

EPC for Onshore Processing Facilities and Associated Onshore Pipelines for Aung Sinkha Development Project (ASK) Phase 1A

SPECIFICATION FOR PIPELINE CONSTRUCTION

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B2	31-Jul-26	ZXY	Issued for Approval #2	LC	YQ		
B1	8-Jul-26	ZXY	Issued for Approval	LC	YQ		
A1	1-Jun-26	ZXY	Issued for Review	LC	YQ		
REV	DATE	BY	DESCRIPTION	CHECK	APPR.	CHECK	APPR.
				ENGINEERING APPROVAL		COMPANY APPROVAL	
REVISION CODE: A = Issued for Review – B = Issued for Approval – C = Approved for Construction							
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		EPC for Onshore Processing Facilities and Associated Onshore Pipelines for Aung Sinkha Development Project (ASK) Phase 1A					
		MM-ASK-1A-APL01-PLR-SPE-0001		REV			
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1.0 INTRODUCTION

1.1 Project Overview

PTTEP International Limited (PTTEPI) intends to develop and produce hydrocarbon from the offshore Block M3 named Aung Sinkha (ASK) field. The project is under Production Sharing Contract (PSC) with Myanmar Oil & Gas Enterprise (MOGE) signed on 7th August 2004 while the PSC effective date was on 1st November 2004.

PTTEPI as an Operator had performed 2,842 line-km of 2D seismic, 619 km² of 3D seismic, and drilled 11 Exploration and Appraisal wells. After successful exploration and appraisal drilling campaigns in 2015, PTTEPI completed the ASK Field Development Plan and submitted to MOGE for approval. MOGE approved ASK Field Development Plan in April 2021.

The ASK field is located at offshore in the Gulf of Moattama, Myanmar, as illustrated in Figure 1.0. The field is located approximately 70 km from Land Fall Point (LFP) at Daw Nyein village and 200 km south-west of Yangon with water depth range 15-25 meters.

The feed gas will be transported from two (2) offshore wellhead platforms through an offshore export pipeline to ASK Onshore Processing Facilities (APF) located in Daw Nyein village for processing. The sales gas after processing will be exported to ASK Metering Station (AMS) which is located nearby the MOGE Pipeline Center Station at Daw Nyein Village, via gas export pipeline 2.5 km from APF and tied-in to the existing MOGE gas pipeline network. The condensate will be stabilized and stored at APF before being transported via pipeline to ASK Condensate Offloading and Personnel Transfer Facilities (ACP) at Kyon Kaw river and offloaded to customers via tankers barge.

The design of the surface facilities will be based on a Contractual Daily Capacity (CDC) of 60 MMscfd with provision for future expansion to 100 MMscfd.

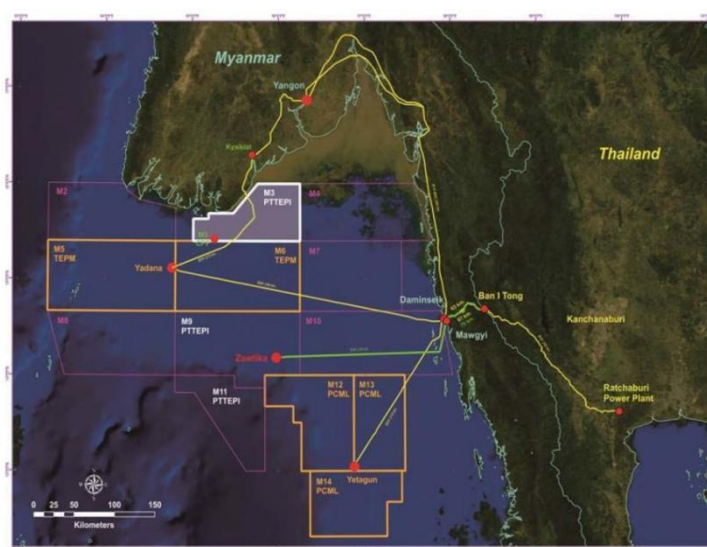


Figure 1-1: Block M3 – Aung Sinkha Field, Offshore Myanmar

The development of Phase 1A consists of the following facilities, as illustrated in Figure 1-2.

- Two (2) - Wellhead Platforms (WPA01 and WPA02) with jacket weight of 1,200 MT approx. and topside weight of 1,000 - 1,400 MT approx.
- One (1) - 12" x 6 km approx. Intra-field Pipeline which links between WPA01 and WPA02
- One (1) – 20" x 90 km approx. Multiphase Offshore Export Pipeline to transport combined fluid of WPA01 and WPA02 to Daw Nyein Land Fall Point
- APL01 One (1) – 20" x 2.5 km approx. Multiphase Onshore Export Pipeline to transport combined fluid from Daw Nyein Land Fall Point to ASK Onshore Processing Facilities (APF)
- ASK Onshore Block Valve Station No.1 (ABV01)
- ASK Onshore Processing Facilities (APF)
- APL02 One (1) – 8" x 18 km approx. Onshore Condensate Export Pipeline from APF to ACP
- APL03 One (1) – 12" x 2.5 km approx. Onshore Export Pipeline from APF to AMS01 at Daw Nyein Village
- ASK Metering Station No.1 (AMS01)
- ASK Condensate Offloading and Personnel Transfer Facilities (ACP) i.e., Condensate Offtake Facilities, Accommodation, Personnel and Material Transfer Facilities, Telecommunication System, road, etc.

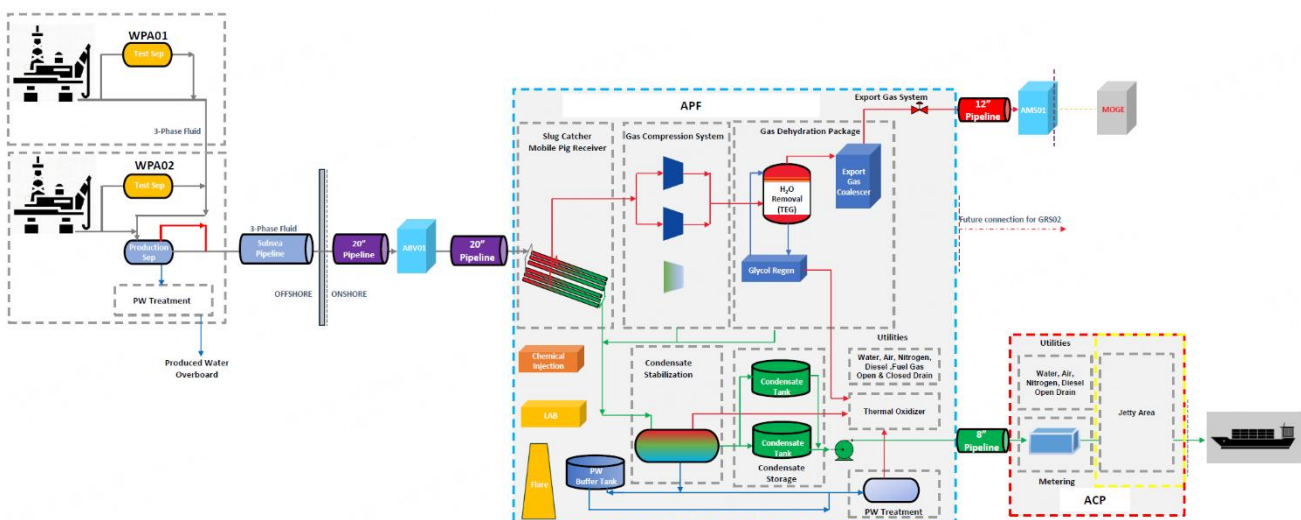


Figure 1-2: Field Block Flow Diagram

1.2 Abbreviation

For the purposes of this document the following abbreviations shall mean.

ABV	ASK Onshore Block Valve Station
ACP	ASK Condensate Offloading and Personnel Transfer Facilities
API	American Petroleum Institute
AMS	ASK Onshore Metering Station
APF	ASK Onshore Processing Facilities
ASK	Aung Sinkha Development Project
ASME	American Society of Mechanical Engineers
CCR	Central Control Room
CPI	Corrugated Plate Interceptor
DEG	Diesel Engine Generator
GBV	Gas to Power Pipeline Block Valve Station
GDS	Gas Distribution Station
GEG	Gas Engine Generator
GJS	Gas Junction Station
GRS	Gas Receiving Station
IEC	International Electro Technical Commission
IP	Internet Protocol
ISO	International Standards Organization
LCP	Local Control Panel
MMSCFD	Million Standard Cubic Feet Per Day
NDT	Non-Destructive Test

PCS	Process Control System
PEGS	PTTEP Engineering General Specification
PLC	Programmable logic controller
PTTEP	PTT Exploration and Production Public Company Limited
SIS	Safety Instrumentation System
TCP	Transmission Control Protocol
UCP	Unit Control Panel
WPA	ASK Wellhead Platform
ZOC	Zawtika Operating Center
TEG	Triethylene Glycol

1.3 The Parties Involved

COMPANY	PTTEP International Limited (PTTEPI)
CONTRACTOR	China National Electric Engineering Co., LTD (CNEEC)
SUBCONTRACTOR	The party who provides services to perform part of the contractual scope of work on behalf of CONTRACTOR
SUPPLIER VENDOR	or The organization selected to supply equipment that has overall responsibility for the equipment. The term VENDOR shall include vendors of any tier.
SUB SUPPLIER SUB VENDOR	or The organization selected be the supplier to supply part of equipment, service or material scoped by this specification.

2.0 GENERAL INFORMATION

2.1 Purpose Of Document

The purpose of this document is to outline the specification for pipeline construction and required criteria for the development of APL01, APL02 and APL03.

2.2 Language

The English Language shall be used in all project communications, reports, correspondences, drawings, specifications, calculations, and invoices etc., submitted to COMPANY. All drawings and documents shall be annotated in S.I. units with other units in parenthesis, where applicable.

In this document, the words should and shall have the following meanings:

Shall	Used to indicate that a provision is mandatory.
Should	Used to indicate that a provision is not mandatory but is recommended as good practice.

2.3 Unit Of Measurement

The Aung Sinkha Phase 1A Project will use metric or SI system of units for all calculations, drawings and in all project documentation.

The units of measurement to be used in this project are summarized below in the **Table 2-1**.

Table 2-1: Units of Measurement

PARAMETERS	UNITS
DIMENSIONS	
Equipment Dimension	mm, m
Pipe Length	m
Pipe Size	inch/ mm
Area	m ²
Volume	m ³
Time	d, hr, s
Distance	m, km
PRESSURE	
Pressure (absolute)	bara (psia)
Pressure (gauge)	barg (psig)
Liquid Head	mbar, bar, mmH ₂ O
Stress	MPa (MN/m ² or N/mm ²), kPa (kN/m ²)
Static Pressure	bar
Pressure Drop	bar
TEMPERATURE	
Temperature	°C (°F)
FLOWRATE	
Mass Flowrate	kg/hr
Gas Volume Flowrate (Standard Conditions)	MMSCFD
Actual Liquid Volume Flowrate	BPD, m ³ /hr, L/hr, L/day
Liquid Volume Flowrate (stock tank conditions)	STBPD
Actual Gas Volumetric Flowrate	m ³ /hr (ft ³ /d)

PARAMETERS	UNITS
PROPERTIES	
Amount of Substance	kmol
Density	kg/m ³
Dynamic Viscosity	cP
Kinematic Viscosity	cSt
Weight/Mass	kg, tonne (1000 kg)
Thermal Conductivity	kW / m-°C
Fouling Factor	m ² .hr.°C/kJ
Velocity	m/s
Interfacial Surface Tension	dyne/cm
Mass Velocity	kg/s
Particle Size	Micron
Head	M
Contaminant Concentration (mass)	ppm
Contaminant Concentration (volume)	ppmv
Concentration	mol %
HEAT, ENERGY, WORK AND POWER	
Heat	kJ
Heat Flow/Duty	kJ/hr
Heat Flux	kJ/m ² .hr
Latent Heat	kJ/kg
Specific Heat	kJ/kg.°C
Heat Transfer Coefficient	kJ/hr.m ² .°C
Heating Value (Liquid)	kJ/kg
Heating Value (Gas)	Btu/scf
Specific Enthalpy	kJ/kg
Volumetric Heat Release	kJ/hr.m ³
Power	W
RADIATION, CONDUCTIVITY AND NOISE	
Radiation	kW/m ²
Noise	dB(A)

Notes:

- Imperial Units may be given between brackets following the SI Units.
- Standard Condition are: 1.01325 bara and 15.55 °C (SI).
- Standard Conditions are: 14.7 psia and 60 °F (Imperial).

2.4 Regulation, Standards and Code of Practice

The Aung Sinkha Development Project Phase 1A shall be designed primarily in accordance with PTTEP's general specifications (PEGSS) and corporate specifications, as appropriate,

and the applicable Myanmar legislative requirements. Where such standards are not applicable, accepted international codes / industry good engineering practice will be adopted. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published on the effective date of a contract.

Any deviation from the standard, shall be documented for derogation and proper permission from COMPANY in writing.

The order of precedence of the applicable documents shall be:

- 1) Government Laws, Rules and Regulations
- 2) Purchase Order/ Service Order/ Contract Documents
- 3) Data Sheet, Drawings and Project Particular Specification (PPS)
- 4) PTTEP Engineering General Specification (PEGS)
- 5) Other COMPANY specifications, standards, and documents
- 6) International Codes and Standards

In case of conflicts / contradictions between the various codes, standards, regulations and specification, unless otherwise agreed or decided by Company, it is understood that the more stringent requirement shall apply.

3.0 DEVIATIONS

Vendor shall include, in his quotation a list of any specific exclusions or deviations to this specification and any other documents listed in the requisition. In absence of such deviation list, it shall be considered that the quotation is in full compliance with the requisition documents and subsequent extra claims arising due to not considering the requirements stated shall not be considered and Company's decision shall be considered final.

Any non-compliance by Vendor not identified and approved shall be rectified at Vendor cost and without any impact on delivery schedule.

Compliance with the provisions of this specification does not relieve Vendor responsibility to furnish the equipment of safe design, meeting the specified service conditions and the requirements.

4.0 GENERAL REQUIREMENTS

The CONTRACTOR shall complete all works associated with the Pipeline scope and ensure it is built to the design, specifications and as per project requirements.

CONTRACTOR shall carry out all construction activities associated in compliance with local laws, by-laws, ordinances and regulations.

CONTRACTOR shall be liable for damage to any and all above or below grade existing manmade structures or natural features that may be located within or adjacent to the working area. Caution and due consideration shall be given to the protection and support of such properties and structures.

The CONTRACTOR shall protect the roads from damage caused during construction, and shall repair any damage in time according to the COMPANY's instructions.

Draining of pollutants onto the land or into water bodies is not permitted. All waste material must be collected and removed by the CONTRACTOR to an approved disposal area on an ongoing basis.

5.0 TECHNICAL REQUIREMENTS FOR CONSTRUCTION

5.1 Route Delivery And Centreline Paying Off

The proposed pipeline route is shown on the pipeline route maps and pipeline alignment sheets. CONSTRUCTION CONTRACTOR shall be responsible to conduct a construction survey of the entire pipeline and place pipe center line pegs at a maximum distance of 100 meters for straight sections and a maximum of 10 meters where horizontal bends are required – pegs should be located at the center of the bend. Pegs should be made from wood and shall be visible by means of painted tops or wrapped in red and white safety tape.

5.2 Right Of Way (ROW)

The ROW defines the band of terrain that shall be dedicated to the installation and operation of the SYSTEM. The boundaries of the area covered by the ROW represent another Battery Limit.

The standard width of the right-of-way for construction is of 30 m, unless specified otherwise in the Project Requirements. The right-of way to be purchased or leased may vary depending on local regulation, the future inspection methodology and future plans for any additional pipelines within the same ROW and may be different for construction and operational phases.

As a consequence of any future pipelines is to be installed in this right-of-way, for the first pipeline installation, the offset between the pipeline and ROW centre lines shall be as large as feasible, and shall remain at constant offset along the ROW. The position of the pipeline within the ROW shall be agreed between the Project and COMPANY's local Operations department.

The distance between existing buried pipeline and new buried pipeline should be 6.0 m, as far as possible, with the minimum acceptable shall be more than 0.4 m or 1xOD whichever the largest.

Several areas for future in-service purposes (i.e. temporary storage of contingency repair means and materials) shall be prepared and worked out in such a way that they will remain accessible during the intended service life of the pipeline.

In specific cases, and as instructed by the Project, certain sections of the pipeline shall be as horizontal as feasible and the number of field cold bends reduced to a minimum. This shall require additional detail studies.

Sections of the pipeline route showing important variations of elevation profile shall be treated as special points, thus requiring special constructional dispositions and means.

No connection shall take place after backfilling in the vicinity of a curvature made of potentially forced elastically bent elements.

The need for maintaining the construction track during the whole life duration of the SYSTEM must be anticipated, i.e. in the view of inspection and maintenance purposes.

The lowers number of bend at these locations shall be considered.

5.3 Grading, Handling, Stringing and Storing

5.3.1 Grading

Before start to clearing Contractor shall be submitted document that show the original site condition which including information:

1)Color picture taken every 100 m along the route line.

2)Color picture taken each road/ railway crossing, each water way crossing with show full length of their crossing.

3) All picture shall be labeled with KP, location, direction toward, date.

The clearing of the ROW shall be carried out in conjunction with the construction of the access roads in the ROW's. After clearing the ROW and when grading has been performed so as to allow passage of loaded trucks and equipment without undue wear and tear thereon, the CONTRACTOR may commence his scheduled work.

The CONTRACTOR shall grade off high points and fill low points to allow the pipe to be bent and laid within the limits set forth herein with due regard to the minimum radius of bends allowed and shall excavate rock or other material which cannot be graded off with ordinary grading equipment in order to provide an adequate working space along the pipeline route. The banks resulting from cutting and filling must be sloped and or terraced sufficiently so as not to present hazards to persons, livestock and wildlife.

Spoil banks from grading operations shall not be placed where drainage will be affected, and such spoil banks shall be placed in locations acceptable to COMPANY. Grading shall be done so as to prevent any erosion and right-of way instability during and after construction.

All stripped topsoil shall be placed on topsoil and excavated subsoil placed on subsoil, and clearly separate from top-soil. Care shall be taken to segregate and not mix topsoil and subsoil. Minimum topsoil stripped shall be 30 cm or as approved by COMPANY.

5.3.2 Handling

CONTRACTOR shall be submitted handling equipment and working procedure for COMPANY review and approval before material receive 30 days in advance. The procedure shall be comply to COMPANY Standards.

Pipe shall be handled in a manner to prevent possible damage to pipe walls and pipe ends. Boomers shall always be used in cross-country or rough road handling. Pipe shall not be dropped or rolled off or onto vehicles but shall be handled with suitable slings. Pre-coated pipe shall be handled at all times with wide non-abrasive canvas or nylon belts, or other equipment designed to prevent damage to the coating. Rope shall not be used. Pipe stockpiled shall be carefully stacked and blocked to avoid damage to pipe or pipe coating. Pipe loaded out shall have suitable tie downs, supports and blocking to prevent shifting. Tie-down, supports, and blocking shall be of such material and construction to provide adequate protection to pipe and to pipe coating. Pre-coated pipe requires tarpaulin protection when being hauled on gravel roads.

CONTRACTOR shall ensure that all construction materials consigned to any part of the work shall be properly stored to prevent theft, damage or deterioration.

CONTRACTOR shall contain all forms of debris from its operation, such as cans, bottles, containers, welding rods, excavated material etc., and dispose of such debris at waste disposal sites approved by COMPANY.

5.3.3 Stringing

CONTRACTOR shall string pipes on the right-of-way in preparation for bending and welding in a manner that prevents damage to pipes and coatings. To minimize the risk of damaging the line pipe, proper lifting method should be considered by the CONTRACTOR for handling purposes.

Pipe shall be lifted from transporters using an approved type of pipe hook. Pipe shall be placed directly onto sand bags or other approved supports to ensure that it is held clear of the ground surface and maintained in a secure position against movement due to rain or settlement.

CONTRACTOR to align on the requirement bottom row of pipes in a stockpile to be elevated at least 6 inches (152 mm) off the ground prevent pipe contact with ground moisture.

Stringing vehicles shall have installed suitably padded supports to prevent pipe coating damage.

Pipe shall be strung alongside the trench on supports properly spaced with the pipe clear of the ground. The trench is to be completely excavated and the area cleared of all debris and the requisite base pre-padding placed before stringing of the pipes. However the CONTRACTOR shall note and make allowance for sand drift into the trench in sandy areas.

The pipe shall be strung parallel to the trench at a suitable and constant distance from the centreline of the trench. The stringing on the ROW shall be done in such a manner as to cause the least interference with the normal use of access by trucks, side-booms, etc. Gaps shall be left at intervals or wherever requested by other users to permit the passage for traffic or equipment across the ROW or along public roads or highways. Pipe stringing shall be done in such a manner as not to cause a hazard or possible damage by traffic.

All coated pipe strung on the ROW shall be supported in such a manner that the pipe is free from contact with the ground at all times. Sand bags are permissible for use as pipe supports except in wet areas. In wet areas, sand bags with wood pads shall be used.

5.3.4 Storing

Materials supplied by the CONTRACTOR shall be properly stored in a safe & secure area and shall not be stored on the ROW. When required the materials shall be transported onto the ROW in covered vehicles and delivered directly to the desired location.

The pipe stacking site should not be in low-lying terrain to prevent water accumulation. In case of continuous rain causing ground subsidence, diversion ditch should be made to avoid accumulation of water.

Temporary pipe stockpile areas must be graded, level, compacted and shall have adequate bearing strength that no ground settling occurs that would adversely affect the piping arrangement. The first tier of pipe shall be placed on padded timber skids, or on sand or dirt berms covered with polyethylene sheeting, supported in at least three (3) places along a full pipe length with no support closer than two (2) meters from the pipe ends. Bottom row of pipes shall be elevated at least 6 inches (152 mm) off the ground. Contractor shall provide rubber or pressed wood separators or propose an alternative for COMPANY approval. Ends of pipe shall be capped with plastic end-caps..

The allowable numbers of tiers for various pipe sizes are summarized in the Table 5-3:

Table 5-3: Pipe stacking heights

Pipeline	Pipe Size (OD)	Bare Pipe	Coated Pipe
APL01	20 inch	6	4
APL02 and APL03	8 inch and 12 inch	10	4

CONTRACTOR shall record the pipe numbers, steel heat numbers, pipe lengths, wall thickness and location of each piece of pipe, as strung.

These records shall be amended “as laid” to include the weld numbers and the welding operator’s identification numbers, and maintain the records.

The length of the welded pipe string shall be planned with due consideration of thermal expansion and other expected or accidental movement of the pipe string. Special attention shall be paid to strings with one or more bends, in view of the inherent increased risk of failure of sand bags due to the above movements of the pipe.

All pipe ends shall be protected / covered to prevent sand from entering the pipe by using weather resistant material.

Coating and primer shall be unloaded from cars at destination points in such a manner as to prevent damage to containers. Containers of coating materials shall not be handled with hooks at any time and shall be stored with tops of containers up.

Valves, fittings, and other materials shall be unloaded in a manner to prevent damage, loss or deterioration and permit easy access for checking of quantities. Valves, flanged fittings, or other materials with finished surfaces shall always be placed on sand bags to prevent the finished surfaces from coming into contact with the earth. Small fittings, fiberglass wrapping material, and supplies shall be kept in suitable warehouses.

5.4 Trench

Before any trenching commences, CONTRACTOR shall obtain the approval of COMPANY. CONTRACTOR shall excavate the pipeline trench in the pipeline corridor as per Project Typical Drawing No. MM-ASK-1A-APL01-PLR-DWG-0034 - Typical trench and excavation details drawing.

Trenching shall include all excavation, whether by trenching machine, power shovel, by hand, or by other methods which may be necessary (after grading has been completed) to prepare a trench for the pipe with the minimum of cover between top of pipe and immediate ground level as specified in alignment sheets.

The depth of the trench shall be measured from the level of the original ground on each side of the trench. It shall be necessary to provide additional depth trench at certain locations such as roads, highways, drainage trenches, ravines, and other water courses, crossings of other underground structures, etc. The trench depth is determined according to the regulations of B31.8 and Pipeline Design Report, detailed in the Pipeline Alignment Sheet.

The minimum cover requirements for trenching and burial are summarized in the Table 5-4:

Table 5-4: Minimum cover requirements for trenching and burial

Location	Minimum Cover (H)	
	Normal Area	Rocky Area
Industrial, commercial, agricultural and residential areas	1.5m	1.5m
Crossings of inland bodies of water with a width of at least 30m across the high water mark	2.0m	2.0m
Railroad Tracks	2.0m	N/A
Public Road and Railroad Drainage Ditches	2.0m	2.0m
Any Other Areas	1.5m	2.0m

The trench shall excavate and grade the trench to a depth and in such a manner that the separation of the pipeline will be a minimum of 500 mm.

The bottom of the trench shall be square cut as neatly as possible to avoid unnecessary handwork. Handwork will be required however, to remove rocks, and protruding roots from the sides or bottom of the trench or as required by COMPANY.

Mechanical excavation shall not take place within 2 meters of an existing service; only manual excavation shall be permitted within this distance. In all cases where the trench has been cut across private or public roads, the CONTRACTOR shall provide Temporary bypass (diversion) road as not to disrupt traffic flow.

The CONTRACTOR shall, whenever possible, complete the trenching, laying and backfilling of roads before the end of the work day so as to avoid hazards to night traffic. Adequate signage shall be placed informing of road works. Hard barricade and battery powered lighting to be placed if road shall be closed during night hours.

Rocks, gravel or other hard materials in the trench, which will damage the pipe or pipe coating, shall be covered with soft earth or sand as project drawing.

The trench shall be kept in good condition until the pipe is laid and inspected. All lumber, jacks, or other materials used to brace the trench shall be furnished and removed.

5.5 Pre-Padding

CONTRACTOR shall provide trench bottom pre-padding in areas of rock trench, or other areas where material in the bottom of the trench has potential to damage the pipes or external coating following pipes installation. Where trench is on slopes, CONTRACTOR shall install soft plugs to avoid soil run off.

Rock free excavated soil shall be used for pre-padding. The maximum size of solid particles of pre-padding should not exceed 20mm.

Trench bottom material shall be placed to a minimum compaction thickness of pre-padding material to a minimum depth of 150 mm and on top of pipe to a minimum depth of 300 mm, above the highest point in the ditch bottom prior to pipe being lowered into the trench and pre-padding shall be placed across full trench width to ensure the pipelines is evenly supported.

All bush, sand bags, pipe, metal of any kind, rocks, large clods, sticks, projecting rocks, and other hard objects shall be removed from the trench into which the pipeline is to be lowered so that the protective coating shall not be punctured or abraded.

The trench shall be made wide enough where slack loops are lowered into the trench so that no coating will be rubbed off for pipeline.

Whenever the bottom of the trench contains rocks which might damage the pipe or coating, the bottom of the trench shall be padded with sand or soft soil.

A bedding of 3 inches (76 mm) or more of loose dirt or sand shall be provided in areas where the native soil contains rocks or does not otherwise provide adequate bedding. Bedding shall not contain rocks larger than 1/2 inch (12.7 mm) in diameter.

The pipe shall be lowered into the trench as soon as the coating has hardened sufficiently so that the lowering will not cause holidays. This shall be checked by picking the pipe up after it has been lowered in and checking with a holiday detector. If this check shows holidays, the pipe must be lowered to sand bags until it has had sufficient time to properly harden.

Wide non-abrasive slings, belts, or rubber tire and cradles shall be used in all lowering of the pipeline. the CONTRACTOR shall lower line in such a manner as to provide sufficient slack. The line shall not be dropped or subjected to impact. Only slings, belts or cradles approved by COMPANY shall be used.

Where trench is excavated in rock, pre-padding will be provided with sand or soft soil.

5.6 Bend

5.6.1 General

CONTRACTOR shall provide all bends and make all field bends required for the laying of the pipelines in accordance with requirements for minimum cover, vertical profiles, and horizontal alignment.

Hot Induction bends are preferred for this project.

5.6.2 Elastic Bends

The elastic bend shall be continuously supported over its full length. The elastic radius is at least $R=550D$, meanwhile, for the section of pipeline lay in the same trench; the elastic radius should meet the large diameter pipeline.

5.6.3 Field Cold Bending (HOLD)

Contractor shall make the cold field bend for change alignment of horizontal and vertical by suitable equipment and adequately for smooth bending of uniform radius without buckles, wrinkles flattening, egging, reduced thickness and to avoid any damage to coating. The longitudinal weld should be located on or near the neutral axis of the bend.

Tangent length of straight pipe at both end of a bent joint shall be at least 500mm or 3 x OD, whichever is larger.

The pipe diameter shall not be reduced at any point by more than 3% of the nominal diameter and not more than 1% at the end of bend. The maximum permanent straining shall be 3%, whatever the NPS, for field cold bends.

Minimum radius of nominal pipe size bend in pipe diameters shall not be less than 30D.

5.6.4 Hot Induction Bends (HOLD)

For all horizontal and vertical angles greater than or equal to 3 degrees of the project's pipeline, the CONTRACTOR should use prefabricated thermal induction bending. It is prohibited for cutting induction bends in site.

The CONTRACTOR shall provide additional mitigation measures or contingency plans in the event that the actual site installation dimensions (As-built Field Survey) deviate from the Approved for Construction drawings, in order to prevent any adverse impacts on the pipeline alignment assembly and tie-in schedule.

5.6.5 Rejection of Bends

Bends with wrinkles, buckles, flat spots or other mechanical damage and bends with excessive ovality as per bending limits shall be rejected. CONTRACTOR shall salvage usable straight pipe from any rejected bend. The entire bending operation shall be conducted so as not to damage pipe coating.

5.7 Welding And Inspection

5.7.1 General

Pipeline welding techniques includes SMAW, GTAW, GMAW, GSFCW or any combination of these techniques. Manual, semi-automatic or automatic welding is acceptable and semi-automatic welding is recommended for large-diameter pipeline. The specific welding technique shall be determined according to the terrain conditions and the CONTRACTOR's equipment conditions.

The performance of the welding equipment should meet the welding procedure and safety requirements, and should be in a good working condition and suitable for field application.

Before welding, a detailed welding procedure instruction should be drafted according to the design requirements, and the WPQ should be carried out accordingly. Based on the qualified welding procedure, the WPS should be compiled.

When the pipe joint adopts a different welding techniques or different welding consumable from that of the trunk line, a new WPQ shall be carried out.

In view of the local environmental conditions, wind-shielding equipment should be installed at the upwind or construction in a wind-proof shed to prevent wind and sand from affecting the pipeline welding.

Welding shall not be carried out in any of the following environments without taking effective protective measures:

- 1) Rain, snow and blowing sand (with high wind);
- 2) The relative atmospheric humidity is greater than 90%;
- 3) Arc welding with low hydrogen electrode, wind speed is greater than 5m/s;
- 4) Arc welding with acid electrode, wind speed is greater than 8m/s;
- 5) Semi-automatic welding with self-shielded flux cored wire, with wind speed greater than 8m/s;
- 6) Gas-shielded welding, wind speed is greater than 2m/s;
- 7) The ambient temperature is lower than the temperature specified in the welding procedure specification.

5.7.2 Pipe Alignment

The pipe alignment should meet the requirements of Table 5.7-1.

Table 5.7-1 Pipe Alignment Requirements

Check List	Requirements
Internal cleaning	Free of contaminants
Nozzle cleaning (within 20mm range) and trimming	The pipe end is intact, free of rust, oil, paint, and burrs
Straight seam distance between two pipe ends	Greater than or equal to 100mm
Misalignment and misalignment correction	When the pipe wall thickness is less than 16mm, the misalignment should be less than 1.6mm; When the pipe wall thickness is greater than or equal to 16mm, the misalignment should be no greater than 10% of the pipe end wall thickness, and should be no

	greater than 2mm; the local misalignment should be no greater than 3mm, and the misalignment should be evenly distributed along the circumference.
Length of short section pipe	1.5 times greater than pipe diameter and no less than 100mm
Butt joint deviation	No greater than 3°

Other requirements include:

1)The inspection and acceptance of the pipe groove quality shall be performed by foreman. Except for joints and elbows, internal alignment devices should be adopted for pipelines with diameter equal to or greater than 350mm.

2)The pipes and equipment should be steadily fixed if in the longitudinal slope. The construction method should be determined according to terrain, topography and geological conditions.

3)Misalignment, if exists, should be evenly distributed along the circumference. Hammering to correct misalignment is strictly prohibited. After root welding is completed, misalignment correction is prohibited. When internal alignment devices are used, it should be detached upon the completion of root welding. During detachment of alignment device, the pipes should be kept in balance. When external alignment devices are used, the installation and detachment should be according to the WPS.

4)When straight pipes and hot bends are connected, the straight seams must be staggered and kept distant for at least 100mm.

5)When hot bends are butt-welded, the welding seams near the centreline of the elbow should be on two sides of the butt elbow. If it is not possible, the two straight seams shall be staggered and kept distant for at least 100mm.

6)No circumferential welds are allowed when crossing highway and railway with a width less than 10m.

7)Mechanical cutting of straight pipeline should be perpendicular.

8)All longitudinal and planar changes are connected by hot bends.

5.7.3 Cutting on Site

For pipelines, if cutting is required on site, hot-cutting methods such as oxy-acetylene should not be used, unless it is guaranteed that heat affected zone can be completely removed with machine cutting (such as cold cutting) after hot cutting. Cold cutting shall be adopted for cutting on site.

Cutting of hot induction bends is prohibited at site.

5.7.4 Welding Consumables

Welding consumables shall meet the following requirements:

- 1) Welding filler materials shall be selected in accordance with characteristics of the base metal. The mechanical properties of the weld shall match that of base material. The chemical composition of the welding metal shall be similar to that of the base metal.
- 2) Welding consumables shall be adopted and comply with the requirements of NACE MR 0175 / ISO 15156, AWS specification and API STD 1104.
- 3) The welding of feed gas and condensate pipes in sour service shall not adopt procedures and welding consumables that may cause the nickel content in the deposit metal to exceed 1%.
- 4) The handling, storage and use of welding consumable should be in accordance with its production specification and WPS.
- 5) The welding operations of feed gas and condensate pipes shall use the same welding consumable type and the same manufacturer as the WPQ. Any modification or changes need to be re-evaluated.

5.7.5 Preheating

All preheating requirement should be in accordance with ASME B31.8, ASME B31.4 and ASME IX, and meet the following requirements.

- 1) Pipeline welding area shall be preheated when it is required in the WPS, or when the ambient temperature is lower than 5°C or the atmospheric humidity is greater than 90%. The preheating shall be in accordance with WPS. The preheating temperature should not be lower than the temperature specified in WPQ and should not exceed this temperature by 50°C.
- 2) The preheating range should be no less than 3 times of the wall thickness on both sides of the groove, and should not be less than 25mm. The heating should be uniform, and local overheating is strictly prohibited. During welding, the temperature between the weld layers shall not be lower than its preheating temperature.

5.7.6 Hardness Inspection

Each pipeline weld and heat affected zone of the Multiphase and condensate should be tested for hardness. A portable Brinell hardness tester or Leeb hardness tester should be used. For portable Brinell hardness tester, the hardness result should be the average of 3 readings. For Leeb hardness tester, weekly calibration should be conducted and the hardness results should be the average of 5 readings.

Sanding, filing or other surface preparation work for hardness testing is allowed providing that depth shall not exceed 0.5mm. The hardness results shall not exceed 200HBW.

5.7.7 Post-weld Heat Treatment (PWHT)

PWHT shall be carried out if required as per WPS/PQR. PWHT is not mandatory in the project. However, when on-site hardness results exceed 200HBW, PWHT shall be carried out according to WPS with a minimum temperature at 620°C. Hardness shall be retested after PWHT. The weld shall be removed if the hardness requirement is still unqualified.

5.7.8 Welding Procedure Specification (WPS)

All welds including weld repairs shall be supported by a relevant WPS. WPS shall be defined according to ASME IX. All WPS shall be in writing and shall be qualified and certified in accordance with the applicable code. All lab test results for PQR shall be witnessed and certified by recognized inspection authority.

Each WPS shall be identified by a unique document number.

the CONTRACTOR shall develop welding procedures, and the completed WPS for a welding process addresses all essential variables. When any of the essential variables and supplementary essential variables of ASME IX is changed beyond what the reference code paragraph allows for the process, the welding procedure must be re-established as a new WPS.

The WPS shall state the actual consumable or flux trade name and type as well as the code designation. All WPS's specifying PWHT should indicate maximum heating rate, holding temperature range, holding time and maximum cooling rate.

WPQ shall use the same welding consumables or flux as onsite welding. Any change of manufacturer or welding consumables classification from the same manufacturer, re-qualification shall be required.

5.7.9 Welding Procedure Qualification Tests (WPQT)

5.7.9.1 General Requirements

WPQT shall comply with Section 7.6 of 10008-STD-6-PLR-025-R00.

5.7.9.2 Supplementary Performance Requirements

a) Charpy impact test

The welds and the heat-affected zone shall be subjected to charpy impact test in accordance with ASTM A370. The test temperature and results shall meet the requirements specified in Table 5.7-2.

Two sets of charpy V-notch impact samples shall be collected by machining on each test block. One group of notches shall be on the vertical center of the weld, and the other group shall be on the fusion line. The direction of the notch shall be perpendicular to the surface of the material.

Table.5.7-2 Requirements of Charpy Impact Toughness

Pipeline Name	Position	Grade	Minimum Charpy Impact Energy (J)		Test temperature (°C)	Minimum Shear area Avge (single)
			Single Value	Average		
APL01	Weld seams and heat affected zone	X65MS	40	54	-10	85% (75%)
APL02	Weld seams and heat affected zone	X65Q	40	54	-10	85% (75%)
APL03	Weld seams and heat affected zone	X65Q	40	54	-10	85% (75%)

b) Hardness test

Hardness test shall comply with Clause 7.6.4.2.7 of 10008-STD-6-PLR-025-R00. Hardness test shall be made using a 5 kg load or a 10 kg load. The hardness test method shall be Vickers hardness in accordance with ASTM E92. The test section shall be taken along the circumferential direction. The maximum single hardness reading of APL01 pipeline shall not exceed 250HV10 due to severe sour service was required. ~~Brinell hardness of cap weld shall be measured in accordance with ISO 6506-1. The maximum single hardness reading of cap weld shall not exceed 200HBW.~~ For APL01 pipeline, hardness test shall be carried out on three sections taken at the 12 o'clock, 3 o'clock and 6 o'clock positions of the steel pipe respectively.

The maximum single hardness reading of APL02 pipeline and APL03 pipeline shall not exceed 300HV10.

The hardness test results shall be included in the WPQ report, as well as the schematic diagram of the hardness test location and the corresponding hardness readings.

The Vickers hardness of the WPQ shall be measured according to Figure 5.7-1 (butt weld), Figure 5.7-2 (fillet weld) and Figure 5.7-3 (repairing weld and partial penetration weld).

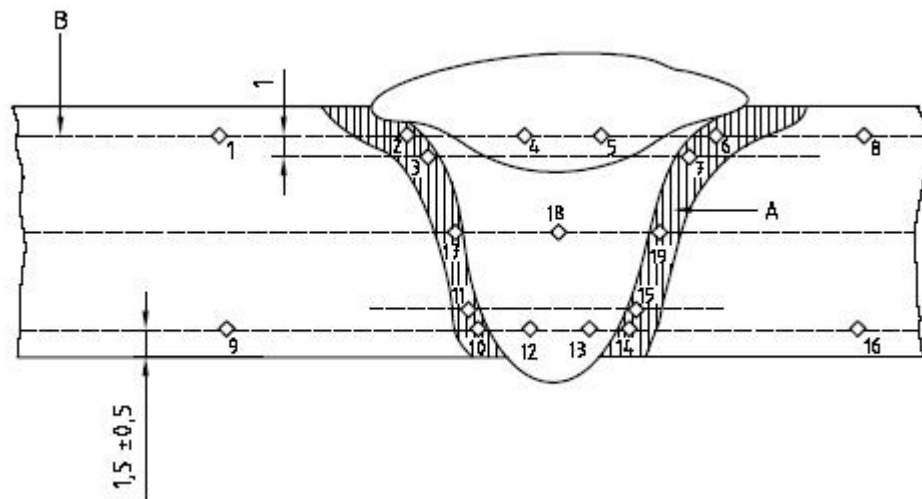


Figure 5.7-1 Vickers Hardness for Butt Weld

A — Heat affected zone (visible after etching);

B — The measuring line.

2, 3, 6, 7, 10, 11, 14, 15, 17 and 19 indentation should be completely in the heat-affected zone, and as close as possible to the fusion line between the deposited metal and the heat-affected zone. The upper measuring line should be in a suitable position so that the 2 and 6 indentations are consistent with the outline of the heat-affected zone or the fusion line of the last weld.

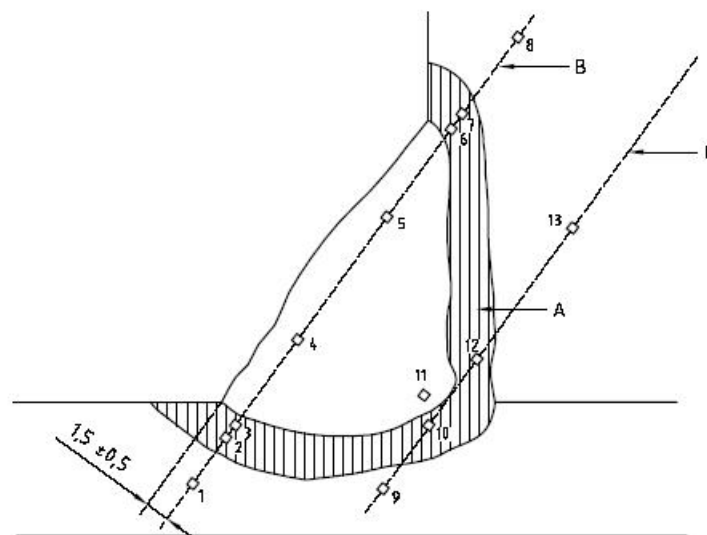


Figure 5.7-2 Fillet Weld

A — Heat affected zone (visible after etching);

B — The measuring line;

C — The measuring line, parallel to the measuring line B and passing through the fusion boundary between the weld metal and heat affected zone.

The hardness indentations of 3, 6, 10 and 12 should be completely in the heat-affected zone and as close as possible to the fusion line between the weld metal and the heat-affected zone.

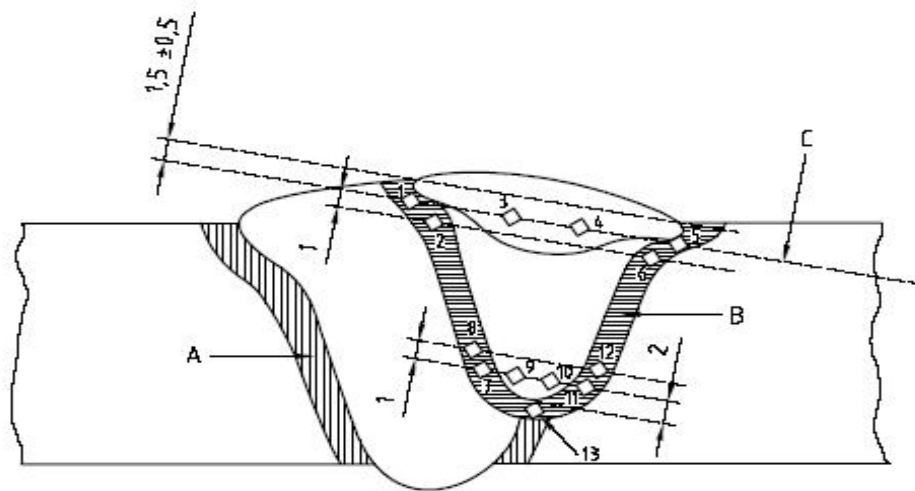


Figure 5.7-3 Repairing Weld and Partial Penetration Weld

A — The initial heat affected zone;

B — Repair welding heat affected zone;

C — The dashed line is parallel to the measuring line.

The upper measuring line should be in a suitable position so that the indentation of the heat-affected zone is consistent with the outline of the heat-affected zone or the cap weld fusion line of the last weld.

HIC and SSC tests are applicable for APL01 pipeline.

c) Corrosion resistance tests

i) HIC

Hydrogen-induced cracking (HIC) test shall be carried out in accordance with NACE TM 0284, test solution: solution A. Test duration: 96 hours. The maximum allowable rate of average of the three cross-sections should not exceed the following indicators:

Crack length rate (CLR) $\leq 12\%$,

Crack thickness rate (CTR) $\leq 3\%$,

Crack sensitivity rate (CSR) $\leq 1\%$.

In addition, no individual crack shall exceed 5 mm in length. The test report should include macroscopic photos of all cracks, and photos or drawings of hydrogen blistering on the surface of the test piece should also be provided.

ii) SSC

The sulfide stress cracking (SSC) test should be carried out in accordance with ISO 7539-2 or ASTM G39 using four-point bending specimens, and the test shall be carried out according to NACE TM0177 solution A.

Loading stress: 80% AYS.

Test duration: 720 hours.

Acceptance criteria: The tensile surface is inspected under a microscope with 10X magnification and no cracks or any surface damage should be observed.

5.7.10 Welder Requirements

The CONTRACTOR shall provide effective welders or welding operators' qualification certificate. CONTRACTOR shall be responsible for conducting tests to qualify the performance of welders and welding operators in accordance with qualified WPS. Welder shall use the same welding technique and proceed at the same welding speed as he/she passes the test and is permitted for welding. Copies of the welder and welding operation qualification test records shall be available for review by the Company's representative at site.

All welding, including pipeline welding, repair welding and tack welding, shall be performed by qualified welders using qualified welding procedures. Welders or welding operator shall be qualified and scope of welder's qualification shall be in accordance with API STD 1104.

5.7.11 Inspection and Acceptance of Welds

Unless other specified, the all requirements of acceptance shall be according API 1104 and followings.

5.7.11.1 Visual Inspection

Welds shall be visually inspected first and meet the following requirements:

No cracks, pores, depressions, slag inclusions and fusion spatter shall be observed on the surface of the weld.

The width of the weld on each side should exceed the groove by 1.0mm~2.0mm.

The surface of the weld should not be lower than that of the base metal and should meet the following requirements:

(a) When upward welding is adopted, the weld reinforcement shall not exceed 3mm.

(b) When downward welding is adopted, the weld reinforcement shall not exceed 2mm, the partial length shall not exceed 3mm, the continuous length shall not exceed 50mm. When the weld reinforcement exceeds 3mm, the weld reinforcement shall be grinded. The grinded weld reinforcement shall be smoothly transitioned to the base metal without any damage to the base metal.

The undercut depth should not be exceed 12.5% of the wall thickness and should not exceed 0.5mm. In any continuous weld length of 300mm, the cumulative undercut length shall not exceed 50mm.

5.7.11.2 Non-destructive Test (NDT)

NDT is allowed to proceed when visual inspection is accepted. The test results should meet the requirements of API STD 1104. NDT shall be performed at least 24 hours after completion of welding.

The inspection ratio and qualified levels of NDT of welds are as follows:

- 1) 100% RT for circumferential weld shall be performed with the acceptance of API STD 1104. Golden welds shall be performed 100% RT + 100% UT.
- 2) 100% PT or MT for fillet weld shall be performed with the acceptance of API STD 1104.
- 3) Cracks and incomplete foot fusion are not allowed in all welds.
- 4) For the unqualified welds of gas and condensate pipelines, only one repair is allowed on the same position (crack defects must be removed and repairs are not allowed). The repaired weld shall allow the use of original inspection methods, and shall be re-inspected using original methods.
- 5) When 100% radiographic test is adopted on the circumferential welds, crawlers shall be used whenever possible.
- 6) When two adjacent construction sections (golden weld) are joined and welded, the ambient temperature should controlled at 20°C to reduce stress due to temperature difference.

5.7.12 Repair and Removal of Defects

As for the welding seams unqualified for the inspection, the removal and rework shall be carried out according to the relevant requirement prescribed in the Section 10 removal and rework of defects in API 1104, including:

The welded joint with cracks shall be cut away from the pipeline according to the relevant regulation. For non-crack defects, the repair of the same welding seam shall not exceed twice.

Inspection and acceptance standard: the reworked area shall be inspected with the original inspection method before rework.

The penetrant inspection shall be conducted to the reworked welded joints according to Welding of Pipelines and Related Facilities (API 1104); the reworked welded joint without any defect shall be deemed as qualified. If the welded joint is not qualified after repairs, the welded joint with cracks shall be cut away from the pipeline.

The repaired welded joint that was once regarded as unqualified during inspection shall be determined whether the repaired welded joint needs to be heat treated or not according to the WPQ test report through project assessment. If it needs to be heat treated according to the WPQ, the hardness test shall be performed to the repaired welded seam.

The inspection unit shall carry out the inspection works according the following rules on the basis of the WPQ and material requirement:

Except when the special requirement is made to the time of butt welding joint, the NDT shall be carried out 4 hour after the completion of welding, and the NDT for the rest parts shall be carried out 24 hour after the completion of welding.

NDT shall be carried out for the repaired welded joints, and the joints between existing pipeline and new pipeline.

Cracked welds shall be removed from the line unless permitted by Section 6.8 in API STD 1104 or when the repair is authorized by the company. Cracks may be repaired provided the length of the crack is less than 8% of the weld length and a qualified repair welding procedure is used.

Defects in the root and filler beads may be repaired with prior company authorization. Defects in the cover pass may be repaired without prior company authorization. A qualified repair welding procedure is required to be used whenever a repair is made to a weld using a process different from that used to make the original weld or when repairs are made in a previously repaired area.

Repair procedure should be complied with the Section 10.2 in Welding of Pipelines and Related Facilities (API 1104).

Repaired areas shall be inspected by the same means previously used. Repairs shall meet the standards of acceptability of Section 6.8 in API STD 1104.

Welder evaluation, repair rate, etc are defined in Welder Evaluation Procedure.

For repairing of APL01, the max diffusible hydrogen content shall be 5ml/100g of weld metal.

5.8 Cathodic Protection

SACP system shall be used for the permanent cathodic protection of buried pipelines, detailed in “Cathodic Protection Design Philosophy” (MM-ASK-1A-APL01-COR-PHI-0001).

Monolithic isolation joints shall be provided at each end of the buried pipeline for electrical isolation purpose as per “Cathodic Protection Design Philosophy” (MM-ASK-1A-APL01-COR-PHI-0001).

5.9 Lowering-In

As far as possible, the pipeline shall be installed free of elastic stresses at bottom of trench, otherwise a max of 10% of SMYS may be tolerated.

This shall include all work necessary to lower pipe into trench.

Lowering in the pipelines into the trench shall be based on COMPANY's approval of the lowering-in certificate. The lowering-in certificate shall certify that the welding, NDT and coating in that section meet the specifications. No lowering-in will take place prior to approval by COMPANY of this certificate.

Before lowering-in the pipe, the trench bottom shall be visible and the trench depth shall be checked to ensure that the specified depth of cover shall be maintained, taking into account any pre-padding that may be required. Holiday shall be performed before pipe lower in.

All coated and wrapped pipe, which has been supported in any manner, shall be subjected to close inspection and checked with a holiday detector to see that the coating is undamaged and if found damaged shall be patched.

CONTRACTOR shall furnish sufficient proper equipment during the lowering-in operation to prevent excess bending of the pipe or damage to coating.

5.10 Backfill

5.10.1 General

Backfilling of the pipeline shall be performed as soon as practicable following lowering-in with accepted by COMPANY. The following shall be determined for backfilling work:

1) Before backfilling, Contractor shall record the joint locations and all underground facilities by survey for as-built purposes.

2) Contractor shall not backfill any buried facilities prior to collection of sufficient as-built data. The pipeline shall be protected against any possible landslide and running water by adequate means to the satisfaction of Company.

This shall include all work necessary to backfill excavated material in the trench, and restore creek banks, hillsides, or other places where the right-of-way has been graded. Immediately after the pipe has been lowered, it shall be weighted by filling the trench over the pipe with backfill material.

The laying of warning tapes should meet the following requirements:

1) The materials, specifications, colours, terms and fonts that should be used for laying the warning tape should meet the design requirements.

2) The warning tape should be laid flat on the top of the pipe, and the distance from the top of the pipe should be 0.3m, with the word face up when laying.

3) The laying of the warning tape should be continuous, and there will be missed connections during intervention.

Upon completion of backfill, the pipeline alignment will be temporarily pegged to ease the installation of permanent marker and signage.

5.10.2 Backfill Material

For initial backfilling, backfill material shall be free from rock and size not greater than 12.7 mm in diameter and filling the trench with padding material to a level not less than 15 cm above the top of pipe to prevent pipe damage. In case of initial backfill material size greater than 12.7 mm, the rock shield or selected material shall be provided to protect the pipe coating. Remaining backfilling may contain the material size larger than 12.7 mm. In areas of rock, the final grade of the backfilled trench shall be to surrounding ROW finish grade elevations. All the separated topsoil shall be placed in the upper part of the backfill. After compaction and restoration requirements are done, a soil berm 30 cm shall be placed over to allow future settlement unless specified otherwise.

5.10.3 Excess Material

Excess material which cannot be used for backfill shall be removed from right-of-way to a location approved by COMPANY.

All surplus rock removed from the trench shall be disposed of to the satisfaction of the COMPANY. All roads, pavements, hillsides, creek banks, terraces, and other places where the CONTRACTOR has moved earth to facilitate the movement or operation of its equipment shall be restored by CONTRACTOR to their original profile and condition.

5.11 Clean-Up

This shall include all work necessary to remove surplus material from the right-of-way and to finish grading the back-fill and right-of-way and to repair fences.

Before the work is finally accepted, CONTRACTOR shall remove all surplus blasted or excavated material from the right-of-way and adjacent property, as well as from public and private roads, and the channels of streams and trenches. All underbrush, broken sand bags, and other such debris shall be disposed of as specified by the COMPANY. Oil drums, sheet metal from paint barrels, and other objects shall be gathered up and removed from the right-of-way. Sheet metal or other material shall not be placed in the pipeline trench and covered up as a means of disposal.

On sections of pipeline where there is rock excavation, all loose rock deposited by such operation, both on right-of-way, and on land adjacent to right-of-way, shall be picked up and disposed of by CONTRACTOR. The backfill shall be piled over the trench and then smoothed down with a grader or harrow. In all areas, all spoil from side hill cuts will be returned to its original position.

Where the pipeline has been laid within improved roadway rights-of-way, the surface of such improved roadways shall be restored using new materials of like quality with those found in the original improvement to the satisfaction of the COMPANY and the governmental authority having jurisdiction over that portion of the work.

5.12 Final Tie-ins

If insufficient overlap of pipe exists at final tie-ins (tie-ins between hydrostatic test sections) such that extra pipe is required, only appropriate pre-tested pipe shall be used. The tie-in weld between hydrostatic test sections shall be tested by other accepted non-destructive methods, should PT in addition to radiography inspection.

6.0 PIPELINE PRECOMMISSIONING

6.1 Basic Requirements

The test pressure shall be the lower of the below two values, unless otherwise specified by the COMPANY:

- a) The test pressure as required in ASME B31.4 (ref 437.4) or B31.8 (ref table 841.3.2-1 and A847.2) as applicable.
- b) The test pressure value of the weakest component in the pipeline system (other than line pipe, e.g. Flange, isolation joint, .etc.)

During the hydrostatic pressure test, the combined stress shall not exceed 100% SMYS of line pipe material based on minimum wall thickness. The combined stress shall be calculated. In no case the test pressure at the lowest point in the system, shall be more than 95 % SMYS.

The elevation profile shall be plotted to assist in checking that the test pressures at the low and high points and shall not result in pressures or combined stresses outside the limits specified above.

6.2 Pre-testing Of Assemblies

CONTRACTOR shall hydrostatically test assemblies following fabrication and installation but prior to tying into the completed pipeline system. Wherever the CONTRACTOR elects to fabricate temporary spool pieces for use during assembly piping hydrotesting, the applicable spool drawings shall be submitted to COMPANY for approval. All assemblies shall be hydrostatically tested to a minimum test pressure as specified by COMPANY, for a minimum period of 4 hours without a loss in pressure. Any variation in pressure shall be explained (e.g. temperature fluctuations). All test certificates shall be furnished by the CONTRACTOR for approval by COMPANY.

6.3 Air Content Determination

The air content of the filled line shall be determined during initial pressurisation by using the pressure/ added volume plot. The linear section of the curve shall be extrapolated to the

volume axis, which shall correspond to static head pressure. The volume of air can be read from the intersection of the line with the volume axis and shall be used to calculate the air content thus:

$$\text{Percentage air content} = (\text{Volume of air} / \text{Volume of line}) \times 100\%$$

If the air content exceeds 0.2 % of the line volume, testing shall be terminated and the cause investigated. If further venting does not bring the air content within acceptable limits, the test section should be emptied and refilled at the discretion of the Principal.

6.4 Temperature Recorder

A temperature recorder shall be installed by CONTRACTOR on each test section a minimum of 500m back from the exposed pipe at one end of the test section. One sensing element shall be placed against the pipe wall, suitably insulated and backfilled. The second element shall be installed in the pipe backfill material a minimum of 0.3m from the pipe wall and suitably insulated and backfilled.

Temperature recorders shall be checked every three hours during filling and testing to ensure they are functioning properly.

6.5 Water Quality Requirement

The pipeline shall be filled with water treated, as per 10008-STD-6-COR-031 requirements and sufficient quantities of chemicals shall be available on Site at all time.

For land pipelines, fresh water shall be used.

Prior to filling of the pipeline, well in advance, samples of proposed test water shall be analyzed by an accepted third party institute, to determine possible contaminant and presence of SRB (Sulphate Reduced Bacteria)

The analysis shall permit to determine amounts of corrosion inhibitor, oxygen scavenger and bactericide needed, but as minimum, bactericide is to be used. Apart from the quality of water, the required amounts corrosion inhibitor, oxygen scavenger and biocide are also determined by the duration of contact of line-fill water with the interior of the test section, the precommissioning requirements and the future use of the pipeline. However, the dosage of chemical treatment required to treat sea water for hydrotest operation and pipeline preservation shall not be less than 1000 ppm. The disposal of the treated water after the test must be in line with the local regulations.

6.6 Internal Cleaning

Once backfilling has been completed the pipeline shall be cleaned and gauged to ensure there is no deformation and the line is clear from any obstructions.

Prior to hydrostatic testing CONTRACTOR shall remove all dirt, loose rust, mill scale and construction debris from the inside of the pipeline.

6.7 Cleaning Scraper Tools

CONTRACTOR shall propel cleaning scraper tools through all sections of the pipeline using compressed air. The pig shall be new or any used pig shall be in an acceptable condition. Multiple runs of scraper tools with polyethylene (PE) pig shall be done to clean the pipeline internal to the satisfaction of COMPANY.

The removal of the cleaning scraper tool shall be witnessed by COMPANY. Extra cleaning scraper tool runs shall be made if, in the opinion of COMPANY, a proper level of internal cleanliness has not been achieved.

6.8 Dirt and Debris Containment

CONTRACTOR shall provide means for containing dirt and debris generated by the cleaning operation. Dirt and debris shall not be allowed to blow over adjacent land.

No visible debris at the outlet of the pipeline after Internal Cleaning is considered qualified.

6.9 Pigging

All pipelines shall, before pressure test, be cleaned no less than 2 times using a brush pig or foam pig.

After pressure test, additional pigging shall be conducted to ensure cleanliness within the pipeline, i.e. no free water and impurity in the pipe. This will be repeated until the pipeline is deemed clean.

Temporary pig launcher and receiver shall not be installed in densely populated areas. Pigging discharge shall meet environment protection requirements. Safe channel must be set up at pig outfalls so to prevent from flooding surrounding areas, and the outfall shall be higher than surrounding ground to prevent from back flow of ponded water.

As for the pigging between stations, the builder shall connect all the pipelines between stations within its specific bid section, and then conduct the pipe pigging using compressed air to drive the pig.

Pigging between stations shall adopt pig launcher and receiver.

All the cut-off valves of the pipelines passed by the pig shall be open.

Pigging between stations adopts compressed air, and the dirt cleaned out shall be drained into the blow down sump so to prevent from pollution. The pigging can be stopped only after the pipeline is considered sufficient clean.

6.10 Gauging

After pigging is completed, the internal diameter of the pipeline shall be measured before pressure test in order to check internal wall defect.

Gauging disc may be installed in the middle part of the pig to check whether such defects as pit and deformation exist in the internal wall or not. The gauging disc shall be commonly made of aluminium plate with 6mm thickness, segmented and with an edge of 45° - 3mm width for pipelines from 4" NPS to 12" NPS 8mm thickness, segmented and with an edge of 45° - 3mm width for pipelines over 12" NPS to 24". And the gauging's diameter shall be 96% of inner diameter of the pipeline. The gauging shall be made with gauge plate diameter equal to 97.5 % of inner diameter for cold bends, induction bends, MIJ and special sections or components at respective workshops after manufacturing/fabrication. Pigging and diameter measurement shall be according to the following procedure: Before pigging and diameter measurement, install temporary receiver and launcher at both ends of the pipeline firstly, and then install the pig in the launcher, start the air compressor to fill compressed air into the launcher to push the pig to move forward until the pig pushes such sundries as soil, sand and welding slag in the pipeline into the receiver, and then stop filling compressed air into the pipeline and open the exhaust valves in the receiver and launcher for exhaust. Open the receiver when pressure in the pipeline lowers down to the atmospheric pressure and inspect effect of pigging and diameter measurement. Pigging shall be done not less than twice to remove all sundries in the pipeline. After pig reaches the receiver, remove the gauging disc from the pig. Diameter measurement meets relative requirements if the gauging disc has no distortion or fold.

6.11 Strength Test

The clean water shall be used as the medium of the pipeline strength test. The pressure of clean water applied to the strength test is 1.5 times as much as the design pressure for gas pipeline, and for condensate pipeline, it should be 1.25 times of design pressure. The pressure test scheme shall be prepared in advance and the water sources relay and drainage measures shall also be considered. Pressure test sections along the pipeline shall be divided by the construction units of specific bid section according to the topographies and water source conditions etc.; for sections with heavier undulating terrain, water relay shall be considered when necessary. All instrument connections shall be blinded off. In-line ball valves shall be in partially opened position.

The pipe strength test shall be slowly progressed, the rate of pressurisation shall be performed at constant rates not exceeding 1 bar/min up to 70% of the pressure test, and then to 0.5 bar/min from 70% to 80% of the pressure test.

When the pressure is separately increased to 30% and 60%, the pressure shall be respectively stabilized for 30min and all potential leakage points shall be checked. After the

pipe has been checked without problems, the pressure shall be continuously increased to strength testing pressure and stabilized there for 4 hours at least.

The pipe is considered as qualified, after being checked by eyes and confirmed to be free from deformation, rupture and seepage, and with a pressure drop less than or equal to $\pm 0.2\%$ of the testing pressure.

Table 6.1-1 Strength Testing Pressure for Newly Built Gas and Condensate Pipelines

Description	Design Pressure (barg)	Specified Minimum Yield Strength, σ_s (MPa.g)	O.D. (mm)	Selecte d W.T. (mm)	Material	Test Pressure	Strength Test Pressure (barg)	Strength Test Duration (h)
APL01	70	450	508	14.3	API 5L X65 (Severe Sour Service)	1.25×DP	87.5	24
APL02	48.7	450	219.1	7.04	API 5L X65	1.25×DP	60.9(HOLD)	24
APL03	153.2	450	323.9	15.9	API 5L X65 (Sweet Service)	1.5×DP	229.8	24

6.12 Leaktightness Test

Leaktightness test can only be carried out after the strength test of the pipelines is passed, with a medium of water and a testing pressure of 1.1 times of the design pressure.

After the satisfactory completion of the strength tests, the test section shall be depressurised to leaktightness test pressure. Pressure let-down valves shall be opened slowly and depressurising continued at a rate that does not generate vibrations in associated pipework. Under normal circumstances, no fitting of any type should be attached to the pressure let-down valve. If fittings or drain lines are attached, they shall be adequately braced and tied down to prevent movement.

The depressurisation rate should not exceed 1 bar (15 psi) per minute until the pressure has been reduced to 40 % of the strength test pressure. Then depressurisation should continue at a rate of less than 2 bar (30 psi) per minute to the leaktightness test pressure.

The leaktightness test shall be passed if no seepage happens and clean water pressure drop is not more than 1% of test pressure after 24 hours under stable pressure. The pressure test is unnecessary for the welded joints at the connecting point of two pressure test sections after the sectional pressure test has been passed. However, the straight nipple used for the connector shall be qualified pipeline sections upon the pressure test, otherwise it cannot be

used. The weld crater at the connection point also shall be subject to 100% X-ray inspection and 100% ultrasonic examination.

Table 6.1-2 Leaktightness Testing Pressure for Newly Built Gas and Condensate Pipelines

Descrip tion	Design Pressure (barg)	Specified Minimum Yield Strength, δ_s (MPa.g)	O.D. (mm)	Selected W.T. (mm)	Material	Test Pressure	Leaktightne ss Test Pressure (barg)	Leaktight ness Test Duration (h)
APL01	70	450	508	14.3	API 5L X65 (Severe Sour Service)	$1.1 \times DP$	77	24
APL02	18.6	450	219.1	7.04	API 5L X65	$1.1 \times DP$	20.5	24
APL03	153.2	450	323.9	15.9	API 5L X65 (Sweet Service)	$1.1 \times DP$	168.5	24

Note:

1)Leaktightness testing pressure is for reference only,because in the COMPANY's standards, there is only one test with test pressure for holding 24 hours.

6.13 Testing Of Special Sections

In some test sections, it is difficult to correlate the pressure changes with the temperature fluctuation, because the temperature fluctuations of the test section are difficult to measure, e.g. in above-ground test sections (effects of the sun, rain and wind). In such cases, the leak test should be carried out, wherever possible, on the basis of a visual examination to check the leaktightness of the test section after the satisfactory completion of the 4-h strength test. The visual examination shall not commence before the pressure has been reduced to the leak test pressure and held for a minimum of 4 h. The results of the visual examination shall be documented by the test supervisor.

If it is not possible to check the leaktightness of the test section by visual examination, the leaktightness shall be demonstrated by a 24 h leaktightness test. The influence of the temperature fluctuation should be considered in specifying the location and number of temperature measurements. It may be necessary to protect above-ground or above-water test sections against sun radiation.

A 24-h leaktightness test for pre-tests of assemblies is not necessary. The influence of the temperature fluctuation should be considered in specifying the location and number of temperature measurements and the stabilisation period.

Contractor shall execute the special section test only after approval from COMPANY.

6.14 Depressurising

After the satisfactory completion of the strength and leaktightness tests, the test section shall be depressurised to hydrostatic head plus 1 bar (15 psi) so that air does not enter into the test section. Pressure let-down valves shall be opened slowly and depressurising continued at a rate that does not generate vibrations in associated pipework. Under normal circumstances, no fitting of any type should be attached to the pressure let-down valve. If fittings or drain lines are attached they shall be adequately braced and tied down to prevent movement.

The depressurisation rate should not exceed 1 bar (15 psi) per minute until the pressure has been reduced to 40 % of the test pressure. Then depressurisation should continue at a rate of less than 2 bar (30 psi) per minute.

Test pressure shall not be used for transfer of water from one test section to another.

6.15 Dewatering

CONTRACTOR shall dispose of water in a manner satisfactory to the authorities having jurisdiction over these matters, and COMPANY. Prior to dewatering, all drain lines and test manifolds shall be firmly tied down and braced to prevent movement.

Care shall be taken so that water is disposed of without causing excessive erosion or flooding.

The polyethylene pigs shall be propelled by compressed air. A pressure recorder shall be connected to the test manifold to record the air pressure while dewatering.

CONTRACTOR will purge the entire section of water by using a pig driven by compressed air. Multiple runs may be required ensure that all of the water has been removed from the test section.

Pigging with foam or brush foam pigs shall continue until they arrive without free water in front.

6.16 Drying

All pipelines shall be dried after pressure test.

Before drying, the pipelines that have passed the pressure test should be swept inspection. If brush pigging is used for inspection, it shall be qualified that there is no clear water at the end. If a foam pig is used for inspection, the qualification standard is that the water content of two consecutive foam pigs is not more than (1.5DN/1000) kg. The interference of the pig can be 3% to 8% of the pipe inner diameter.

Dry air can be used to dry the pipeline. The water dew point at the end of the pipeline does not exceed 3°C after 4 hours of the airtight test, and it is qualified if it does not exceed -20°C.

6.17 Preservation

- 1) The replacement of the air in the pipeline should be carried out after the strength test, the leaktightness test, the cleaning of the pipe, and the drying pass. Nitrogen or other non-corrosive, non-toxic inert gas should be used as the isolation medium.
- 2) The mixed gas should be discharged to the vent system during the replacement process. Vents should be far away from traffic lines and residential areas, and an isolation area with a radius of 300m should be established around the vents. Pyrotechnics and static sparks are not allowed in the empty isolation area.
- 3) The end of the replacement pipeline should be equipped with gas content detection equipment. When the oxygen content of the vent pipe at the end of the replacement pipeline is not more than 2%, the replacement can be considered qualified.
- 4) If the owner cannot confirm that the pipeline (or pipe section) can be put into production immediately after the completion of the pipeline, in order to ensure the safety and life of the pipeline, the pipeline section or the entire line completed in advance should be timely used to effectively protect the inner wall of the pipeline with nitrogen. It should be filled with dry nitrogen, and keep the internal pressure of the pipe greater than 0.12MPa~0.15MPa (absolute) in a dry state to prevent external moisture from re-entering the pipe, otherwise it should be dried again.
- 5) If the CONTRACTOR cannot confirm that the pipeline (or pipe section) can be put into production immediately after the completion of the pipeline, in order to ensure the safety and life of the pipeline, the pipe section or the entire line completed in advance should be timely used to effectively protect the inner wall of the pipeline with nitrogen. It should be filled with dry nitrogen, keep the internal pressure of the pipe greater than 0.12MPa~0.15MPa (absolute), and seal the pipe ends to prevent external moisture from entering the pipe, otherwise it should be dried again.

6.18 Safety Requirement

The safety of employees and mass people during the pressure testing period shall be considered, the safety plan shall be formulated. The pipe strength test pressure shall be boosted progressively and slowly; when the pressure is separately boosted to 30% and 60%, the pressure boosting shall be stopped respectively and the pressures shall be stabilized for 30min; after the system has been checked without any abnormal situation, the pressure shall be continuously boosted to the strength test pressure. In the meantime, within the period of boosting the pipeline's hoop stress from 50 % σ_s to the maximum test pressure for the first time and later reducing the pressure to the maximum operating pressure, appropriate procedure shall be adopted. The staff who does not involve into the pressure testing shall evacuate from the pressure testing area.

7.0 TREATMENT FOR SPECIAL SECTIONS

7.1 Road And Railway Crossings

7.1.1 General

Road and railway crossings shall be installed in accordance with the project and by the means to satisfy the requirements and specifications of the jurisdictional authorities.

7.1.2 Bore Crossings

CONTRACTOR shall ensure that the edges of bore entry pit & bore exit pit shall be kept away more than 3 meters from the toe slope and / or shoulder of road crossing.

Bore crossings shall be installed using a pilot pipe section. The pilot section shall be pipe provided by the CONTRACTOR. Once the pilot section is in place, the permanent, coated, carrier pipe shall be welded onto the pilot section and jacked or pulled through the bore. The pilot section shall then be cut off and removed. No boring or augering shall take place through any portion of the permanent carrier pipe.

CONTRACTOR may wish to propose alternative trenchless crossing methods to COMPANY that could be more suitable to the conditions and environment, or for safety reasons.

Bore pipes shall only be line pipes with 4.5 mm thicknesses of factory applied 3LPE external coating, respectively to provide the necessary abrasion protection during pullback installation.

Bore crossings shall be as per MM-ASK-1A-APL01-PLR-DWG-00010 - Typical Road Crossing Details(Bored) Drawing and MM-ASK-1A-APL01-PLR-DWG-00011 - Typical Highway Crossing Details(Bored) Drawing.

7.1.3 Open Cut Crossings

Prior to any excavation within the road ROW, barriers, warning lights, signage, flaggers, and other safety measures shall be provided in accordance with the requirements of the jurisdiction authority and/or Project SHE Specifications.

Before cutting the road surface, the road crossing pipe section shall have been completed, inspected, and approved for installation, and all fill and surfacing materials required to reinstate the road, following pipe installation, shall be readily available.

The backfill and restoration of the road surface shall be completed in accordance with permit requirements or, as a minimum, shall meet the following specification:

- All roadway backfill materials including bedding and padding shall be placed in 15 cm maximum lifts and compacted to ninety five percent (95%) Modified Proctor density (ASTM D1557), as minimum. **Field Density Tests (FDT) must be conducted to control compaction quality. Testing shall be performed at every specified interval (e.g., every [X] meters or 50-100m) and for every compacted soil layer. The test results must be submitted to the Civil Engineer for approval prior to the next stage of work.**Padding lift is not required to be compacted.

- The road crossing pipe section shall be bedded and padded with materials and to dimensions specified in Section 13 of this Specification. The remainder of the backfill shall consist of the original road sub-base materials or similar.
- For paved roadways, the final 30 cm of trench backfill below bottom of pavement shall be crushed stone base. The aggregate shall consist of durable, angular fragments of uniform character and shall have an abrasion loss not to exceed forty percent (40%) when tested as per ASTM C131.
- Gradation for crushed stone base shall be as follows:

U.S. Std. Sieve Size	Passing Percentage
1½" (38 mm)	100
¾" (19 mm)	60-90
3/8" (10 mm)	40-80
No. 4	25-40
No. 30	7-15
No. 200	0-3

- In all pavement restoration, the existing pavement shall be saw-cut back by an additional 30 cm minimum on both sides of the trench for the full depth of the pavement to ensure a neat, smooth paving joint. A uniform grade between the two edges of the prepared, existing pavement shall be maintained during pavement restoration to ensure no swales or bumps in the final pavement repair.

Final pavement restoration shall be completed utilizing material similar to the existing adjacent pavement. Asphalt pavement, as a minimum, shall meet the requirements of the jurisdictional authorities.

Open cut crossings shall be as per MM-ASK-1A-APL01-PLR-DWG-0009 - Typical Road Crossing Details(Open Cut) Drawing.

7.2 Waterway Crossings

CONTRACTOR shall strictly perform constructions to comply with jurisdictional authorities' rules, regulations, and permit conditions. For reinstatement, CONTRACTOR shall provide erosion controls to ensure slope stability in good condition as before (e.g. to provide riprap, gabion, jute sag, etc.).

Crossings of streams, rivers, canals, ditches, ponds, and other watercourses shall be installed in accordance with the project and by means, which satisfies any conditions imposed by the jurisdictional authorities.

At crossings that are navigable by pleasure or commercial craft, the CONTRACTOR shall comply with all special precautionary measures required by governing maritime authorities, to prevent or minimize obstructions to navigation on the watercourse.

Construction of the pipeline across rivers and streams shall be performed in such a manner as to keep any damage to shorelines, water crossed, adjacent drainage areas, and fish and

wildlife habitats, to a minimum. The CONTRACTOR shall take all measures deemed necessary to protect and prevent bank erosion or damage resulting directly or indirectly from construction activities.

Prior to commencement of the Work, the CONTRACTOR shall submit for COMPANY approval, a Work Plan detailing the proposed method of installation of major water crossings. The Plan shall include a schedule, list of equipment and personnel, and procedures to be used.

Concrete-coated pipe shall be used at open-cut crossings of rivers, streams, ponds, and exceptionally wet area. CONTRACTOR may wish to submit an optional field-joint filler proposal for COMPANY consideration and approval.

7.2.1 Open Cut Crossings

During open cut construction, CONTRACTOR shall maintain and control obstructed drainage or water flow (e.g. for normal waterways or large waterways, and detoured drainages or detoured waterways shall be provided; but for small waterways, flume pipes shall be installed).

During open cut construction, CONTRACTOR shall provide sediment traps or silt curtains in order to prevent the sediment to ingress to downstream side.

Across streams and rivers, the pipeline shall be laid as near to level as practicable and, where required. The CONTRACTOR shall excavate the trench to such dimensions to permit installation of the pipeline with the specified depth of cover. The location of sags and over-bends on each side of the crossing will be subject to the approval of COMPANY.

Cutting of the pipeline trench in sloped approaches shall not be undertaken until actual pipe laying is to be carried out, to minimize silt input into the watercourse. If necessary, the work area shall be graded, and other precautions shall be taken to prevent surface run-off entering the trench.

Prior to construction at designated crossings, the CONTRACTOR shall stockpile adequate quantities of approved backfill materials. All excavated materials from the designated stream beds shall be disposed of at sites approved by COMPANY.

If the bottom of the trench cannot be seen, the CONTRACTOR shall verify that the bottom of the trench is smooth and continuous. After lowering in, CONTRACTOR is required to survey the top of pipe for as-built purposes and request approval from COMPANY before backfilling begins.

Following installation of the pipe, the beds of streams and rivers shall be restored to their former elevations and grade. Spoil, debris, piling, construction materials, and obstructions resulting from the construction of the pipeline shall be removed from the crossing to prevent

interference with normal water flow and use of the waterways and shall be disposed of in a manner and at locations approved by COMPANY.

Where practical, stream and river banks shall be backfilled and compacted in 15 cm maximum lifts to a point above the high-water line. To prevent soil and bank erosion, CONTRACTOR shall apply some protections, such as sandbag and/or rip-rap. Such work shall be performed to the satisfaction of the landowner and/or tenant, COMPANY, and the jurisdictional authority. As a minimum, compaction shall be to densities equivalent to those of the surrounding soils. At crossings with an undefined high-water line, such as unlined irrigation ditches and canals, the compaction effort shall extend for a minimum distance of 1.7 m beyond the outside banks of the ditch or canal.

Open cut crossings shall be as per MM-ASK-1A-APL01-PLR-DWG-0012 - Typical Minor Waterway Width <2000mm Crossing Details (Open Cut) Drawing and MM-ASK-1A-APL01-PLR-DWG-0013 - Typical Canal / Waterway Width >2000mm Crossing Details (Open Cut) Drawing.

7.2.2 Bore Crossings

CONTRACTOR shall ensure that the edges of bore entry pit & bore exit pit shall be kept away more than 3 meters from the toe slope of waterway crossing.

In certain cases, the jurisdictional authority may require installation of the pipeline across the waterway to be performed by boring.

7.3 Underground Utilities Crossing

The pipeline shall cross existing underground pipelines with a minimum of 600 cm clearance, cross all utilities with a minimum of 400 cm clearance and cross underground power cables with a minimum of 500 cm clearance, between the two services, while maintaining the specified minimum cover on the pipeline. The CONTRACTOR shall obtain approval from individual utility owner and COMPANY. All crossings shall be recorded and shown on as-built drawings. Where the pipeline crosses or is parallel to other metallic utilities, the CONTRACTOR shall install a cathodic protection test station as per the relevant AFC drawings. In addition, CONTRACTOR shall investigate and report for any interferences, then reflex to CP design. Permit is required for cad welding / pin brazing third party pipelines to COMPANY pipeline.

7.4 Pipeline Work At Block Valve Stations

CONTRACTOR shall install that portion of the mainline and associated piping located within the limits of the pressure relief and metering station, as per the locations and elevations shown on the Project.

Reinforced concrete foundations and supports shall be fabricated and installed in accordance with Project Specification, at locations shown on the Project.

At no time, shall the security of the station be compromised during construction.

CONTRACTOR shall advise COMPANY of its daily work plan prior to commencement of the Work, which shall comply with all COMPANY safety procedures and standards.

Pipeline work at block valve stations shall be as per MM-ASK-1A-APL01-PLR-DWG-0035 - Typical Block Valve Station Tie-In Details Drawing.

7.5 OHTL Crossings/ Parallel

Contact with overhead electric lines could be lethal. Overhead power lines are not normally insulated and if direct contact or near contact is made with them (i.e. by a crane boom, scaffold pole or similar conductive material) the electrical current shall arc to earth across any person or persons in the immediate vicinity causing serious injury or death. Power lines may automatically switch off resulting in claims for loss of revenue from the utility owner.

For pipelines welding shall not be executed under high voltage power lines and the section to be installed under them shall be prepared 10m minimum away, and then carried in position when ready to install.

Each piece of equipment utilized to handle pipe in any way, such as unloading picking up, transporting, bending or "lowering in" shall be grounded and may be equipped with a cable assembly capable of grounding the joints of pipe to the piece of equipment handling that pipe.

7.6 Construction Access Road

Temporary bypass (diversion) road placed as not to disrupt traffic flow. The road shall be of good standard and maintained throughout the activity as required.

8.0 MARKERS AND SIGN BOARDS

The location of buried pipelines shall be clearly identified by markers. Pipeline markers shall be as per MM-ASK-1A-APL01-PLR-DWG-0022 - Typical Pipeline Marker Sign And F.O.C. Manhole Marker Sign Details Drawing.

Sign Boards In areas where the risk of interference or disturbance by mechanical excavators is high, additional warning signs should be installed to lower the risk. Pipeline markers should be installed at the locations along buried pipelines as indicated in.

9.0 PIPELINE BUOYANCY CONTROL

CONTRACTOR shall install screw anchors at regular intervals along the Pipeline (apart from at bore), to sustain the effects of negative or neutral buoyancy. The use of concrete set-on weights or bolt-on weights shall not be permitted.

The screw anchor hold down polyester saddle that spans over the pipe shall be used to provide downward pressure on the pipe without damaging the pipe or shorting out the cathodic protection by damaging the external coating of the pipe.

At pipeline crossings, in addition to the anchors required for buoyancy control, an anchor will be placed on either side of the feature being crossed, i.e. highway, road, railway, and canal.

10.0 SAFETY

On all pipelines, these safety rules and specifications shall apply:

All construction shall comply with health and safety regulations of the local authority having jurisdiction.

Corresponding personal protective equipment should be equipped according to the type of work and operation content. the CONTRACTOR will provide his personnel with the necessary protective equipment.

CONTRACTOR is to supply two fire extinguishers whenever tie-ins to existing lines are being made.

All tie-ins to existing lines will be done according to a written tie-in procedure approved by CONTRACTOR and COMPANY. Hot-Work Permits are required for all tie-ins.

Well pads and existing pipeline rights-of-way are not to be used as storage or parking areas without approval of the COMPANY.

CONTRACTOR is to ensure that all foremen are in possession of pipeline drawings before start of work.

Cable crossings shall be handled in a similar manner as foreign pipeline crossings.