readings/manual readings and the plotted data.
- Corrected isometric plans or piping plans with all material related to the test identified.
- List of Items excluded from the test
- Piping Pressure Test Approval Form signed by Owner.
- Location of blinds, spades, end caps, plugs and test heads.

.

9.0 SAFETY

Contractor shall implement measures to keep persons not working on the testing operation away from the test area. Contractor shall erect barricades to restrict the test area. Approval from Owner/Consultant shall be obtained on the measures to be implemented and on the structures to be erected before starting the hydrostatic testing program.

10.0 REFERENCE DOCUMENTS

ASME B31.3	Process Piping
ASME B31.8	Gas Transmission and Distribution Piping Systems
PR-Z-2201.15-0637-001	Piping Non-Destructive Test Procedure
MN-X-2201.15-0637-001	Job Safety Environment Analysis
EIA	Environmental Impact Assessment

11.0 ATTACHMENTS

ATTACHMENT 1 : SCHEMATIC DIAGRAM FOR HYDROSTATIC TEST

ATTACHMENT 2 : TYPICAL HYDROSTATIC TEST ARRANGEMENT DRAWING

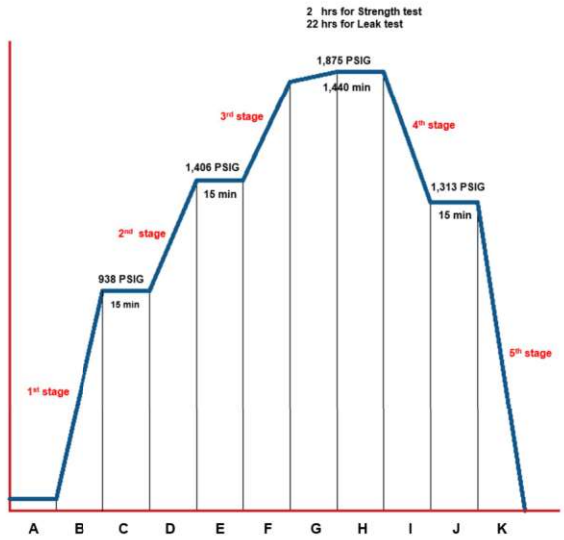
ATTACHMENT 3 : HYDROSTATIC TEST RECORD FORM

ATTACHMENT 1 : SCHEMATIC DIAGRAM FOR HYDROSTATIC TEST

Pressure rating dass D60

Test pressure 1.5 x 1250 = 1875 psig

Pressurizing Chart



A	=	Water filling
B, D and F	=	Pressurize
C	=	50% of Test pressure
E	=	75% of Test pressure
G and H	=	1.5 of Design Pressure (2 hours for Strenght test and 22 hours for Leak test)
I and K	=	Depressurize
J	=	70% of Test pressure

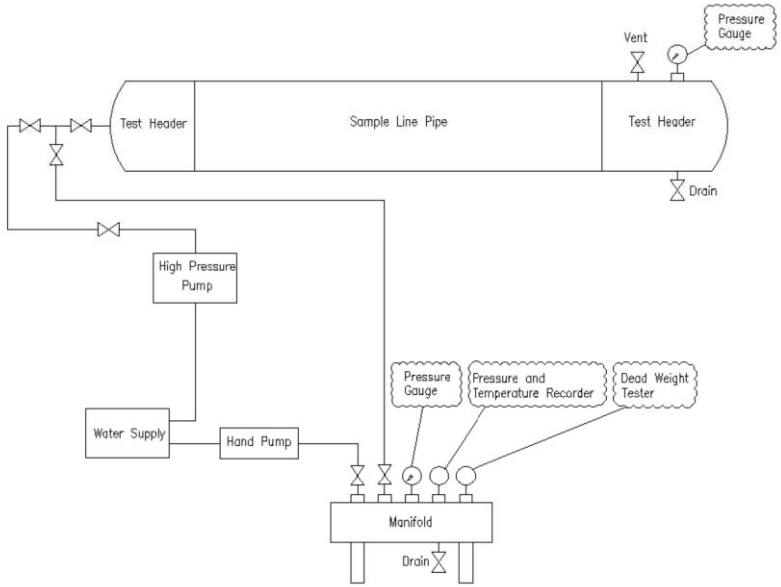
Note : Pressurize and depressurize will commence at a rate **not** exceeding following conditions;

1 bar/minute for 1st and 2nd stage (B and D)

0.5 bar/minute for 3rd stage (F)

1 bar/minute for 4th and 5th stage (I and K)

ATTACHMENT 2 : TYPICAL HYDROSTATIC TEST ARRANGEMENT DRAWING



ATTACHMENT 3 : HYDROSTATIC TEST RECORD FORM (Sample)

HYDROSTATIC TEST RECORD

INSTRUMECH COMPANY LIMITED

PROJECT NAME	: WNMR Onshore 4 & 5PL Connection Project		
OWNER	: PTT PUBLIC COMPANY LIMITED	REPORT NO.	:
CONTRACTOR	: INSTRUMECH COMPANY LIMITED	ISSUE DATE	:
SUB-CONTRACTOR	:	TEST PACKAGE NO.	:
KP	to KP	PAGE	: of

TEST INSTRUMENT DETAIL	PRESSURE INDICCATIOR	CHART RECORDER
BRAND NAME		
TYPE		
SERIAL NO.		
OPERATING RANGE		

DESCRIPTION :

PRESSURIZING PSIG/MIN

DEAD WEIGHT RESTER

DURATION TIME	PRESSURE			AMBIENT TEMPERATURE (°C)	PRESSURIZING STEP	REMARK
	PRESSURE INDICATOR		CHART			
	P 1 (PSIG)	P 2 (PSIG)	RECORDER (PSIG)			

COMMENT/NOTE :

Recorded by	:	Company		Date	
Inspected by	:	Company		Date	
Witnessed by	:	Company		Date	
Approved by	:	Company		Date	

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	TIE-IN PROCEDURE	
DOCUMENT NO.:	PR-D-2201.15-0637-002	REVISION: 0

REVIEW STAMP		COMMENTS
☐ E. Work may proceed.		
☐ F. Work may proceed. Submit Final Document / Drawing.		
☐ G. Revise and Resubmit. Work may proceed Subject to incorporation of changes indicated.		
☐ H. Revise and Resubmit. Work may not proceed.		
☐ I. Review not required. Work may proceed.		
Acceptance in any of these categories shall be in no way relieve the Contractor/Supplier of its responsibility for the due and proper performance of the Work in accordance with the Contract/Purchase Order.		
Name:		
Sign:		
Date:		

0	07 Dec 2022	Issued for Construction	SKW	KPS	PJK
B	12 Nov 2022	Re Issued for Approval	SKW	KPS	PJK
A	29 Sep 2022	Issued for Approval	SKW	KPS	PJK
Rev.	Date	Description	Prepared By	Checked By	Approved By

INSTRUMECH COMPANY LIMITED

CONTRACTOR:

INSTRUMECH COMPANY LIMITED

DOCUMENT CHANGE RECORD

Rev	Date	Prepared/ Revised By	Reviewed By	Approved By	Description
A	29 Sep 2022	SKW	KPS	PJK	Issue for Approval
B	12 Nov 2022	SKW	KPS	PJK	Re Issue for Approval
0	07 Dec 2022	SKW	KPS	PJK	Issued for Construction

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1.0 PURPOSE

The purpose of this procedure is to ensure that the tie-in process will perform safe and successfully. And the procedure will conform to the requirements of the PTT in accordance with the Contract and specifications for WNMR Onshore 4 & 5PL Connection Project.

2.0 SCOPE OF PROJECT

PTT Public Company Limited (PTT) has intended to increase the gas distribution capability between the onshore 4th natural gas pipeline through Nakhon sawan and 5th natural gas pipeline connect at WN_CC4. The contractor with the appropriate capabilities to undertaken the Engineering, Procurement and Construction (EPC) of a project.

The main component of the project in Mechanical and Piping are as follows:

- Supply main equipment, pipe fitting and accessories.
- Barred tee welding for tie-in valve between BV5.14 and BV5.15 KP.249+185.66. Underground pipeline 100 m. by open cut.
- New pipe support and piping to be established in the Wangnoi metering station with cathodic protection system and communication system.

3.0 DEFINITIONS

Owner	PTT Public Company Limited.
Project	WNMR Onshore 4 & 5PL Connection Project
Contractor	INSTRUMECH COMPANY LIMITED.
Subcontractor	The party which Contractor has assigned a portion of the Work under this contract, without any form of employment relationship to the works subject to the approval of the Owner or Consultant.

4.0 REFERENCE DOCUMENT(S)

ASME Section IX	Qualification for Standard Welding and Brazing Procedures
ASME B31.3	Process Piping
ASME B31.8	Gas Transmission and Distribution Piping Systems
API 1104	Welding of Pipelines and Related Facilities
API Std 5L	Specification for Line Pipe
MN-X-2101.15-0637-001	Job Safety Environment Analysis (JSEA)
PL-X-2201.15-0637-001	Emergency Response Plan
PR-W-2201.15-0637-001	Welding Procedure Specification (WPS)
PR-W-1804.01-010-104	Golden Weld Procedure
PR-W-1804.01-010-107	Welding Procedure
PR-W-1804.01-010-144	Proposed Welding Procedure Specification for Block Valve Station (Piping)

PR-Z-2201.15-0637-001	Non-Destructive Testing Procedure
ST-C-2201.15-0637-004	Lifting Plan Calculation
P1-0701.12-0636-0002	Piping & Instrument Diagram Parallel Pipeline Receiver & Filter Station Revised WNMR Onshore 4 & 5pl Connection Project

5.0 RESPONSIBILITY

5.1 Construction Manager

Construction Manager is responsible for ensuring that the whole of the construction work is managed by employing competent appropriately qualified and trained personnel to supervise and implement the works.

5.2 Project Engineer

Project Engineer shall be responsible for ensuring activities shall always be performed by competent persons and ensuring activities defined within this procedure are carried out in accordance with procedure, specification and statutory requirements. Engineer, in conjunction with Safety Supervisor, is responsible for the safe planning and operation of the works.

5.3 QC Manager

QC Manager is responsible to ensure that all construction inspection and testing requirements have been completed and that the relevant Release certificate has been issued prior to commencement of drying activities. All Quality Assurance and Control activities are carried- out in accordance with Project Requirements.

5.4 SH&E Manager

SH&E Manager is responsible for ensuring compliance of all parties with the SH&E requirements of the Project as summarized in Section 8.0 of this document. He will provide trained and competent personnel to monitor and assist with compliance by construction personnel with the SH&E requirements, and will assist with the development of JSEA's.

6.0 EXECUTION

6.1 General Requirement

- Excavation preparation
- Passing check
- Mobilisation & positioning of lifting appliances and temporary supports
- Cut and prepare pipe end
- Alignment & fit up
- Welding (including pre-heat, if required by the weld procedure)
- NDT and clearance
- Clean, prepare and coat weld joint
- Holiday test field joint and exposed pipe coating
- Backfill & compaction

- Issue of test reports

6.2 Passing Check

6.2.1 To ensure that existing main valve (which shall be tie-in to) shall be 100% closed position.

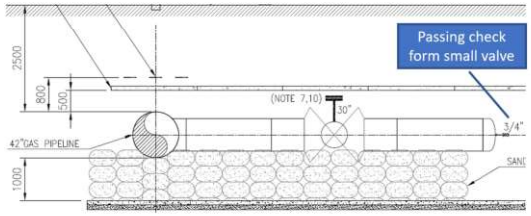
6.2.2 Flexible hose, Pressure gauge, Coupling and all necessary fitting shall provide to connect for temporary line for gas ventilation from downstream vent of existing small ball valve to atmosphere at safe location, slowly open vent valve for gas venting.

6.2.3 Gas Detector shall be used for checking gas's leak (Checking for %LEL).

6.2.4 Fully close of small ball valve then connect prepared pressure gauge to small ball valve. Monitoring pressure every 15 minute within 3 – 4 hours.

6.2.5 Fully close of small valve and remove of pressure gauge.

6.2.6 Acceptance criteria of gas passing are less than 2.5% LEL with no pressure build up.



6.3 Stop Main Valve Seat Passing

6.3.1 In case of gas passing from existing main valve, Contractor shall be mitigated valve before tie in work. Repairing work for main valve shall commence to proceed with Sealant injection.

6.3.2 Connect the sealant injection pump's coupler to valve's sealant injection fittings for cleaning valve with using solvent cleaner or valve cleaner.

6.3.3 Start pumping for charging the lubricant through around seat valve (approximately 30 ounces.), both side of seat valve (upstream side for flange tie-in) shall be injected solvent cleaner with same condition, during inject the cleaner process, monitor and control pump pressure shall not exceed 5,000 psig. And then holding 30-40 minutes (min).

6.3.4 Start purging the cleaner with Total-lube #911, method of injection follow article 6.3.3.

6.3.5 Re-checking %LEL at small ball valve with Gas Detector.

6.3.6 If still seat passing, sealant injection shall commence to proceed. The 5050 Sealant (No. XH, XXH, XXXH and XXXXH) is recommended to injecting.

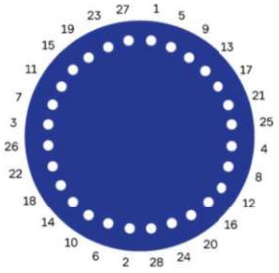
6.3.7 In case of gas passing during tie-in operation, Contractor shall be connected flexible hose to valve vent body for vent gas leaked to atmosphere at safe location. For this case, contractor will consult PTT's team for get necessary advice and agreement.

6.4 Tie-in Flange (HV-0042)

6.4.1 Temporary support and Lifting equipment shall be provided to handle the pipeline.

6.4.2 Open existing blind flange and proceed to tie-in flange.

6.4.3 Commence to proceed torque bolt (28 x 2" bolt, 3794 Nm torque value) follow tightening sequence with gasket's manufacturer recommendation torque value.



(Typical Flange Bolt Tightening Sequence (For 28 bolts))

6.5 Tie-in Weld (HV-0111)

6.5.1 At the 30" pipeline sides, Pig receiver shall be removed out of tie-in point.

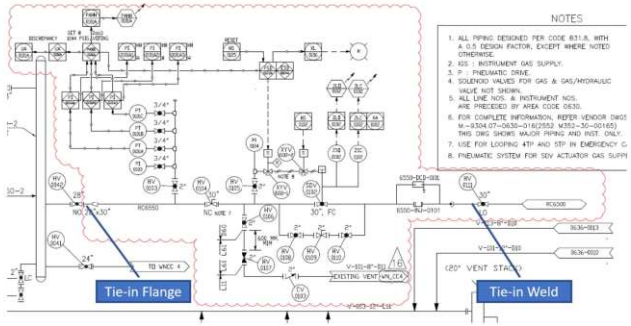
6.5.2 At sale tap sides, Marking pipe cutting point match with prepared pipe spool. And then installation of cold pipe cutting machine.

6.5.3 Start cutting and removing spool piece.

6.5.4 Bevel pipe refer to WPS requirement. Then Fit-up and alignment prepared pipe spool with main pipeline.

6.5.5 Start welding, All welded layers shall be tested with MT method by third's party.

6.5.6 RT confirm the welding joint when finished of welding.



(Tie-In Points)

6.6 Restore system

6.6.1 When finished of tie-in work, Contractor shall purge injected sealant by using valve cleaner and Total-lube #911.

7.0 EQUIPMENTS

- Excavator
- Lifting machine (crane)
- Lifting rigging
- Weld sets
- Hand tools
- Torque wrench
- Generator
- External pipe clamp
- Radiography equipment
- Magnetic particle test equipment
- Measurement
- Cold pipe cutting machine
- Flexible hose (temporary vent line)
- Balloon
- Platform

8.0 MATERIALS

- Welding rods with dryer oven
- Temporary support
- Radiographic film
- Inspection dye, paint and particles
- Marker tape
- Platform
- Signs and Barricades
- Nitrogen gas

9.0 SAFETY

All construction activities will be executed in accordance with the requirements of PL-X-2201.15-0637-001 "Emergency Response Plan". Contractor will take all necessary safety precautions related to or arising out of the performance of the contract in order to protect the work, Contractor's personnel, property of Park Owner and all Third parties. JSEA's shall be conducted for tie-in work.

- Fire truck
- Ambulance
- Warning sign and Barricades
- Fire extinguisher

Contractor will comply with all applicable safety laws, regulations (including permit to work systems) in accordance with PL-X-2201.15-0637-001 "Emergency Response Plan".

The Safety department will employ a dedicated trained fire watcher, who shall be on site while any tie in work is in progress. This will include cold cutting and welding. No tie in operations shall be permitted to commence until the fire watcher is satisfied that all safety precautions are in place.

10.0 QUALITY CONTROL

10.1 Contractor shall provide all supervision and inspection of fabrication and installation to ensure compliance with the Project Specifications and AFC drawings.

10.2 All inspections Tests and reports shall be signed by Third Party and/or PTT.

11.0 ATTACHMENT

Method statement of bolt torque (sample)

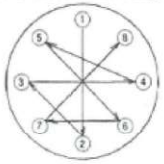
MARVEL SERVICES

Marvel Servicees Company Limited
178/355 M.5 T. Banchange A. Banchang
Rayong 21130 Thailand

METHOD STATEMENT OF BOLT TORQUE

: Start the tightening procedure by lubricating the nuts and bolts.
: Then hand tighten till they are snug against the flanges.to the minimum.
: If an air wrench is used make sure the pressure is set .
: When tightening, always use the correct sequential bolt order for the flange.

First Step	Marking number on bolt follow sequence pocedure
Second Step	Set up presure at pump pressure gauge 30% of final torque and torque follow sequence procedure
Third Step	Set up presure at pump pressure gauge 60% of final torque and torque follow sequence procedure
Third Step	Set up presure at pump pressure gauge 100% of final torque and torque follow sequence procedure
final Step	Clockwise or counter clockwise sequentially around the flange.
	TORQUING OPERATION IS NOW COMPLETE



GASKET TYPE : Spiral Wound or Ring Type Joint
TOOL COVERAGE : Single Torque Wrench

Marvel Prepare By	Client
Signature	Signatur

Comment Response Sheet (CRS)

WNMR Onshore 4 & 5PL Connection Project

PTT Contract No.		**Owner**	PTT Public Company Limited				
Project No.	2201.15	**Prepared by**	IMC	**Date**	7/12/2665		
Document Title	TIE-IN PROCEDURE	**Rev. No. of the commented**	B	**Sheet**	1	of	1
Document No.	PR-D-2201.15-0637-002						

Mark-up No.	Page	Comment	Response	By	Remark
1	7	Acceptance criteria of gas passing are less than 2.5% LEL	Completed	SKW	
2	8	In case of gas passing, Contractor will consult PTT to get necessary advice	Completed	SKW	

Additional Notes (if any) Attachments:	
DISTRIBUTION	

Comment Response Sheet (CRS)

WNMR Onshore 4 & 5PL Connection Project

PTT Contract No.		**Owner**	PTT Public Company Limited				
Project No.	2201.15	**Prepared by**	IMC	**Date**	12/11/2665		
Document Title	TIE-IN PROCEDURE	**Rev. No. of the commented**	A	**Sheet**	1	of	1
Document No.	PR-D-2201.15-0637-002						

Mark-up No.	Page	Comment	Response	By	Remark
1	1	งานยกต่างๆภายใน tie in procedure จะทำรวมในเอกสารนี้ หรือจะแยก lifting procedure	แยก Lifting Procedure โดยรวบรวมใน Document : ST-C-2201.15-0637-004	SKW	
2	4	เพิ่ม WPS จาก คทก.5 เข้าไปใน WPS Procedure	Reference to that WPS	SKW	
3	4	bolt torque procedure	เพิ่มใน Attachment (Page 10)	SKW	
4	6	Adding for valve passing case	Completed	SKW	
5	7	Contractor shall be mitigated valve before tie in work.	Completed	SKW	
6	8	Update tag no.	Completed	SKW	

Additional Notes (if any) Attachments:	
DISTRIBUTION	

บริษัท ปตท. จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

โครงการท่อส่งก๊าซธรรมชาติไปยังสถานีควบคุมความดันและวัดปริมาณก๊าซวังน้อย

ระหว่างเดือนมกราคมถึงเดือนมิถุนายน พ.ศ. 2569 (ปิดงานระยะก่อสร้าง)

ภาคผนวก 2-9

มาตรการความปลอดภัยขณะปฏิบัติงาน (JSEA)

ผู้จัดทำรายงาน
บริษัท เอ็นทิค จำกัด

PTT PUBLIC COMPANY LIMITED

WNMR Onshore 4 & 5PL Connection Project

DOCUMENT TITLE:	JOB SAFETY & ENVIRONMENTAL ANALYSIS	
DOCUMENT NO.:	MN-X-2201.15-0637-001	REVISION: 0

REVIEW STAMP		COMMENTS
☐ E. Work may proceed.		
☐ F. Work may proceed. Submit Final Document / Drawing.		
☐ G. Revise and Resubmit. Work may proceed Subject to incorporation of changes indicated.		
☐ H. Revise and Resubmit. Work may not proceed.		
☐ I. Review not required. Work may proceed.		
Acceptance in any of these categories shall be in no way relieve the Contractor/Supplier of its responsibility for the due and proper performance of the Work in accordance with the Contract/Purchase Order.		
Name:		
Sign:		
Date:		

0	29 Nov. 2022	Issued for Construction	SWR	KPS	PJK
B	09 Nov. 2022	Issue for Approval	SWR	KPS	PJK
Rev.	Date	Description	Prepared By	Checked By	Approved By

CONTRACTOR:

INSTRUMECH COMPANY LIMITED

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PTT PUBLIC COMPANY LIMITED

Likelihood		Consequences			
		A	B	C	D	E
		Fatality Permanent Damage	Permanent Disability Long Term Effect Large Area	Lost Time Injury Long Term Effect Small Area	Medical Treatment Short Term Effect Large Area	First Aid treatment Short Term Effect Small Area
1	Expected to Occur (once per week)	H	H	H	M	M
2	Common (once per month)	H	H	M	M	L
3	Sometimes (once per year)	H	M	M	L	L
4	Rarely (once in < 20 years)	M	M	L	L	L
5	Highly Unlikely (once in > 20 yrs)	M	L	L	L	L

WNMR Onshore 4 & 5PL Connection Project

JOB SAFETY & ENVIRONMENTAL ANALYSIS (JSEA)

การวิเคราะห์ผลกระทบสิ่งแวดล้อมและความปลอดภัย

TITLE : Survey works (การสำรวจพื้นที่ก่อสร้าง)	JSEA No : MN-X-2201.15-0637-001	Rev : 0

BASIC PPE REQUIRED FOR THIS JOB:

☒ Long Shirt Sleeves	☒ Long Trousers	☒ Hi vis vest or clothing	☒ Sun Hat/Brim	☒ Hard Hat (if working in designated hard hat areas/operations)
☒ Safety Footwear	☒ Gloves (as required)	☒ P2 Mask (as required)	☒ Ear Plugs (as required)	☒ Safety Glasses ☒ Goggles (as required)

REFERENCES FOR THIS JOB:

☒ Safety, Health & Environmental Plan	☒ Construction Execution Plan	☐ JSEA	☐ .....
☐ Plant Hazard Assessments	☐ Alignment Sheets	☒ Emergency Response Plan	☐ .....

Initiated by :	Reviewed by :	Concurred by :
Safety / Environment Officer	Safety / Environment Professional Officer	SHE Manager

PTT PUBLIC COMPANY LIMITED

Likelihood		Consequences				
		A Fatality Permanent Damage	B Permanent Disability Long Term Effect Large Area	C Lost Time Injury Long Term Effect Small Area	D Medical Treatment Short Term Effect Large Area	E First Aid treatment Short Term Effect Small Area
1	Expected to Occur (once per week)	H	H	H	M	M
2	Common (once per month)	H	H	M	M	L
3	Sometimes (once per year)	H	M	M	L	L
4	Rarely (once in < 20 years)	M	M	L	L	L
5	Highly Unlikely (once in > 20 yrs)	M	L	L	L	L

RISK TYPE ชนิดของงาน	POTENTIAL ACCIDENT OR HAZARD อันตรายจะเกิด	RISK LEVEL (Pre-control) ระดับความเสี่ยง	RISK CONTROL MEASURE มาตรการควบคุม	EQUIPMENT REQUIREMENTS อุปกรณ์ที่จะต้องมี	RISK LEVEL (Post control) ระดับความเสี่ยง	SUPERVISORY REQUIREMENTS ผู้ควบคุมงานต้อง
Manual Handling การขนย้ายโดยใช้แรงงานคน	Splinter from survey stake เสี้ยนตำจากไม้หมุด	Medium อันตราย ระดับปานกลาง	- Gloves to be worn when holding stakes for driving and handling stakes generally. Use of proper manual handling techniques. สวมถุงมือก่อนจับตอกไม้หมุด หรือการขนย้ายไม้หมุดและใช้วิธีการขนย้ายให้ถูกต้องตามหลักการขนย้ายด้วยแรงคน (มือ)	Suitable gloves ถุงมือเหมาะสม สำหรับงานที่จะปฏิบัติ	Low อันตราย ระดับต่ำ	
Alcohol and substance abuse แอลกอฮอล์และสารให้โทษ	Accidents อุบัติเหตุ Time loss through illness หยุดงานเนื่องจากการเจ็บป่วย	Medium อันตราย ระดับปานกลาง	- Previous work a random drug and alcohol. สุ่มตรวจสารเสพติดและแอลกอฮอร์ ก่อนปฏิบัติงาน		Low อันตราย ระดับต่ำ	Monitor behaviour of personnel for indications of abuse. ติดตามดูพฤติกรรมของพนักงานว่าเกี่ยวข้องกับสิ่งที่ต้องห้ามหรือไม่
Sewage treatment and unhygienic toilets. น้ำเสียและส้วมไม่ถูกสุขอนามัย	Infectious diseases Food and water borne diseases อาหารและน้ำดื่มติดเชื้อโรค	High อันตราย ระดับสูง	- Encourage awareness through toolbox awareness session. Regular cleaning of toilet facilities. Hygiene and sanitation surveillance and periodic inspections. กระตุ้นให้มีความตระหนักในเรื่องความสะอาดและสุขอนามัย โดยสอดแทรกในเวลาประชุมก่อนเริ่มงาน จัดให้มีการตรวจสอบเรื่องความสะอาดและสุขอนามัยเป็นระยะๆ	Portable toilets สุขาเคลื่อนที่	Low อันตราย ระดับต่ำ	

PTT PUBLIC COMPANY LIMITED

Likelihood		Consequences				
		A Fatality Permanent Damage	B Permanent Disability Long Term Effect Large Area	C Lost Time Injury Long Term Effect Small Area	D Medical Treatment Short Term Effect Large Area	E First Aid treatment Short Term Effect Small Area
1	Expected to Occur (once per week)	H	H	H	M	M
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5	Highly Unlikely (once in > 20 yrs)	M	L	L	L	L

RISK TYPE ชนิดของงาน	POTENTIAL ACCIDENT OR HAZARD อันตรายจะเกิด	RISK LEVEL (Pre-control) ระดับความเสี่ยง	RISK CONTROL MEASURE มาตรการควบคุม	EQUIPMENT REQUIREMENTS อุปกรณ์ที่จะต้องมี	RISK LEVEL (Post control) ระดับความเสี่ยง	SUPERVISORY REQUIREMENTS ผู้ควบคุมงานต้อง
Boredom อาการเบื่อหน่าย loss of vigilance ขาดความระมัดระวัง Tiredness ความเหนื่อยเหนื่อย Highway hypnosis Excessive Speed หลับในหรือขับรถเร็ว Improper securing of loads. ไม่จัดการยึดของที่บรรทุกอย่างถูกต้อง Driving too long without break. ขับรถทางไกลโดยไม่มีการพักผ่อน	Road traffic accidents (RTA) เกิดอุบัติเหตุบนท้องถนน Trauma Multiple trauma Fatalities. ได้รับบาดเจ็บจากอุบัติเหตุจนถึงแก่ชีวิต	High อันตราย ระดับสูง	- Safety regulations, education / training, Good maintenance of vehicles ระเบียบข้อบังคับความปลอดภัย, การฝึกอบรมและการดูแลยานพาหนะให้อยู่ในสภาพดีพร้อมที่จะทำงาน - Loads secured properly ยึดสิ่งของที่บรรทุกให้เหมาะสม - Occupational surveillance Minimize road transport as much as possible. Stringent procedures for: driver's pre-employment screening and training. controlling speed and vehicles maintenance. Seat belts compulsory. ควบคุมการขนย้ายบนท้องถนนให้น้อยที่สุดเท่าที่จะทำได้ พร้อมจัดระเบียบอย่างเข้มงวด ในการคัดเลือกคนขับ, ทำการอบรมควบคุมความเร็ว, ซ่อมบำรุงยานพาหนะและบังคับให้ใช้เข็มขัดนิรภัย	Vehicles Seat belts เข็มขัดนิรภัยในยานพาหนะ	Medium อันตราย ระดับกลาง	
Crossing roads การข้ามถนน	Collision with vehicles. Personal and material damage ถูกยานพาหนะเฉี่ยวชนจนก่อให้เกิดความเสียหายต่อบุคคลและวัตถุ	High อันตราย ระดับสูง	- Clearly indicate with signs in accordance with the current rules (signs, flags). ปฏิบัติตามกฎระเบียบข้อบังคับกฎหมายในปัจจุบัน พร้อมปฏิบัติตามตามสัญลักษณ์ของธงและป้ายต่างๆ	Warning signs ป้ายเตือน Flags ธง	Medium อันตราย ระดับกลาง	